

Cooper's Island Nature Reserve Management Plan



Government of Bermuda
The Ministry of the Environment and Sports



February 2008

EXECUTIVE SUMMARY

Vision: The combined area of Cooper’s Island Nature Reserve and the Former NASA Tracking Station at Cooper’s Island, St. George’s provides an opportunity to restore a critical ecologically sensitive area as a unique eco-tourism destination and environmental education center for the enjoyment of the Island’s residents and visitors.

Key to the concept of Cooper’s Island is its “development” as an eco-tourism destination. Extensive consultation confirmed that there was little support for a new on-site tourism facility, but rather a critical need for a new destination for existing hotels and cruiseships to ‘send’ tourists too.

The goal of the management plan is to restore Cooper’s Island Nature Reserve (CINR) as Bermuda’s National Nature Reserve, a ‘Living Museum’ that will provide Bermuda with a unique place to experience its cultural and environmental heritage. The CINR will:

“Seek to educate and promote conservation and an interest in all aspects of marine and terrestrial conservation through the establishment of a diverse range of habitats; develop compatible facilities, programs, economic initiatives and support services in order to facilitate its conservation mission, while serving as a passive park and nature reserve.”

Mission

The CINR will have three related foci:

1. The Reserve will become a world-class “environmental” destination capitalizing

on a growing global eco-adventure market. There will be opportunities for guided walking eco-tours, whale watching, bird viewing, scuba, snorkeling and kayaking tours, which will be integral to the functioning of the Reserve.

2. The Reserve will be a “living laboratory”, allowing for the development of facilities and teaching programs to educate children in the importance of our natural environment.

3. The Reserve will undertake and support the scientific community in their continued study of Bermuda’s unique flora and fauna.

4. The Reserve will support Bermuda’s sports programs by providing passive training opportunities and facilities for both local and visiting teams.

Restoration & Capital Development:

Cooper’s Island’s location, accessibility and size will allow unprecedented numbers of visitors to enjoy its wonders, while not overburdening its sensitive eco-systems.

It is proposed that Cooper’s Island be restored to its pre-WWII condition, through a 4 phased restoration program pioneered by the original ‘Living Museum’ program on Nonsuch Island. Nonsuch Island has shown how successful this can be. Cooper’s Island will continue this success and Bermuda will reap the benefits of its visionary investment.

Integral to the Reserve will be the removal of all defunct structures and roadways and the minimization of any new development within the Nature Reserve.

The Nature Reserve will be centred around a Visitor and Recreational Centre, housed in the former NASA Administration Building. This facility will celebrate the rich historical heritage of Cooper's Island, its role in the U.S space program and the site's environmental 'uniqueness'. The Centre will be renovated to include temporary accommodation for children, visiting teams and eco-tourists.

The CINR will recognize existing facilities and will seek to create and interpret a diverse range of habitats, including the:

*Turtle Reserve, Rocky Coastland
Cahow Islands, Butterfly Sanctuary
Fern Sanctuary, Weather Station,
Protected Rocky Coastland, Upland
Hillside, Lowland valley, Saltmarsh,
Fresh Water Pond, Mangrove Reserve
and Marine Park*

New infrastructure will include:

- Restoration of the existing administration building as a visitor centre with accommodation facilities;
- Conversion of the recycling centre into a nursery/maintenance yard;
- Public transport hub;
- Securing and interpreting the weather station.

It is estimated that the restoration and improvement of the CINR will total approximately seven (7) million dollars over an 8 year period. This will be generated through a variety of sources including, the existing resources of Government departments, Government capital expenditure, in kind local volunteers and guided capital campaign and international environmental donations.

Management & revenue generation

Responsibility for the management of Cooper's Island will be with the Ministry of the Environment and Sports (Ministry), led by the Department of Conservation Services, with assistance from the Department of Parks.

It is estimated that the initial operating cost of the CINR will be \$650,000. This will cover the re-occurring costs associated with efficiently running the CINR.

In order to offset some of these costs and make the Reserve more financially sustainable, the Department of Conservation Services will forge partnerships with local interest groups, specifically the Bermuda Zoological Society.

By combining the resources of the Government with a vibrant non-profit organization it will be possible to make Cooper's Island as financially resilient and sustainable as possible, opening up revenue generating opportunities traditionally not available to the Government.

A variety of revenue generating initiatives will be developed that have the potential to raise approximately \$300,00-400,000 per annum once fully engaged. These will include visitor entry fees, tour programs, merchandising, concessions, education camps, endemic plant sales, adopt-an-area program, voluntary-add-on program, membership drives and international donations. These strategies will ensure the long-term viability of the Reserve and provide a host of services, which will add substance to the CINR, with little to no cost to Government.

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Section 1.0 INTRODUCTION & BACKGROUND

1.1. Purpose of Plan

The purpose of the management plan is to present a phased program for the management, improvement, and long term maintenance of Cooper's Island Nature Reserve.

1.2. Jurisdiction

The site known as Cooper's Island Nature Reserve is owned by the Bermuda Government and protected under the 1986 National Parks Act.

" to be managed in a manner to encourage conservation and enjoyment of the natural, historic, and educational features of these areas with a minimum of commercial activity."

This document has been prepared in order to fulfil the requirements of sections 11 & 12, of the Bermuda National Parks Act, 1986.

Section 11(1) "For each protected area, a management plan shall be prepared by the Director and be in effect within five years from the date the area is declared a protected area..."

Section 12 (1) "A management plan shall be so designed as to ensure that the protected area to which it applies is managed in such manner as to achieve the objectives set out in section 5(1)", as follows:

1. *" To safeguard and maintain plants and animals as well as geological, marine and other natural features..."*

2. *To provide for the use of the area in its natural state with a minimum of commercial and mechanized activity;*
3. *To provide open space;*
4. *To protect and maintain historic monuments and buildings (including forts), marine products, site of particular historic, archaeological or aesthetic value and to so manage them so as to protect them from deterioration and to provide public enjoyment, research and educational opportunities."*

1.3. Location

The area of land known as "Cooper's Island" is one the largest tracts of relatively undeveloped land in Bermuda. Located at the north-eastern most tip of Bermuda, Cooper's Island as a whole consists of approximately 44.5 acres of land (Figure 1).

The site is bounded by Cooper's Island road (formerly Mercury Road) and included the existing Cooper's Island Nature Reserve and the area formerly occupied by the United States National Aeronautics and Space Administration (NASA)¹.

¹ NASA is the agency of the United States government responsible for developing space exploration and research initiatives.



Cooper's Island:

Located on the extreme southeastern tip of Bermuda, the lands of the former U.S. NASA tracking station comprise 44 acres of beautiful beaches, coastline, and woodlands. The site is strategically located between the internationally recognized Nonsuch Island Nature Reserve and the “Cahow” nesting islands.

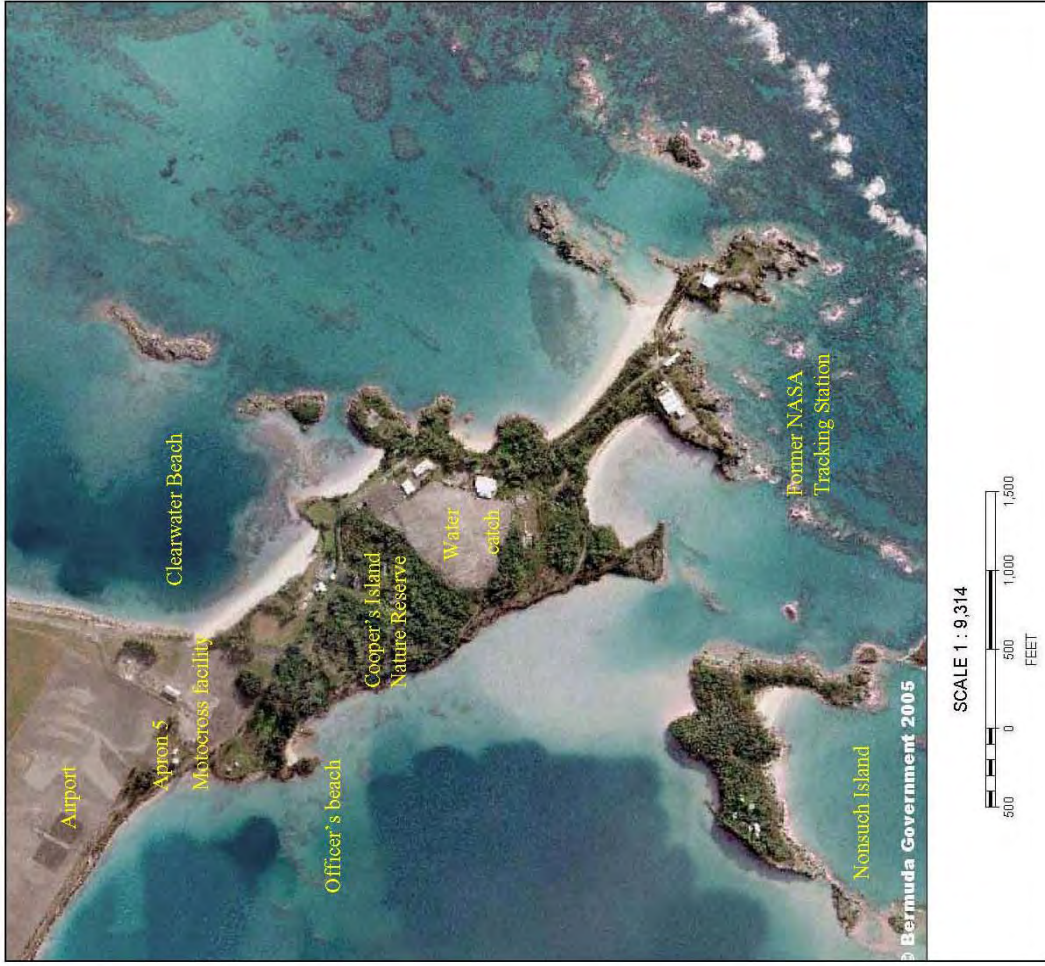


Figure 1: Location plan-Cooper's Island, St. Georges, Bermuda

The existing Cooper's Island Nature Reserve (12 acres) and is bounded by Cooper's Island Road to the east, the former NASA collimation site to the north, the waters of Castle Harbour to the west and the former NASA site to the south.

The site of the former tracking station (39 acres) is bordered to the east and south by the waters of the Atlantic Ocean and to the west by Castle Harbour. Cooper's Island Nature Reserve and Clearwater Beach Park border the site to its north. The site possesses some of Bermuda's most picturesque beaches including Turtle Bay, Long Bay and Well Bay.

The NASA tracking station also had a satellite facility, referred to as the "collimation site" (3.5 acres) and was located to the north of Cooper's Island on Castle Harbour Road.

1.4. History of Cooper's Island

It is thought that Cooper's Island was named after William Cooper of Southwark, London who was a member of the Somers Isle Company or Thomas Cooper of Paget Tribe.

The first mention found of Cooper's Island is when Governor Moore was faced with the problem of famine in 1612, caused by the accidental introduction of rats to the main island from a captured Spanish grain ship. The rats destroyed all crops and stored food.

"One hundred and fifty of the most weak and sick he sent to Cooper's Isle, where were such infinite numbers of the birds called "Cahowes", which were so fearless, they might take as many as they would, and that admired abundance of fish, that the extremity of their hunger and their gluttony was such, those heavenly blessings they so

*much consumed and wasted by carelessness and surfeiting, many of them died."*²

In 1614 Governor Moore built Pembroke Fort on the south eastern end of Cooper's island armed with two cannon.

Unfortunately this work was destroyed in World War Two during the occupation of the United States forces.

The Savage map (1901) (Figure 2) shows Cooper's Island as an island devoid of structures and mostly wooded with sand beaches and a few clearings. A note on the map indicates the presence of a rifle range on the island near the present day location of the small fire arms range (SFAR) building.

The agricultural land on Cooper's Island was mainly farmed by men from St. David's Island and until the Second World War, it was the favorite picnicking spot for St. David's islanders.

*"Cooper's Island, area 77 acres, belongs to Mr. Hastings Outerbridge and the last time I spoke to him about it, he told me he wouldn't sell it for less than a million dollars. More power to Hastings and for the sake of Bermuda wild life, I hope that he will never sell this lovely island but will eventually give it to Bermuda with the understanding that no building of any kind shall ever be constructed upon it. Cooper's Island was the breeding place of the now extinct 'Cahow' birds. It was also the home of Christopher Carter who volunteered to remain alone in Bermuda when his companions took the body of Sir George Somers back to England. In fact Cooper's Island is the only part of Bermuda which could ever be used as a National Park for the benefit of future generations."*³

² Governor Moore's History of the Somers Isles

³ Chapter 10, Bermuda in three colors, Carveth Wells, Robert M. McBride, 1935.

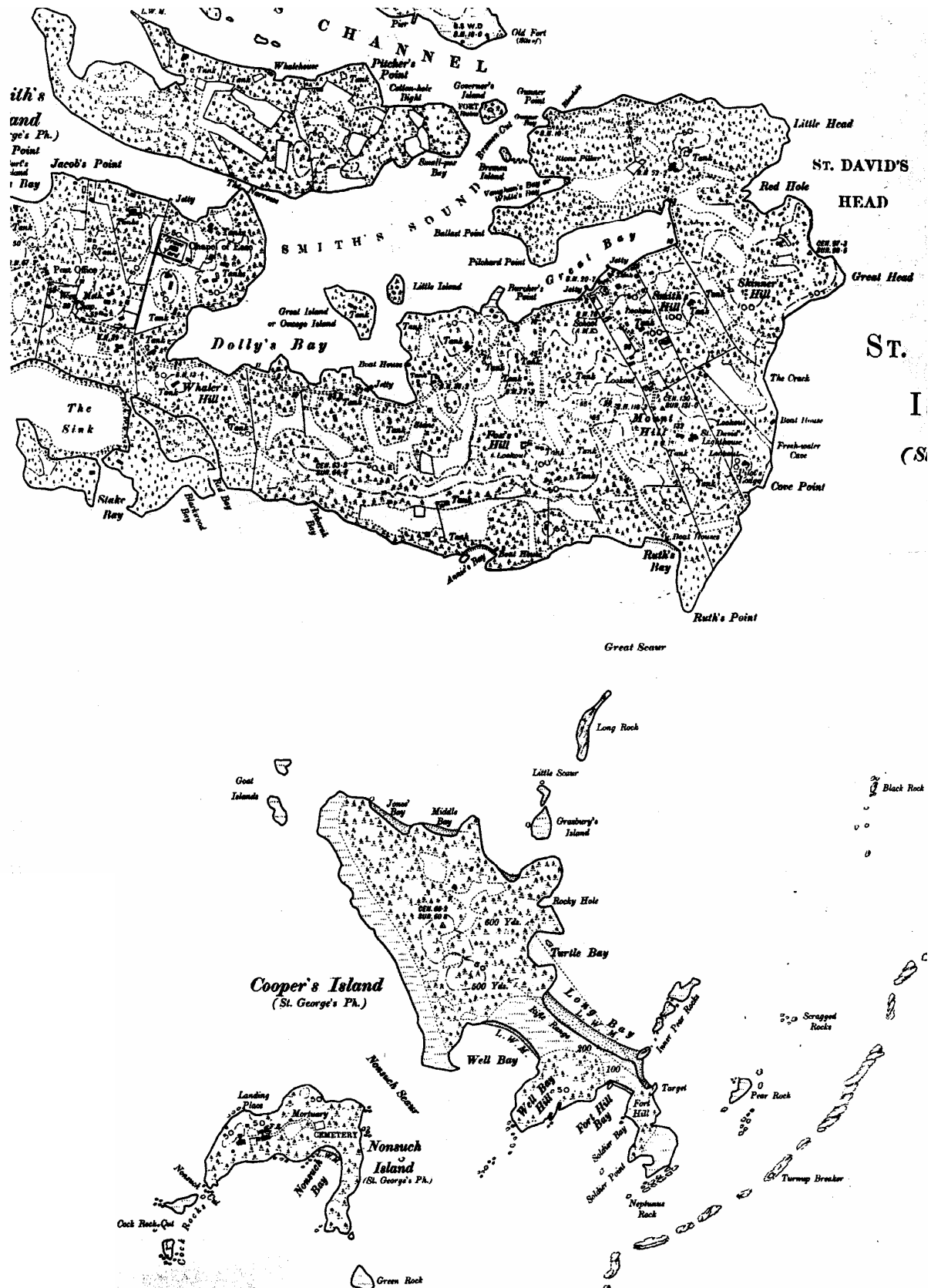


Figure 2: Cooper's & Nonsuch Island, St. George's - Savage Map, 1901

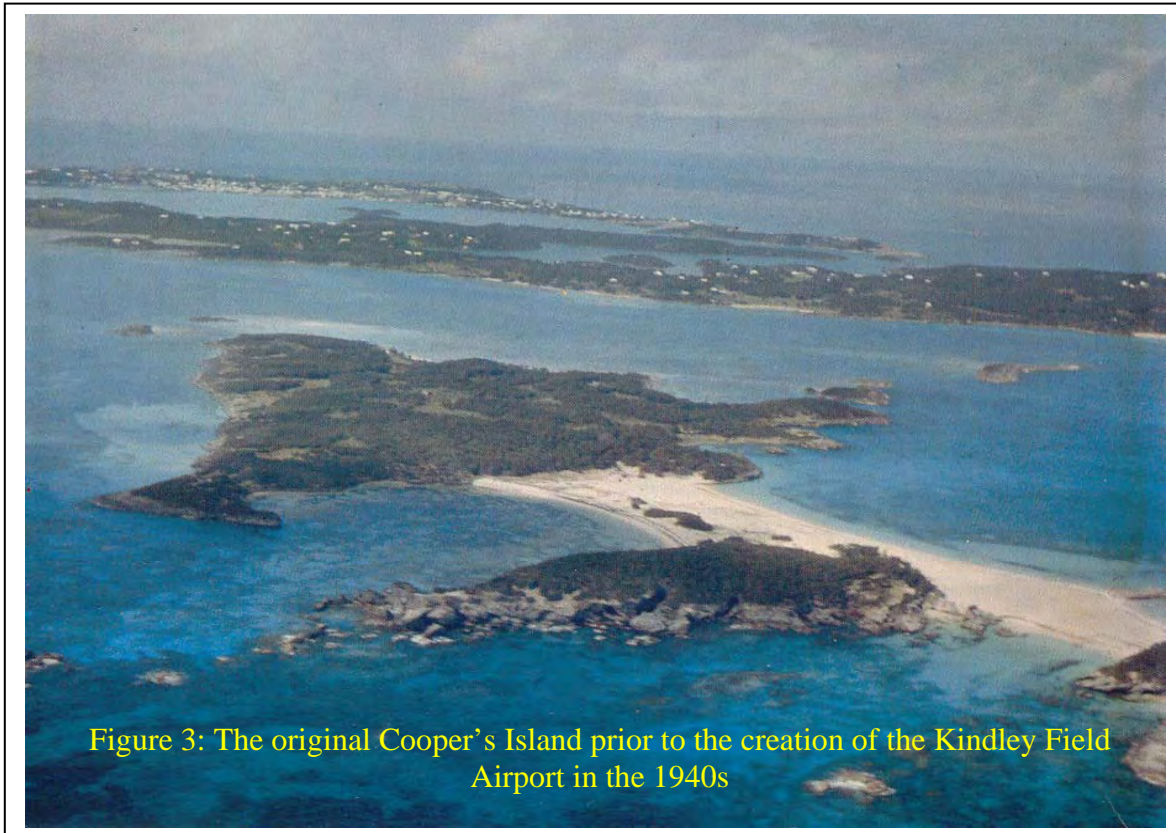
A lease agreement effective March 27, 1941, between the United States and the United Kingdom, allowed for the development and occupancy of a U.S. army base in Bermuda. This gave the U.S. the rights, power and authority within the leased land areas, adjacent territorial waters and air spaces necessary to establish, operate, defend and control the leased lands (DOD 1998)⁴.

An army post was established in St. George's Parish known as Fort Bell and an airfield called Kindley Field was developed from 414 acres of original land and 760 acres of dredge fill lands.

Works were completed in June 1944 (DOD 1998). The creation of the filled area connected Cooper's Island to St. David's Island (Figures 3 & 4).

During the Second World War, the strategic location of Cooper's island, near the new airfield and Fort Bell, led to the establishment of a battery of US manned 155mm guns at Cooper's Island. These were subsequently removed at the end of the war.

Agreement for NASA to build a tracking station on the air base was negotiated with the U.S. Department of the Air Force and the United Kingdom. The main objective of



⁴ Department of Defense (DOD), 1998. Report of the Congress of the United States: Environmental Effects of the Presence of the Armed Forces of the United States in Bermuda. May 1998.

the station was to gather tracking and scientific data from all NASA spacecraft, satellites and planetary probes. The station was one of NASA's eighteen (18) worldwide-manned space tracking stations constructed in support of Project Mercury.

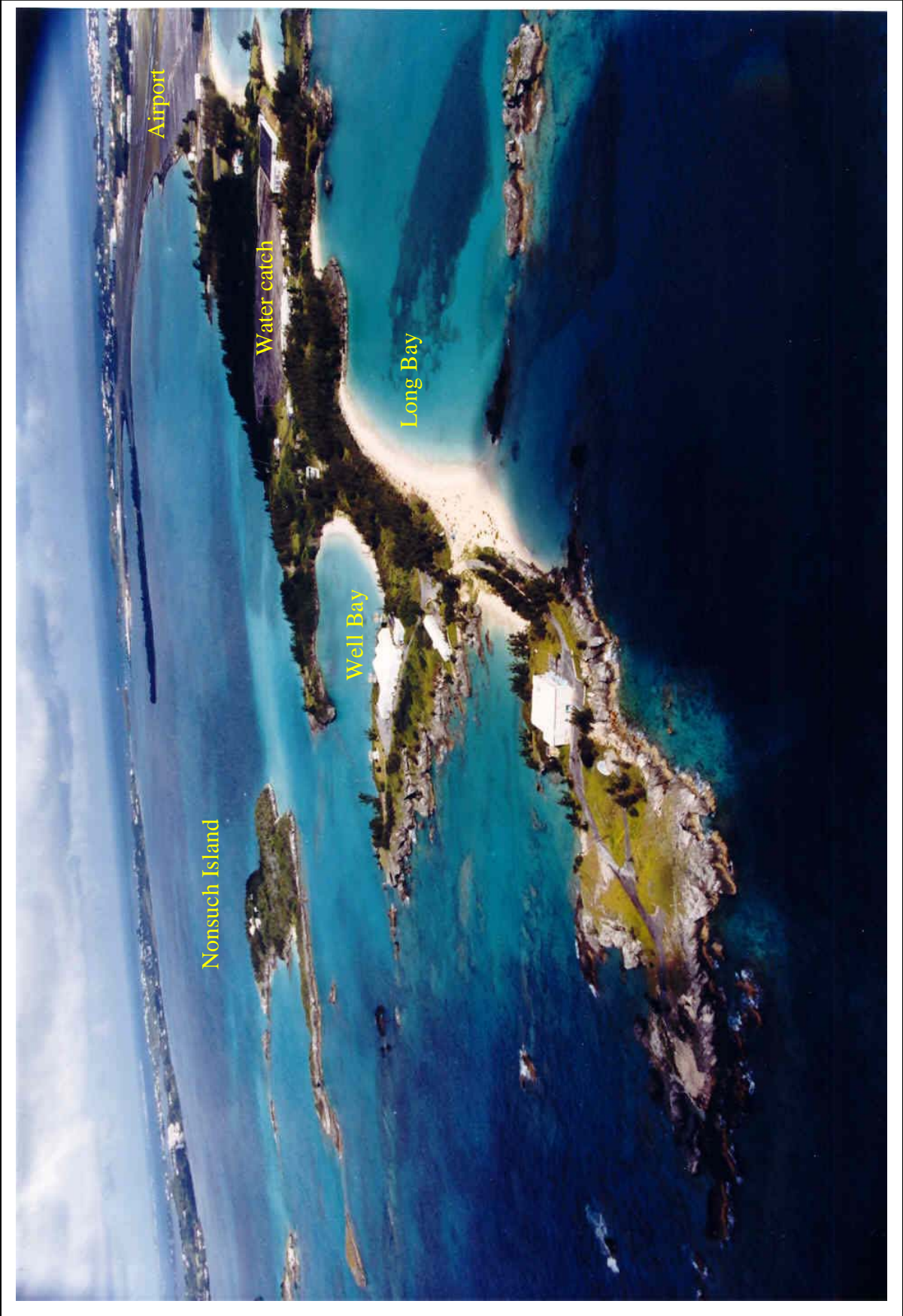


Figure 4: Aerial photograph, Cooper's Island, 2002

Prior to NASA occupation, the site contained 15 storage bunkers (most likely constructed during World War II), two large underground storage tanks (UST's), a small firearms range (SFAR) and an asphalt batch plant.

The tracking station was built in 1960 and became officially operational for the launching of the Mercury Atlas 4 Mission in September 1961. The station participated in all of the Gemini, Apollo and Skylab missions. The station also supported unmanned scientific launches conducted by NASA, as well as orbital and translunar / transplanetary coast support for scientific spacecraft.

In 1995 the U.S Navy opted to close the main Naval Air Station (NAS) and terminated the lease agreement with the United Kingdom. However, NASA retained the tracking station under a separate negotiated lease agreement. The Navy also designated additional land for use by NASA on a smaller site adjacent to Castle Harbour Road, the NASA collimation site.

Technological advances have diminished the need for ground support of the space programme and in 1997 NASA began to make plans to close the Tracking Station. Following the installation of a communication relay satellite network, the Cooper's Island facility became obsolete and was handed back to the Bermuda Government in September 2001.

1.5. Island wide value

At 44.5 acres, Cooper's Island Nature Reserve is critically important to Bermuda as one of the last major tracks of predominantly unspoilt open space left.

The NASA Tracking station is strategically located at the epicenter of the world renowned Nonsuch Island Nature Reserve and the last remaining nesting grounds of Bermuda's national bird, the critically endangered Cahow. This tract of land represents one of the best opportunities for translocation of the Cahow onto the main land, which would ensure its continued existence.

Cooper's Island is unique as a place, which can show case examples of all of the different type of natural habitats and species in Bermuda, such as the noted Cahow, Indian Top Shell, Yellow Crowned Night Heron, Sea Turtles and Bermuda Skink.

Protected open space is not only important for the protection of plant habitat and the Island's species, it is also essential to the social well being of our society. It is been proven to be essential that humans experience the benefits of nature, in order to heal, de-stress and add enjoyment to their lives.

In our increasingly urbanized lives it has become more and more important to have these experiences and it is the mandate of the Ministry to provide these opportunities.

1.6. Major stakeholders

Below is a list of the major current stakeholders that play a role in the management and decision making at Cooper's Island. (Section 6.6 for future responsibility & commitment of these organizations) (Figure 5).

- The Department of Airport Operations
- The Department of Parks
- The Ministry of Education
- The Department of Conservation Services & Bermuda Zoological Society

- The Department of Environmental Protection
- The Department of Planning
- The Department of Sports
- The Ministry of Tourism & Transport
- The Ministry of Works & Engineering
- Bermuda Land Development Co.

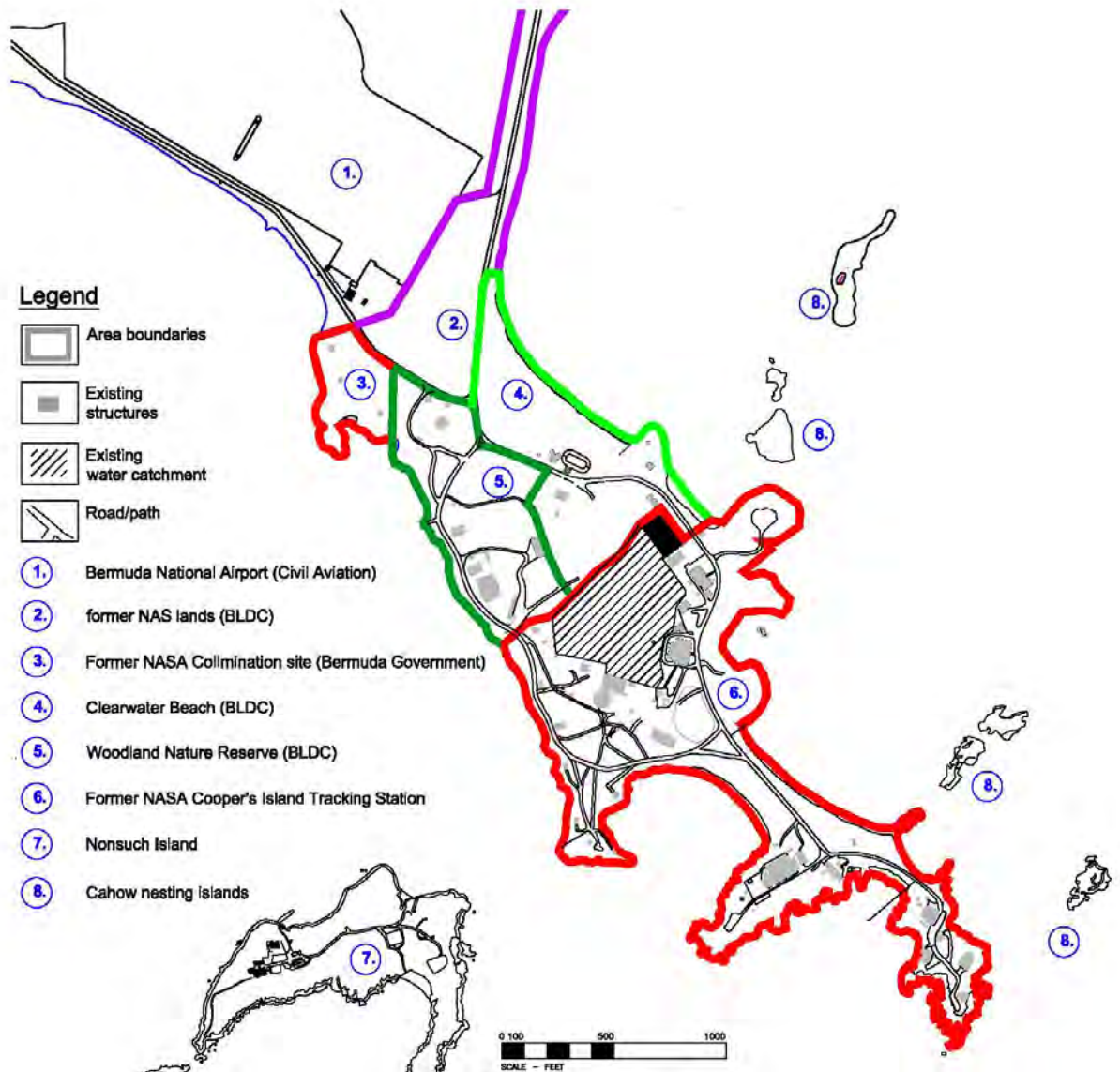


Figure 5: Existing jurisdiction site plan

Section 2.0. Existing Situation

2.1. Existing Site Conditions

This Plan concentrates on two distinct parts of Cooper's Island, the existing Cooper's Island Nature Reserve and the former NASA tracking station site.

2.2. General Description

Cooper's Island Nature Reserve

Cooper's Island Nature Reserve is heavily wooded and comprises a diverse range of habitats including salt-water marsh, rocky coastline and upland hillside habitats (Section 2.13).

The site is leased to BLDC for a period of 120 years. Although the site is not officially part of the National Parks system, it is currently maintained by the Department of Conservation Services as a Nature Reserve and has been the subject of a phased woodland management program for several years.

Previously part of the U.S. NAS, the site was used for ammunition storage and was predominantly left in its natural state. The site includes the following structures (see Figures 4 and 6):-

- ◆ Gazebo - originally constructed by the U.S, it was destroyed in Hurricane Fabian 2003;
- ◆ Storage bunkers - constructed by the U.S., these are open to the elements and frequently used by the homeless and are prone to vandalism;
- ◆ Former recycling plant; and
- ◆ Building currently used by Triathlon Club.

The site is an important Nature Reserve for the east end. It is heavily used for shore fishing, triathlon events and nature walks.

Typical activities include walking, picnicking, bird watching, and shoreline fishing.

The site is experiencing some activity, which could be deemed as undesirable. These uses include:

- ◆ Motorbike scrambling;
- ◆ Squatting/illegal camping;
- ◆ Vandalism;
- ◆ Excessive taking of protected species.

2.3. General Description:

Former NASA site

The former NASA site was handed back to the Government of Bermuda in September 2001 and remains under the management of the Ministry of Works & Engineering.

The site houses a number of buildings and structures which were used to store plant and electronics equipment and to provide work areas for administration, operations and maintenance personnel.

The Site is officially restricted from public access. With permission there have been several organized walks and debris clean up days.

However unofficial access to the site is high, especially during the summer months. Activities include:

- ◆ Walking for exercise and exploring the existing facilities;
- ◆ Access to the beaches for recreational purposes by boat and on foot. Most of these trips are private, but there has been a notable rise in tour boat excursions to the site.

Overall on site there are 18 structures, 8 storage bunkers, a major water catchment area with water storage tanks and at least 10 concrete plinths constructed to secure antenna or dirigibles. Of these there are seven (7) main buildings associated with the facility (Section 2.7.).

The majority of the built form is located on the interior of the Island, retaining the majority of the coastline in its natural state. Some of the buildings are large and in visually prominent positions (Figures 6 & 7).

There are several institutional bodies with facilities and interest on site: These include:

1. BLDC.-Water catch and water storage tank facilities. These facilities are seen as essential to both BLDC and the CINR and will be retained.
2. Bermuda Weather Station- Doppler Radar. The Ministry of Tourism and Transport has constructed a new Weather Service Doppler Radar at Cooper's Island, which will allow more accurate tracking and warning of tropical cyclones and severe weather systems. The Bermuda Maritime Operations Centre, (formerly Harbor Radio), will also

use this facility for certain radio transmitters and antennae to aid marine navigation. These uses are passive and will have minimal environmental impact. An existing structures have been set aside for the North Atlantic International Monitoring Station for the detection of nuclear tests. This site will be in the vicinity of the Doppler Radar facility.

3. Bermuda Police- Temporary firing range. The SFAR has been used by the Police Services for some time. It has recently been upgraded and is likely to be used for Police fire arms training for at least the next 5 years.

The site is experiencing some activity, which could be deemed undesirable.

These include:

- ◆ Vandalism;
- ◆ Squatting/illegal camping;
- ◆ Graffiti;
- ◆ Theft;
- ◆ Illegal mooring;
- ◆ Taking of protected species.

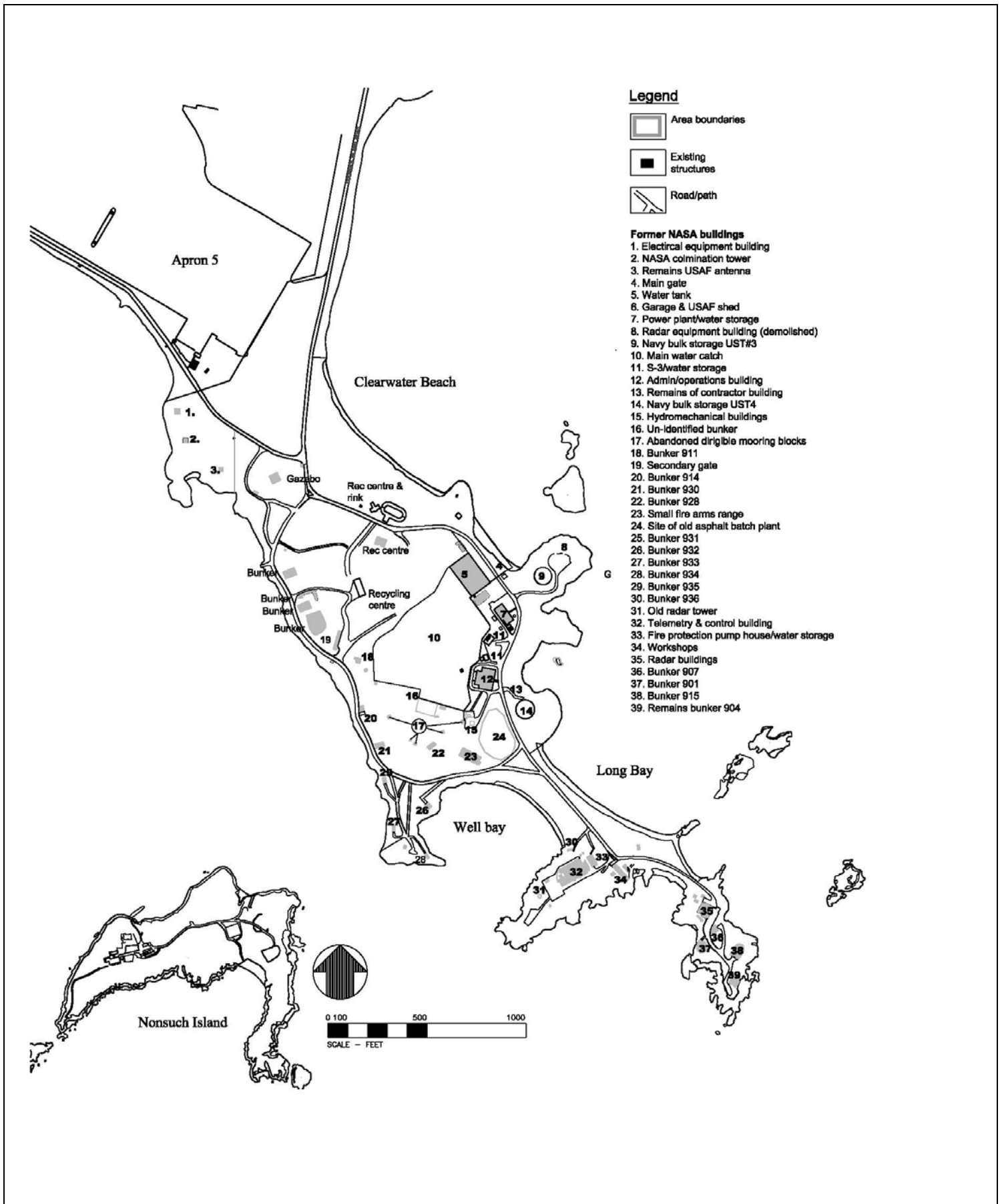


Figure 6: Existing Built Form

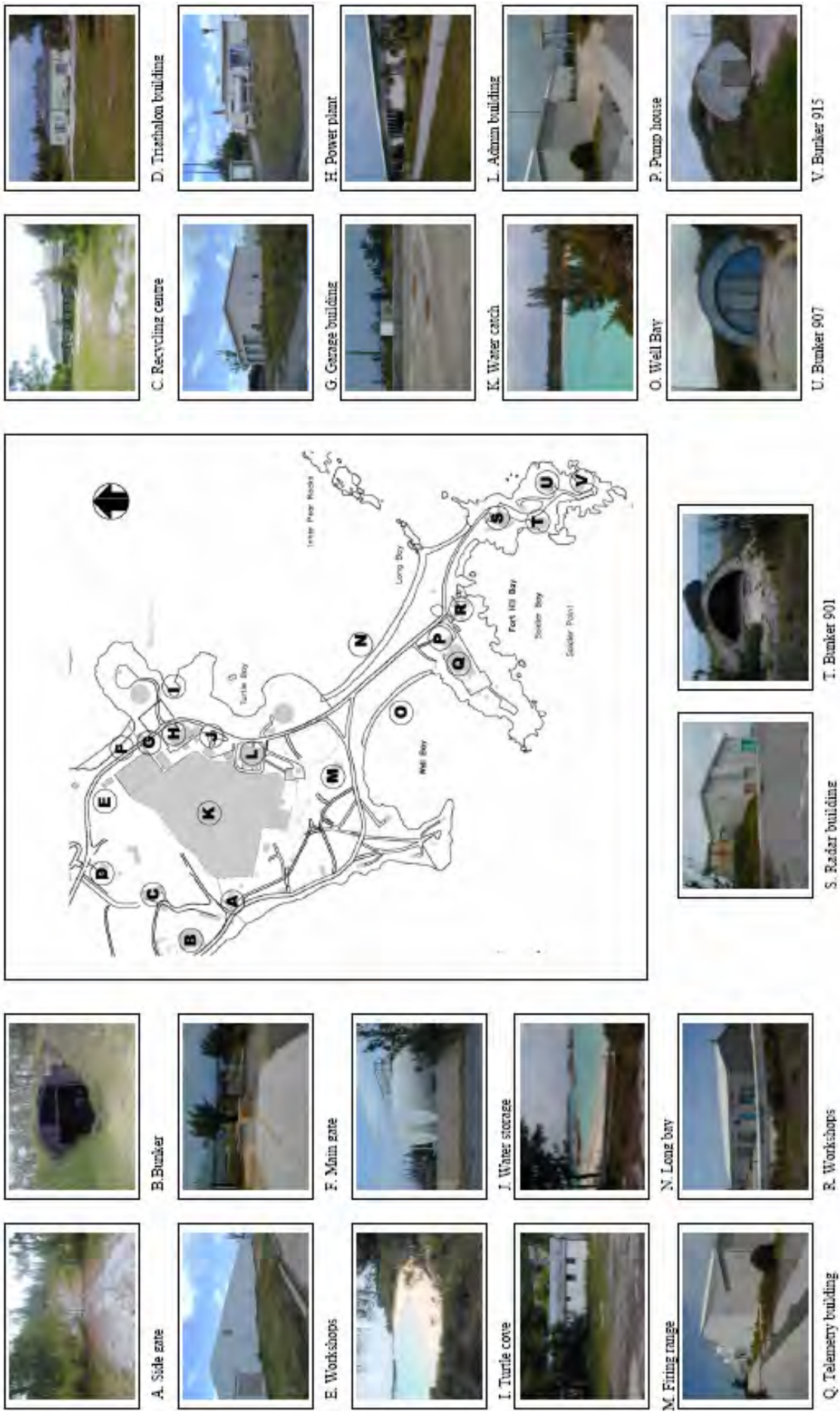


Figure 7: Visual Assessment

2.4. Current Zoning & Administration

The Bermuda Plan 1992 is the current development plan for Bermuda and contains planning policies and zoning provisions for all areas of Bermuda with the exception of the City of Hamilton and the former military base lands. The City of Hamilton has its own local plan. The military base lands were not subject to planning control until 1995.

In 1995, the U.S Navy closed the NAS base and transferred ownership back to the Bermuda Government. This required the preparation of a new development plan for these areas to supplement the Bermuda Plan 1992 (Figure 8).

In 1996, the Bermuda Government Planning Department published a Development Plan for the former military baselands. The NASA site was not included in this Plan, however, as it was still occupied by the United States. Unlike the Bermuda Plan 1992, the Development Plan for the Former Military Bases (1996) does not provide fixed zonings for the former base lands. Instead it provides a more flexible approach to the control of land use and development by setting out a series of 'preferred uses'.

The existing Cooper's Island Nature Reserve is designated with a preferred use of 'Recreational and Open Space' under the Special Development Zone for St. David's. The Plan states that within this area "only development required for recreation or other activities associated with their public enjoyment will be permitted." This area was designated as such to provide for public enjoyment of the beaches and wildlife and

development is restricted because of the site's proximity to the airport.

The area formerly occupied by the NASA tracking station currently does not have a zoning designation. However, it is proposed that all former military baselands, including Cooper's Island, will be incorporated into the next review of the Bermuda Plan. The new Bermuda Plan will supersede both the Bermuda Plan 1992 and the Development Plan for the Former Military Bases (1996).

2.5. Adjacent Land Uses

The main land uses and marine areas adjacent to Cooper's Island include the lands at Southside, the Bermuda International Airport, Clearwater Beach Park and Nonsuch Island (see Figure 4).

2.5.1. Lands managed by the BLDC

In December 1997, the Bermuda Land Development Company (BLDC) was given management responsibility for the former NAS areas (with the exception of the site occupied by the NASA tracking station) and is currently undertaking a phased redevelopment of these lands.

The areas of land managed by the BLDC within or in proximity to Coopers Island include the Cooper's Island Nature Reserve, Clearwater Beach Park, Southside and the peninsula/finger extending into Castle Harbour which is an old runway.

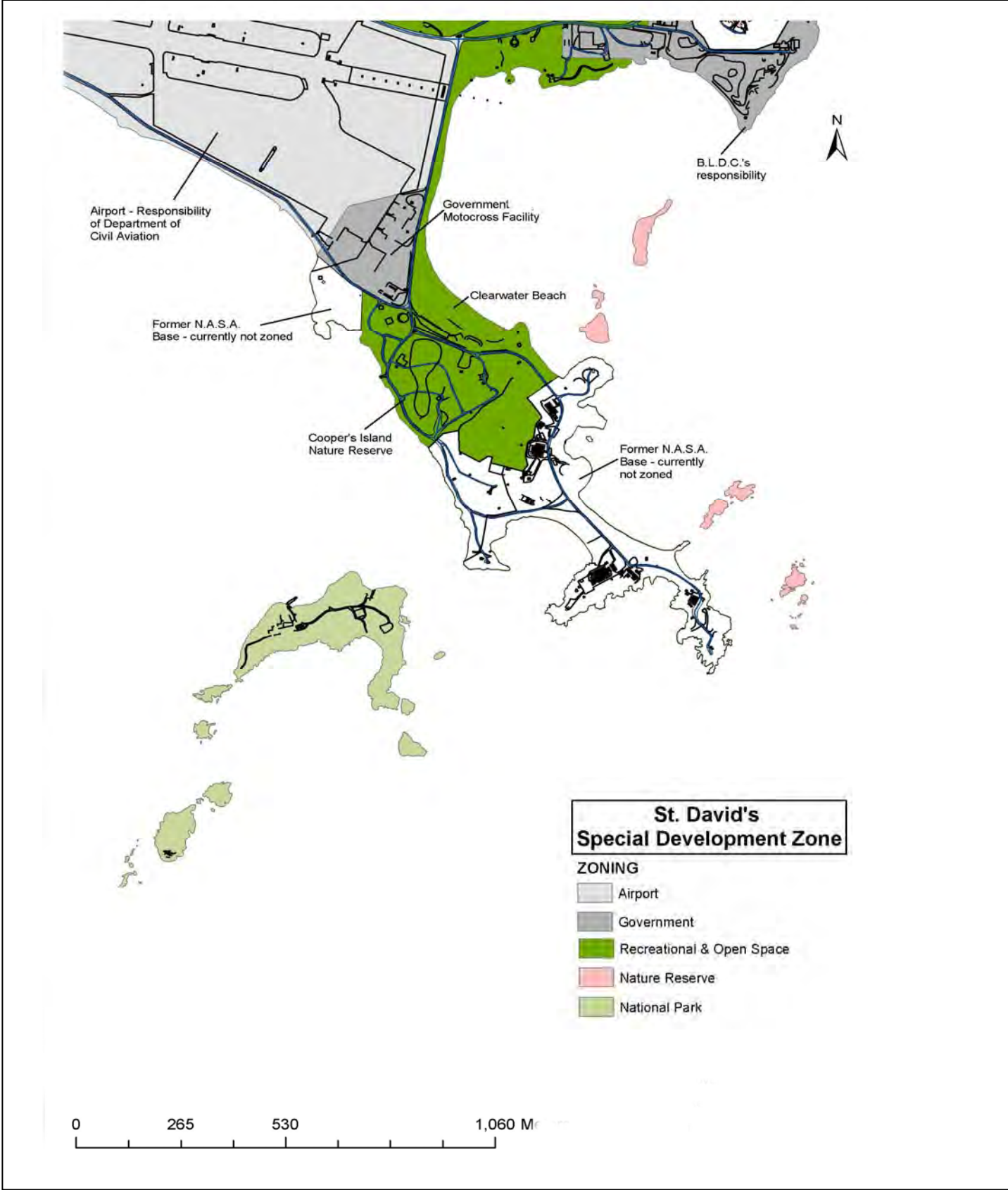


Figure 8: Existing development zone designations

2.5.2. Bermuda International Airport.

The Bermuda International Airport is managed by the Bermuda Government Department of Airport Operations. It occupies an area of approximately 560 acres used for airfield operations (runways, taxiways, aircraft parking areas and maintenance hangers).

2.5.3. Clearwater Beach Park

Clearwater Beach Park is located on Cooper's Island Road (formerly Mercury Road) and is a product of the land reclamation that created a significant portion of the NAS site.

The Clearwater Beach Park area is 12 acres and consists of a publicly accessible beach and picnic areas. A playground, public toilets, a concession building and the former roller blade rink support the beach.

Clearwater Beach is leased to BLDC and is not currently part of the National Park System. The Bermuda Government Department of Parks currently maintains Clearwater Beach Park as a public beach and park on behalf of the BLDC. The Department of Parks provides park and playground maintenance, park ranger and lifeguard services for the area.

Main uses include passive recreation of the beaches, private and corporate outdoor events such as picnicking, and music.

The site is experiencing some activity, which could be deemed as undesirable. These uses include:

- ◆ Motorbike scrambling
- ◆ Vehicular parking within the beach area.

2.5.4. Castle Islands Nature Reserve & Nonsuch Island

Cooper's Island is strategically located between the islands of the Castle Islands Nature Reserve. Protected under the National Parks Act 1986, these islands are home to critically endangered species including the Bermuda petrel (Cahow), the Bermuda skink and the West Indian top shell.

Most notable of the Reserve islands are Nonsuch Island, Pear Rock and Inner Pear Rock. Nonsuch Island is located west of the former NASA site and covers an area of 15.56 acres. It has the status of "Living Museum" due to the presence of rare species and the long running conservation programs being successfully conducted on the Island. Pear Rock and Inner Pear Rock are located off the east shore of the former NASA site. These rocky outcrops are zoned as Nature Reserve and are home to a nesting colony of approximately 60 pairs of the critically endangered Cahow.

2.6. Environmental Assessment of previous uses.

A review of the preliminary assessment material supplied by KCI Technologies Inc, on behalf of NASA Goddard Space Flight Center, identified the following areas of environmental concern on the site of the former NASA Tracking Station (Figure 9):

- ◆ Bulk storage tank #3 &4;
- ◆ Batch asphalt plant;
- ◆ Small Fire Arms Range (SFAR);
- ◆ Power plant area;
- ◆ Soil management area;
- ◆ Maintenance trailer area;
- ◆ Teletype repair building areas; and
- ◆ Workshop building area.

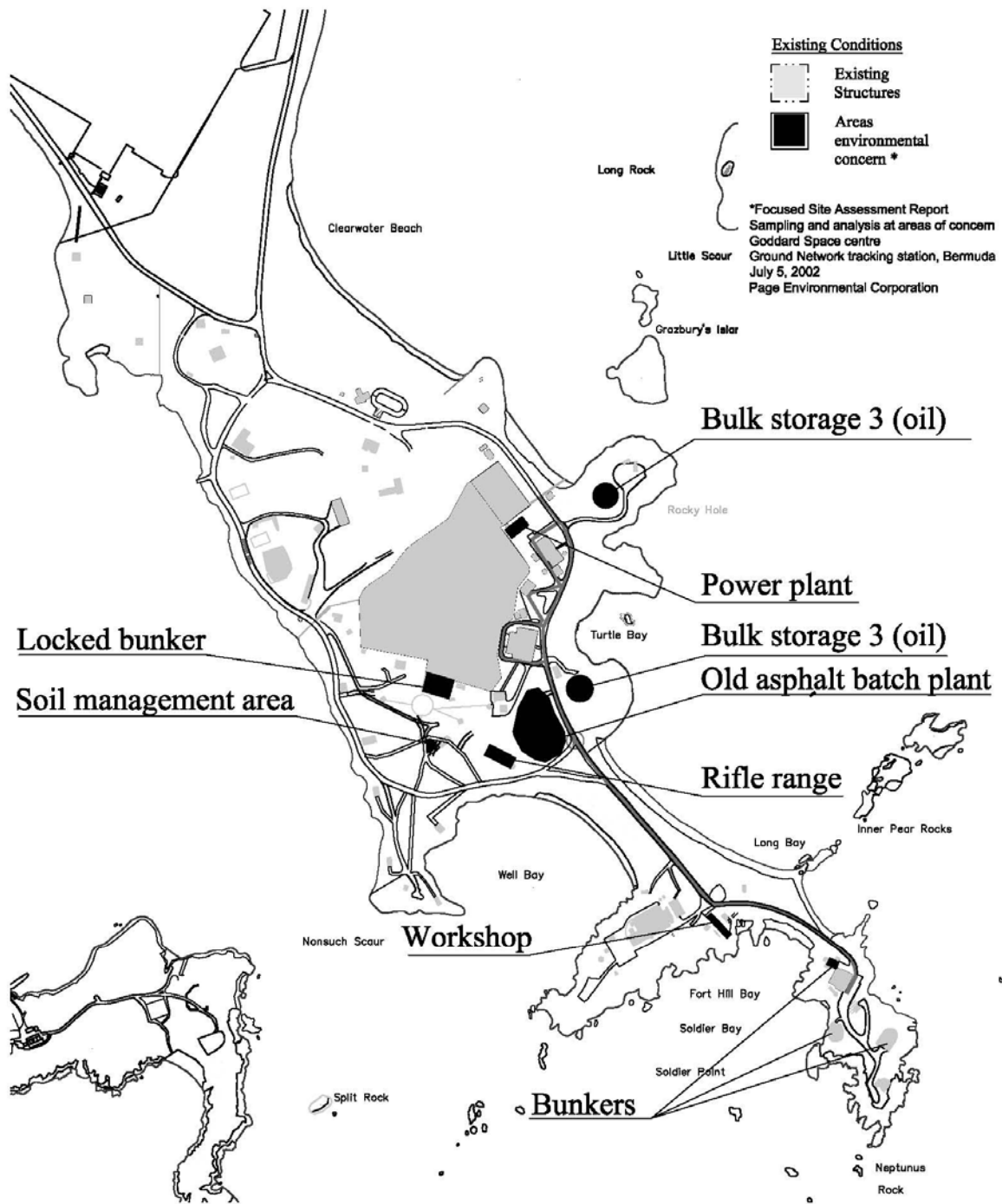


Figure 9: Environmental Concern

In addition, the following three waste management issues were identified:-

- ◆ General liquid storage units;
- ◆ Lead and asbestos containing building materials; and
- ◆ Bunkers.

The report tested and evaluated areas of environmental concern and examined the hazardous substance exposure pathways and determined the potential harm to human health and/or the environment.

The areas evaluated and assessed were:-

- (1) Ground water pathway - Accounts for hazardous substance migrations to and within aquifers and potential threats to drinking water supplies.
- (2) Surface Water pathway - Accounts for hazardous substance migration to surface water bodies, potential threats to drinking water supplies, the human food chain and sensitive environments.
- (3) Soil exposure pathway - Considers the potential threat to people on or near the site who may come in contact with the exposed wastes or areas of suspected contamination. This includes both soil ingestion and dermal exposure.
- (4) Air pathway - Accounts for hazardous substance migration, in gaseous or particulate form, through the air, potential threats to people and sensitive environments.

The areas that gave results which indicated that they could pose a hazard are:-

- ◆ the small fire arms range;
- ◆ the soil management area;
- ◆ the maintenance trailer area; and

the lead and asbestos containing building materials. Only one building was noted as having asbestos roofing, that being the workshop.

According to the report, the remaining areas of concern posed minimal risk.

2.7. Built form Assessment

The following assessment looks at 6 of the major buildings on site and an overall assessment of the various bunkers which are all in the same general condition.

No investigation was made into the remaining small 10 ancillary buildings as they were deemed minor in nature, providing little impact to the future of the site.

Additionally no assessment could be made of the underground water storage tanks nor the SFOR Firing Range currently used by the Bermuda Police Force at the time of the writing of this plan.

The assessment is based on a recent visual assessment of the station (2006) and the *GN Infrastructure Survey, BDA STDN Station, Cooper's Island, Bermuda (June 1993)* compiled by AlliedSignal Technical Services Corporation (GN Report), the latest known report completed before the closure of the NASA Tracking Station (Appendix 1).

A more thorough structural assessment will have to be undertaken by a certified structural engineer to reassess the buildings in today's condition, however this preliminary survey does provide a good description and assessment of the condition of the buildings prior to the

final closure of the base, plus visible changes that have occurred since 1993. The survey looked at the following areas:

- ◆ Structural
- ◆ Masonry
- ◆ Moisture & thermal control
- ◆ Doors, Windows & glass
- ◆ Finishes
- ◆ Equipment
- ◆ Furnishings
- ◆ Mechanical
- ◆ Fire protection
- ◆ Electrical

*Utilities are discussed in section 2.8.

The buildings assessed were mainly constructed of concrete masonry on a structural concrete foundation. The exterior masonry block typically has a stucco finish. There are generally intermediate reinforced concrete columns and reinforced concrete tie beams at the top of the masonry walls. The roof systems consist of steel joists of steel joists, metal deck and insulation topped with a 2 inch concrete slab. If changes were made to the roof structure the original built up roof(s) was replaced with an SKB system.

The exception to the above is the Telemetry & Control building which was constructed in 1960 as a pre-engineered metal building on a structural concrete foundation. A masonry block addition was added to the building in 1971 on the south side. All interior rooms have suspended ceilings and most rooms have a vinyl tile floor. Interior rooms are partitioned using metal studs and gypsum board.

The majority of the buildings were assessed in 1993 as being in solid

structural condition. However much of the plant, finishes, doors and windows were nearing the end of their life expectancy. Today after 6 years of dormancy many of the issues noted in the 1993 assessment have been substantially exacerbated, due to a lack of maintenance, exposure to storm conditions, the corrosive effects of a saline environment and vandalism.

2.7.1. Power plant

- ◆ Former usage: Houses power generating equipment and associated switchgear, waste heat recovery system, waste lube oil system, office space and shop area. The Station's central fire alarm control panel is located in this building since the building was manned 24 hours per day.
- ◆ Original construction date: 1966
- ◆ Square footage: 5,040 sq.ft
- ◆ Floors: 1

The building is in average condition but all the mechanical systems are now obsolete and do not comply with today's U.S. Environmental Protection standards. Further study should be undertaken to ascertain if it is viable to upgrade the building for its present use. If not, the building should be demolished as it can not be easily converted to other uses.

2.7.2. Fire pump house & water storage Facility

- Former usage: Houses 2 diesel fire pumps and one electric jockey pump
- Original construction date: 1975
- Square footage: 752
- Floors: 1

The pump house building is in average condition but the system is now

obsolete and should be removed. Due to its specialized use it can not be easily converted to other uses and should be demolished.

The ground water storage facility was assessed in 1993 as having seven major leaks. As the pump house would have to be demolished it is so recommended that water storage tanks should also be removed as it would be incongruous with the intent of the management plan.

2.7.3. Telemetry & control building (T&C building)

- ◆ Former usage: Logistics, administration office, logistics storage, conference room facility and mission support.
- ◆ Original construction date: 1960 & 1971
- ◆ Square footage: 13,940
- ◆ Floors: 1

The building is of mixed construction type. The pre-engineered portion, which makes up 2/3rd of the building, is failing rapidly due to exposure and lack of maintenance.

Additionally the original specialized purpose of the building is no longer valid and it can not be easily converted to other uses compatible with a nature reserve. It is recommended that the building should be demolished.

2.7.4. Administration building

- ◆ Former Usage: Operations, administrative office, space, conference room, and building utilities
- ◆ Original construction date: 1960
- ◆ Square footage: 10,536 sq.ft
- ◆ Floors: 1

The overall structure is in good condition with some internal damage.

Due to its location, general layout, and its original multi-purpose function this building is suitable for conversion.

2.7.5. Workshop

- ◆ Former usage: Carpentry, paint and mechanical shops, tool storage, houses saltwater hydropneumatic tanks and pumps
- ◆ Original construction date: 1960
- ◆ Square footage: 2,817
- ◆ Floors: 1

The building is in poor condition and not easily convertible to other uses. It is recommended that the building should be demolished.

2.7.6. Radar building

- ◆ Former usage: Operations, office space, electrical shop and building utilities
- ◆ Original construction date: 1960, 1965, 1971
- ◆ Square footage: 8642
- ◆ Floors: 2

The building is located on the most exposed peninsula of the site. The building is in poor condition and its condition will continue to worsen due to further exposure to storm damage, salt corrosion and vandalism.

All its underground utility systems were completely destroyed during Hurricane Fabian (2003).

Due to its specialized service and its phased growth it would be very difficult to convert this building to another useful purpose. It is recommended that the building be demolished.

2.7.7. Bunkers

There are a number of similar type bunkers located around the site. All were constructed in the same way and used for the same general purpose. These storage bunkers were constructed as World War II ammunition bunkers and were later converted to storage for the station.

The bunkers are constructed of riveted corrugated steel arch plate and anchored to a concrete floor slab. One end wall was constructed of steel plan and the exposed end wall constructed of concrete masonry block. Earthen fill was originally placed over the bunker as camouflage and remain today.

- ◆ #904 Storage bunker storage of flammable materials such as paint & oil, 764 sq.ft and built in 1940.
- ◆ #907 Storage bunker, storage of bulk material, 788 sq.ft and built in 1940.
- ◆ # 915 Storage bunker, storage of bulk material, 1,453 sq.ft and built in 1940.
- ◆ #928 Storage bunker, storage of lumber & bulk material, 1,551 sq.ft and built in 1940.
- ◆ #932 Storage bunker, storage of diesel parts, lube oil, motor oil transformer oil, 1,024 sq.ft and built in 1940.
- ◆ # 935 Storage bunker, storage of administrative “dead” files, 820 sq.ft and built in 1940.
- ◆ #936 Storage bunker, storage of lumber & bulk material, 788 sq.ft and built in 1940.

The remainder of the bunkers were de-commissioned over time and at the closure of the station were un-used.

All structures were assessed in 1993 as being in poor condition. At the time it was noted that the corrugated steel arch plate had rusted through and structural integrity had been compromised. Further the GN report recommended that if the structure should remain in use that major works be done to the steel arches, masonry walls power lighting, entrance doors, fire detection and alarms.

It is recommended that the majority of these structures be demolished for health and safety reasons.

For the sake of historical preservation each should be fully recorded and interpreted as part of the exhibits proposed for the Visitor Centre. Further it is recommended that at least two of the most sound bunkers in the vicinity of the existing Cooper’s Island Nature Reserve be reconditioned and interpreted as a reminder of the original purpose of the base.

2.8. Utilities

This section describes and assessed all that is currently known of the utility systems that were originally installed at the station. The included partial utility plan indicates all known information of utilities excluding telephone (Figure 10).

Figure 10 indicates existing known routes of utilities. Missing data includes all areas west and south of the water watch area on the former NASA site.

2.8.1. Sanitary Sewer system

Each building that has toilet facilities has its own sanitary sewer system consisting of 4-inch-diameter cast iron drain piping and leaching pits.

Raw sewage flows by gravity from the buildings to the leaching pits. The pits are typically constructed with walls of masonry block laid on the side with a concrete slab top. The pits are built so the sewage effluent drains into the surrounding soil and function by anaerobic bacterial decomposition. In 1993 the cesspits were considered to be in average condition. Today each pits and underground piping would have to be considered to be obsolete, unless otherwise assessed.

2.8.2. Fuel Systems

The Station has two systems that provided fuel to the power plant and its vehicle fleet.

Diesel Fuel System

Diesel fuel for the power plant generator sets were supplied from two 15,000 gallon above ground storage tanks located in a containment dike southwest of the Power Plant.

Fuel oil flowed via gravity feed through two 1-1/2 inch single wall steel pipes from the storage tanks to the Power Plant, where branch piping fed each diesel engine-generator set.

In addition there is a 1,000-gallon lube oil tank co-located with the fuel oil tanks that also served the generator sets.

In 1992 the interior of the two diesel tanks were recoated in order to extend their lifespan. However it was noted in the GN report that the tanks had exceeded their expected service life and were obsolete.

Additionally the fuel piping did not include for any containment features or devices for monitoring leakages. The system as installed did not meet with US EPA regulations of the time (1993).

The GN Report recommended that the entire system should be replaced in order to comply with current EPA standards. Today the system will not be compliant with more advanced EPA standards and the previous recommendation should still stand. That being either the system is removed and the building demolished or totally replaced.

Gasoline fuel system

A gasoline refueling station provided for station vehicles from a 1,000 gallon tank with 1-1/2 inch fiberglass piping and gas pump located on the south west of the power plant inside the containment dike.

This above system was installed in 1993 and has lain unused since the closure of the station. Its functional state is unknown. However external condition of the pump and housing is currently in poor condition.

2.8.3. Potable Water

Water used for drinking and other domestic uses was furnished from rainwater collected from the buildings and stored in underground concrete storage tanks and then pumped to pressure tanks in each building. The majority of domestic water piping was ductile iron piping.

- ◆ Water collected from the roof of the Operations buildings served both this building and the Power Plant.
- ◆ Water collected from the workshop served this building, the T&C building and the radar building.
- ◆ Water collected from the power plant was not used for drinking water but was stored separately and used for maintenance purposes and washing station vehicles.

Each system was assessed in 1993 and found to be in average condition with no major problems reported.

Today the system is now over 40+ years old and has lain derelict for over 8 years. The systems will have to be re-assessed in the future if it were to be retained.

2.8.4. Fire Service system

The fire service system was installed in 1974. Water used for the fire service at the station was furnished from rainwater collected from the roof of the T&C building.

Water was collected in a 90,000 gallon reinforced concrete tank (1974) to the north of the building. In 1993 the walls of the tank was assessed as having at least seven major leaks and cracks in the roof slab radiating from pipe penetrations. It is unknown if repairs

were made prior to the closing of the station.

The fire service system was separate from the domestic water system. Distribution piping originated at the fire pump house and routed to each major building via 6-inch/8inch transit pipes. Fire hydrants, post indicator valves and valve boxes completed the station fire service system.

In 1993 the system itself was assessed as in good condition with no major problems. Since the closure of the base the system has lain dormant. A recent visual assessment (2006) has shown that there is significant weathering to all exterior portions of the system and to components of the fire system plant. Additionally the piping system to the radar building was destroyed in hurricane Fabian 2003. The remainder of the system should be re-assessed in the near future.

It is the general recommendation of this management plan that the system is now obsolete and should be removed.

2.8.5. Saltwater system

In lieu of fresh water, saltwater was distributed to each of the buildings that contained bathrooms and used for all toilets.

The saltwater system consisted of a reinforced concrete saltwater well, two horizontal centrifugal pumps, a 4,000-gallon hydropneumatic tank, air compressor, automatic controls and distribution piping.

In 1993 this system had been in service for over 30 years and the system was scheduled for a major renovation. It is

unclear whether the renovations took place, which would have seen the installation of 4 new tanks, new compressor and a new automatic control system with new PVC piping.

2.8.6. Electricity provision

The electrical system consisted of direct burial cables, underground duct banks, above ground cable duct, area and security lighting and building ground fields.

The 4160-volt primary power was furnished to the main station buildings from the power plant through a network of the underground duct banks and distribution transformers.

In 1993 the condition of the 30+ year system varied significantly and was considered to be of average to below average condition.

In 1993 the majority of the underground cabling was being replaced in phases with the installation of a new substation N01 transformer building. This upgraded the system from 480 volts to 4160 volts for the T&C building, the Workshop and Radar building. Extensive damage was sustained to all utilities leading along the causeway to the Radar building during Hurricane Fabian 2003.

All transformers were originally located outside and exposed to harsh saline conditions and in 1993 were undergoing a phased upgrade to underground ductbanks.

The overall grounding system consisted of bare copper cables that terminated in the ocean. All buildings and electrical systems were tied to an ocean ground.

Today these cables can still be seen and are extensively corroded.

Security lighting was installed on all buildings and was kept low in order to be sensitive to the adjacent Cahow restoration program. A visual assessment of building security lighting shows there has been extensive deterioration since the closure of the station.

Station manholes and underground ductbanks were assessed as being in good condition in 1993 with the exception of the causeway to the Radar building. Most of these units had been shifted due to high tidal surges and were cracked. Today the majority of the manhole and routes in these areas have been destroyed due to recent storm damage.

Today the entire electrical system has lain dormant for over 8 years and much damage has been done to the causeway, beach areas and buildings. It is recommended that the former system is removed and all future development is tied into the Bermuda grid.

2.8.7. Mechanical Equipment (HVAC)

The HVAC equipment at the BDA Station consists mostly of small package units with the exception of the equipment for the Operations Building and the Radar Building.

The Operations Building has central air-cooled condenser chillers and air handler units. Most of the mechanical equipment was well maintained but now must be reassessed.

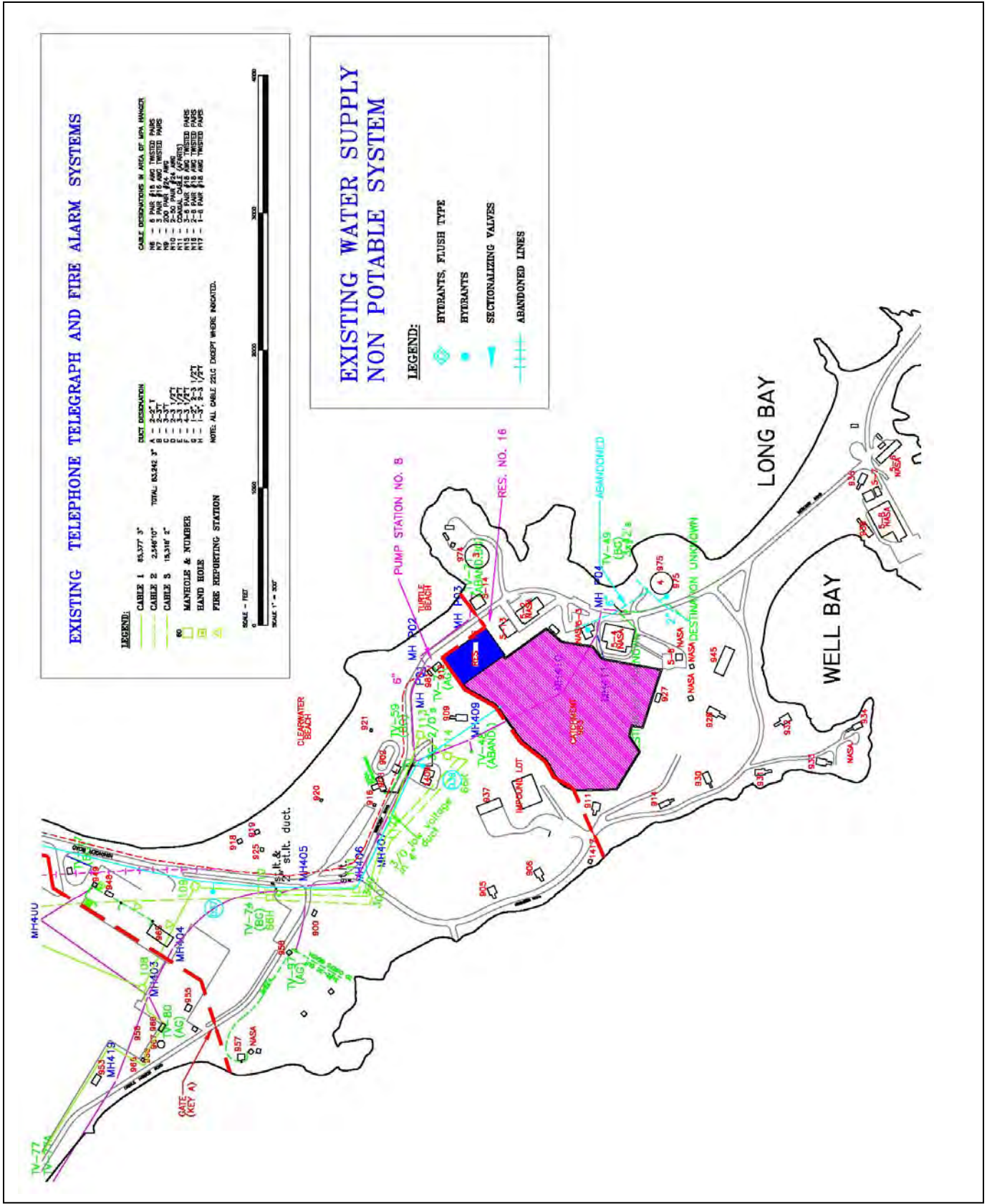


Figure 10: Partial utility survey

2.9. Access & Security

Fencing. At present, the former NASA site is gated and fenced which controls public access. The main gate is located off Cooper's Island Road (formerly Mercury Road) and a secondary gate is located to the extreme northwest of the main water catch within the existing Cooper's Island Nature Reserve.

The security fencing is constructed of galvanized chain link fabric with 3 strands of barbed wires running along the top. There was originally 484 linear feet of security fencing.

The security fences were installed at 2 main locations as follows:

- A. One section of fence across the entrance road to the NASA station at the main gate. This section has a motorized double swing gate.
- B. The second section of fencing was located at the back gate in the vicinity of the former USN antennas with a non-motorized double swing gate system.

Today both gates remain padlocked closed.

The GN Report noted that the fencing could easily be breached by pedestrian personnel. Today the fencing helps to restrict vehicular traffic but can easily be breached by pedestrian traffic. The majority of the fencing is in poor condition and will need to be restored or removed.

Roads. The primary roadway system was built in 1959 of bituminous concrete pavement. The road system is typically

18 feet in width and there is approximately a total of 0.8. mile of roadway paving.

The present road system extends to all buildings and out to the peninsula. All buildings have allocated car parking areas.

Pedestrian access is via a series of well-established trails of tarmac and bare earth laid out in natural routes that conform to the existing topography.

In 1993 the GN Report evaluated the condition of the roadway system as below average with some areas deemed as hazardous. The road system had not been resealed or repaved since its construction in 1959. The recommendation at that time was to overlay the entire system with 1-1/2 inches of asphalt.

The condition of the roads has further deteriorated substantially due to natural regeneration, hurricane damage and lack of regular maintenance. Many of the roads are now impassable to all but 4-wheel traffic.

Parking lots. Each of the six primary buildings has designated asphalt parking areas and service road. Based on estimated quantity take off there are approximately 5,763 yards of parking area.

The GN Report noted that these parking areas were experiencing the same problems as the roads, principally alligator cracking, lack of resealing, the majority of pre-cast concrete curb deteriorated or broken and no or poorly marked roads. This condition has been

substantially exacerbated with an additional 6 years of no maintenance.

The GN report recommended that these areas be totally repaved.

2.10. Geology

In the early 1940s, the U.S. army conducted a massive filling operation to link the natural islands of St. David's, Cooper's Island and Long Bird Island. The former NASA site is situated on the remains of the original Cooper's Island (Figure 11).

One of the direct affects of this was the re-directing of ocean currents and the formation of what is now known as Clearwater Beach.

The northern portion of the Island is designated as part of the Walsingham formation and the southern portion stretching east to west from Long Bay to Well Bay is a combination of beach, sand dune, rocky headline and rocky coastline.

The former NASA site is located within the Brighton Aquifer. The Brighton Aquifer is generally too permeable for fresh ground water accumulation and saline or brackish water is normally present.

2.11. Hydrogeology

Cooper's Island is located approximately 5 1/2 miles from the St. George's lens and does not appear to be hydraulically connected to the lens. As a result, there are no fresh water wells in the Cooper's Island area, with the closest well being located north of the site near St. David's 1/2 to 1/4 mile from the former NASA site (Figure 12).

Local water supply for the site relies on on-site rainwater catchments. From 1960 until 1999, toilet flushing and fire pumps used brackish water derived from seawater and stored in tanks located adjacent to the former workshop building (building 9). In 1999, the flushing and fire pumping system was converted to fresh water supplied from water catchments.

There is a large water catchment area comprising an area of approximately 370, 260 sq.ft, (7 acres) located on the former NASA site and water storage tank with the capacity of 2 million gallons.

Also left are two 40,000 gallon per day reverse osmosis desalination plants (DOD 1998), the condition of these units are unknown.

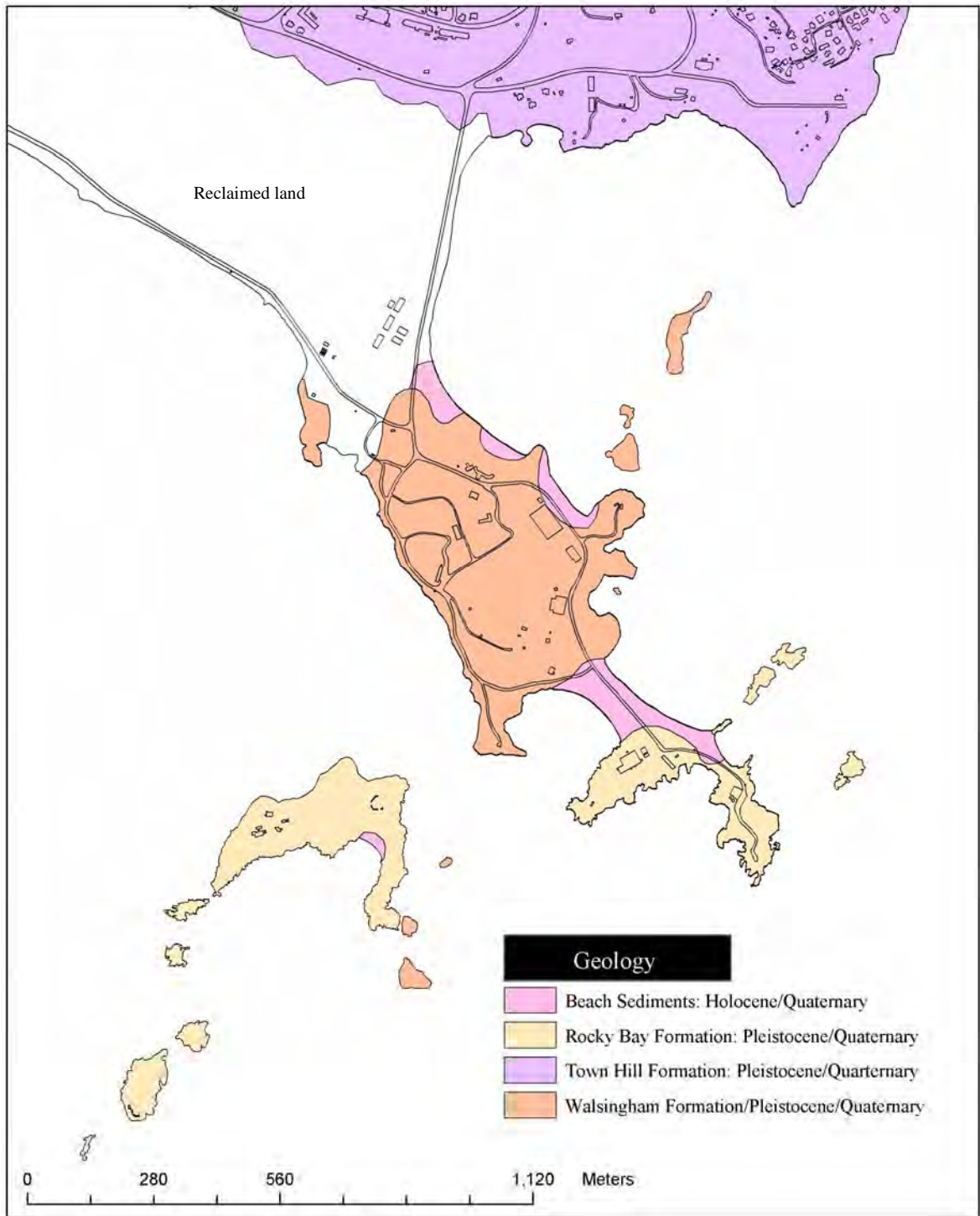


Figure 11: Geology map

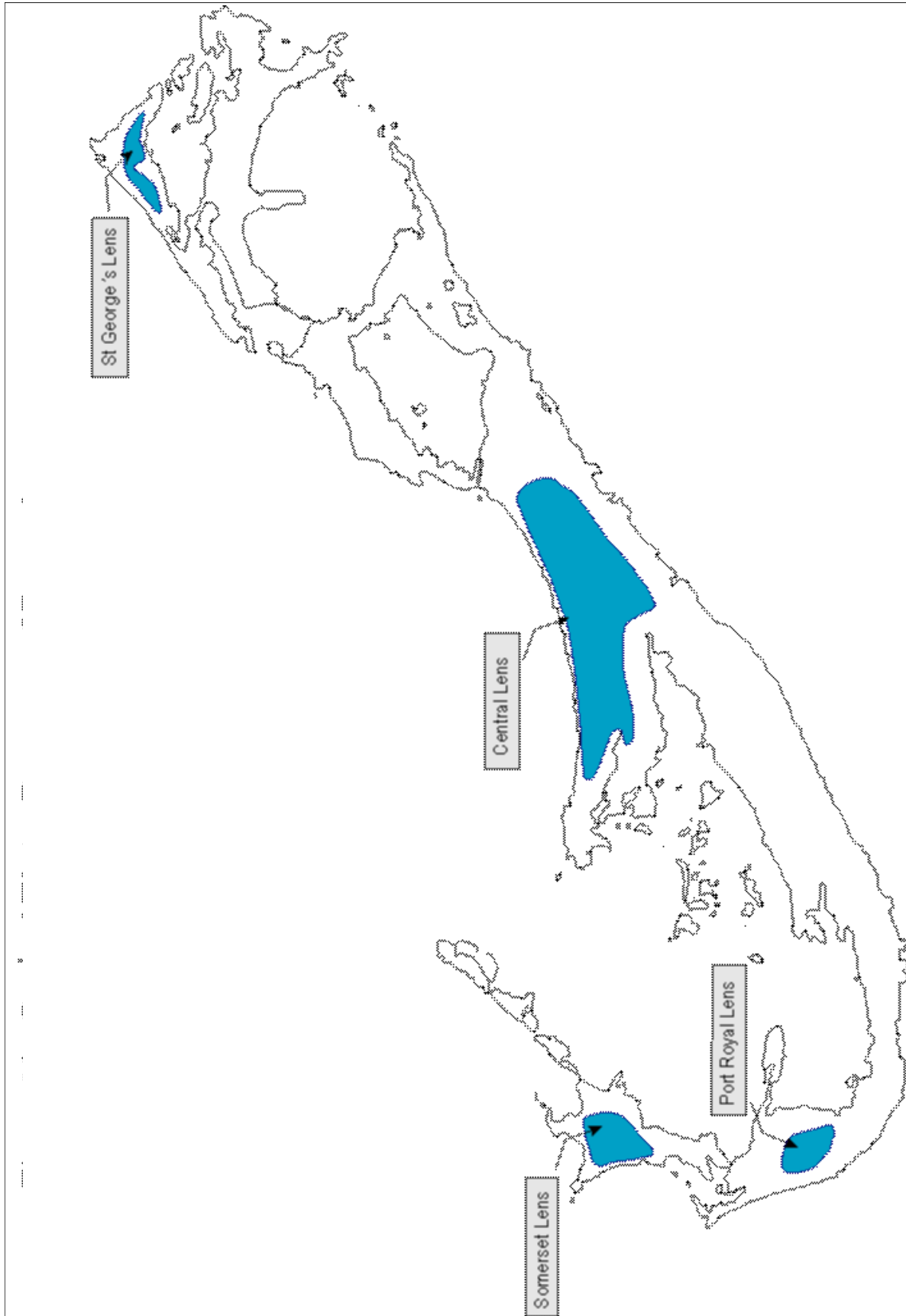


Figure 12: Groundwater resources of Bermuda

2.12 Topography & storm surge analysis

2.12.1 Topography

The elevation of the site of the former tracking station lies between mean sea level and 52.5 feet above sea level.

Surface water drains from the property towards the ocean at Turtle Bay, Long Bay, Soldier Bay, Fort Hill Bay, Well Bay and Castle Harbour.

2.12.2 Storm surge

Due to its geology and topography, Cooper's Island and the adjacent Clearwater Beach Park are prone to flooding during periods of extreme storms.

Records show that during seasonal storms, such as hurricanes, areas below the five-foot elevation above sea level (DOD 1998) are flooded (Figure 13).

Flood risk is a key planning consideration in the allocation and release of sites for new development particularly development involving human habitation such as residential and tourism development.

Cooper's Island is completely cut off during high storm surge. As such, there would be a mandatory evacuation of any residents, guests or visitors located in this area in the event of a hurricane.

Floods can endanger lives and damage property. Although flood defense mechanisms can be engineered, they are often unsightly. In addition, the precautionary approach is to locate new development outside known flood risk areas. The precautionary principle which is stated in the Rio Declaration

1992 (and which also forms part of the Environment Charter to which Bermuda is a signatory) states that:-

"Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

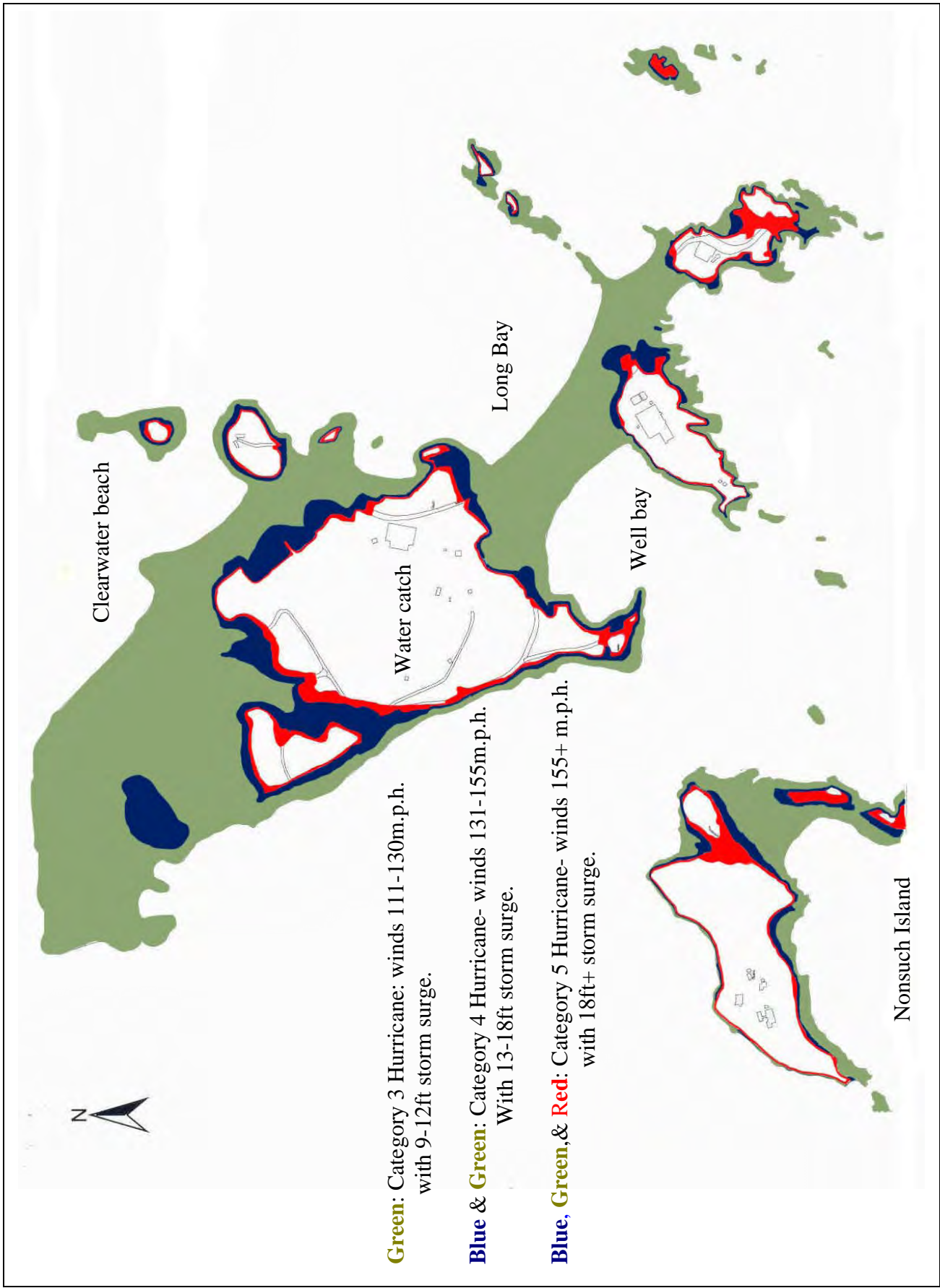


Figure 13: Storm surge analysis

2.12.3. Post Hurricane Fabian

A preliminary damage assessment of Cooper's Island was undertaken by the Parks Department in the aftermath of Hurricane Fabian, which hit Bermuda on 5th September 2003. The assessment showed the following damage (Figure 14):-

- ◆ Some building damage was noted throughout the site. Most damage was limited to door, window and minor roof damage. No major damage was noted to major facilities or the water catchment;
- ◆ The entire site suffered significant damage to vegetation. Typical damage ranged from wind/salt burned trees and shrubs as well as wind blown trees. A number of large casuarinas specimens were down throughout the site; and
- ◆ There was significant coastal erosion and flooding including the following:-
 - ❖ The access road from the main gate to Turtle Beach - visible signs of storm surge included typical beach debris being deposited over the main road;
 - ❖ The access road running between the two main beaches - typical damage was an average 6-inch layer of sand covering the road, boulders (most possibly from the Clearwater Beach area), typical beach debris and loss of the majority of sand dune, vegetation and major trees;
 - ❖ Extensive damage was noted to all the coastal rock areas of the outer peninsula and the Cahow Islands. White scarring was seen all along the length of the coast where the coastal

rock was eroded by wave action and storm surge.

- ❖ The bridge link to the outer island was washed out and was made impassable to vehicular traffic. The surrounding areas have been significantly eroded by wave action.

2.13. Terrestrial Environment

Early records of Cooper's Island describe it as being "well covered in thriving young cedars"⁵ There were also references to yellow wood trees growing on the island⁶ as well as cahows, and an abundance of fish in the waters surrounding the island.⁷

Today there is little evidence of the original endemic and native forest, which once covered the island. The cahows have been eradicated from this particular island although they are still found on some of the smaller islands nearby.

Despite its exposed location, much of Cooper's Island remains heavily vegetated. These habitats vary in composition from predominantly planted casuarinas to mixed secondary forest containing a mix of native and introduced species. The inland thickets are dominated by jumbie bean and Brazil pepper (Figure 15).

Ecologically, Cooper's Island is still very important as it supports a variety of habitats. These habitats include:- beach and dunes, rocky coastal, salt marsh, upland coastal and upland hillside (Figure 16).

⁵ Royal Gazette sale advertisement (1823), Mr. Van Norden

⁶ Lefroy's Memorials of Bermuda 1901

⁷ Governor Moore's History of the Somers Isle



1. View from gate showing storm surge over main access road into Cooper's island



2. View from access road between beaches showing storm surge and debris.



3. View along access road showing storm surge over main access road.



4. View to outer island showing bridge link completely destroyed.



Cooper's island
Location Plan

Figure 14: Visual assessment of storm surge, Hurricane Fabian 2003

2.13.1. Beach and Dunes

Cooper's Island has beautiful beaches which are backed by low dunes. The dunes are covered by salt tolerant endemic and native flora. Some plants, such as seaside evening primrose, beach lobelia, and Darrell's fleabane are abundant on Cooper's Island, but are relatively rare on the mainland. Unfortunately casuarinas have invaded this habitat.

Yellow crowned night herons and a wide range of shore birds, including the endangered piping plover, semi-palmated plover, sanderlings, ruddy turnstones, lesser yellowlegs, willet, least sandpiper and pectoral sandpiper forage in this habitat. It is an important habitat for both land crabs and ghost crabs.

2.13.2. Rocky Coastal

This habitat is defined as the zone of coastline between the mean high tide mark and the upland coastal zone. It is characterized by cliffs, rock outcrops and an absence of soil.

There are two types of rocky coastland, protected and exposed. The difference between the two being predominantly exposure to prevailing winds.

The only plants found growing in this habitat are those that are wind and salt spray tolerant. These plants include stunted buttonwoods and seaside ox-eye and in sheltered areas, seaside golden rod. The most characteristic organism of this zone is a cyanobacterium which causes the black patches on and slightly within the rock. The rocky coastline of Cooper's Island is virtually untouched as development was concentrated in the interior of the Island.

This habitat is essential to the white tailed tropic bird or longtail. Cooper's Island has one of the densest concentrations of tropic bird nests on Bermuda, with an estimated 50-70 breeding pairs nesting in holes and crevices along the rocky coast. This area is particularly important because longtails are losing their nesting sites due to increasing development along Bermuda's coast.

The critically endangered Bermuda petrel or cahow, which was hunted almost to extinction by the first settlers, has been forced to nest in burrows along the shore of the small rocky islands off Cooper's Island where it is secure from predators, such as rats and cats, and development. Due to the proximity of these islets, any non-compatible development on Cooper's Island would pose a serious threat to the continued survival of this internationally recognized and slowly recovering species.

Birds such as ruddy turnstones, spotted sand pipers, yellow crowned night herons, great blue herons, great egrets and snowy egrets frequently forage for crustaceans, bivalves and small fish along the rocky shore of Cooper's Island. Organised birding tours to Cooper's Point already take place and there is great potential to establish a permanent viewing area here for bird and whale watching.

This area is also home to the land hermit crab, a crustacean that is only known to exist in small numbers at six other locations around Bermuda.⁸

⁸ Walker, S.E. (1994) Biological Remanie: Gastropod fossils used by the living terrestrial

2.13.3. Salt Marsh

There is a small salt marsh, which has been partially destroyed because rubble has been dumped in it but it has the potential to be restored. The dominant plant is sheathed paspalum. It is possible that mangroves were present and were destroyed when it was filled with rubble. There is a small population of the giant land crab living in this salt marsh. This crab only exists in small populations at 4 other sites around Bermuda. The salt marsh is used by wetland birds, such as the northern water thrush, and herons, egrets and belted kingfishers all roost in vegetation around the salt marsh.

2.13.4. Upland Coastal

The upland coastal habitat is just inland from the rocky coastal and beach and dune habitats. This habitat usually has a thin layer of soil which is often covered by grasses which help reduce erosion. As this is an exposed habitat, much of the vegetation is adapted to strong winds and salt spray. Native vegetation typical of this habitat includes buttonwood, sea lavender, tassel plant, Spanish bayonet, prickly pear, seaside goldenrod, seaside oxeye, Bermuda cedar and bay grape, all of which are present in the upland coastal habitat of Cooper's Island. Unfortunately in some areas, the introduced casuarinas, Brazil pepper and tamarisk have also become established.

This is the habitat in which the yellow crowned night herons nest, as well as some long tails. The yellow crowned night herons are predators of the land crabs which also inhabit this area. It is possible that the upland coastal habitat of Cooper's Island was once nesting

hermit crab, *Coenobita clypeatus*, on Bermuda. Palaios 9:403-412

grounds for the cahow. The belted kingfisher and osprey roost in the vegetation of this zone.

The endemic Bermuda skink is found in the rocky coastal habitat of Nonsuch and other islets off Cooper's Island. Recent surveys were conducted on Cooper's Island for the Bermuda skink but no skinks were found, indicating that there are very few individuals or possibly none at all.

It is presumed that Cooper's Island fostered a skink population before it was joined to the mainland, especially as they are still living on the nearby islands. There are many documented factors which are thought to have caused the skinks to decline in this area after human settlement. Introduced predators, such as rats and cats and the burning of vegetation in these areas are thought to have had a huge impact on skinks.

There is an opportunity for a future skink reintroduction programme at Cooper's Island as the peninsula has the potential to become a sanctuary for this critically endangered endemic species.

2.13.5. Upland Hillside

There are only a few existing natural examples of upland hillside habitat left in Bermuda today as most of these areas have been cleared for development.

The Bermuda cedar was the characteristic tree of upland hills and associated with it were a number of other native and endemic trees and shrubs. Unfortunately much of the remaining upland forest is dominated by trees which have been introduced and these have out-competed the native and endemic vegetation.

On Cooper’s Island there is a substantial tract of upland hillside. Although this is dominated by the introduced species, such as Brazil pepper, jumbie bean, fiddlewood, casuarinas and Allspice, there are pockets with a high percentage of native vegetation. Bermuda cedars, palmettos and olivewoods are present in small numbers as well as the native white stopper, Jamaican dogwood, forestiera, southern hackberry and the endemic Bermuda snowberry⁹, all of which would have once been found in an upland forest before man inhabited Bermuda.

Historically, upland hillside used to be the prime nesting site for cahows but they no longer nest on Coopers Island or anywhere on the mainland. It appears that they have been pushed into suboptimal nesting habitats on the small rocky islands off Cooper’s Island where they are safe from man and predators.

White-eyed vireo, gray catbird, northern cardinal, mourning dove, ground doves and the European goldfinch all nest in the upland hillside habitat of Cooper’s Island.

Due to the close proximity of Cooper’s Island to Nonsuch Island and the “cahow” islands, decisions for the long-term use of Cooper’s Island will be critical to the continued success of both the Living Museum Project and the survival of the cahow.

⁹ Survey of Bermuda’s terrestrial habitats and vegetation (March 2003) Heather De Silva, Joseph Furbert, Anne Glasspool PhD, Wolfgang Sterrer PhD, Jack Ward, BZS.

Botanical Name	Common name
Trees	
<i>Juniperus bermudiana</i>	Bermuda Cedar
<i>Sabal bermudiana</i>	Bermuda Palmetto
<i>Cassine laneanum</i>	Bermuda Olivewood
<i>Coccoloba uvifera</i>	Baygrape
<i>Conocarpus erecta</i>	Buttonwood
<i>foresteria segregata</i>	Foresteria
Shrubs	
<i>Chiococca bermudiana</i>	Bermuda Snowberry
<i>Dodonaea viscosa</i>	Jamaica Dogwood
<i>Eugenia auxillaris</i>	White Stopper
<i>Pluchea odorata</i>	Shrubby Fleabane
<i>Suriana maritima</i>	Tassel Plant
<i>Baccharis glomeruliflora</i>	Doc Bush
<i>Yucca aloifolia</i>	Spanish Bayonet
<i>Sophora tomentosa</i>	Coast Sophora
<i>Borrichia arborescens</i>	Sea Ox-eye
<i>Mallotonia graphalodes</i>	Iodine Bush
<i>Scaevola plumieri</i>	Beach Lobelia
Sub-shrub, Succulents and Grasses	
<i>Heliotropum curassavicum</i>	Seaside Heliotrope
<i>Limonium nashii</i>	Sea Lavender
<i>Oenothera humifusa</i>	Seaside Evening Primrose
<i>Sesuvium portulacastrum</i>	Sea Purslane
<i>Turnera ulmifolia</i>	Turnera
<i>Erigeron darrellianus</i>	Darrell's Fleabane
<i>Sysirinchium bermudiana</i>	Bermudiana
<i>Croton punctatus</i>	Beach Croton
<i>Euphorbia buxifolia</i>	Coast Spurge
<i>Solidago sempervirens</i>	Seaside Goldenrod
<i>Cakile lanceolata</i>	Scurvy Grass
<i>Salicornia europaea</i>	Woody Glasswort
<i>Kyllinga brevifolia</i>	Short Leaved Kyllinga
<i>Oplismenus hirtellus</i>	Wood Grass
<i>Polymnia uvedalia</i>	Bear's Foot
<i>Euphorbia heterophylla</i>	Joseph's Coat
<i>Valerianodes jamaicensis</i>	Jamiaca Vervain
<i>Leucaena virgatum</i>	Virgate Mimosa
<i>Lippia nodiflora</i>	Cape Weed
<i>Nephrolepis exaltata</i>	Sword Fern
<i>Paspalum caespitosum</i>	Slender Paspalum
<i>Cenchrus tribuloides</i>	Burr Grass
<i>Sporobolus virginicus</i>	Sea Share Rush Grass
<i>Eustachys petraea</i>	West Indian Grass
<i>Paspalum vaginatum</i>	Sheathed Paspalum
<i>Stenotaphrum secundatum</i>	Crab Grass
<i>Panicum virgatum</i>	Switch Grass
Vines	
<i>Parthenocissus quinquefolia</i>	Virginia Creeper
<i>Cardispermum microcarpum</i>	Small-fruited Balloon Vine
<i>Ipomoea pes-caprae</i>	Seaside Morning Glory
<i>Canavali lineata</i>	Bay Bean

Figure 15: Vegetation survey

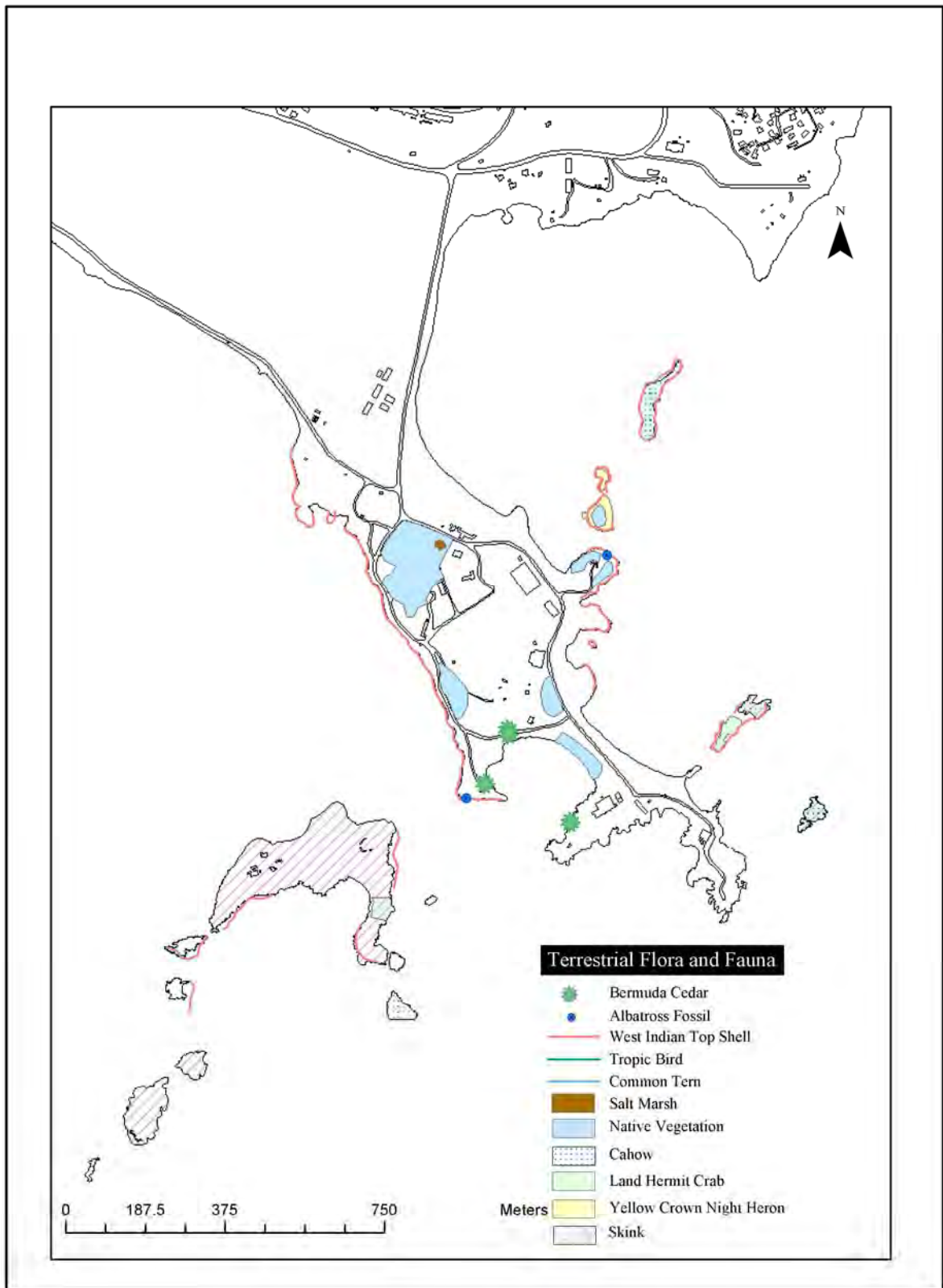


Figure 16: Terrestrial flora & fauna

2.14. Marine Environment

The Cooper’s Island peninsula is surrounded by seagrass beds and coral reef. The seagrass beds are located on the western and eastern sides of the peninsula while the coral reefs are mainly around the southern tip (Figure 16).

2.14.1. Coral Reef

Bermuda is the most northerly location of active coral reef growth in the world, due to its location near the warm waters of the Gulf Stream and the Northern Equatorial current.

In 1978, all corals around Bermuda were protected under the Fisheries (Protected Species) Order 1978, but prior to this, Bermuda had already established two coral reef preserves, one on the north shore and one on the south shore, under the Coral Reef Preserves Act (1966). Within these preserves it is unlawful to remove, damage or be in possession of any plants or animals (including corals), whether dead or alive, which are attached to the coast, seabed or reef. Fishing is, however, permitted in these areas. The South Shore Coral Reef Preserve extends along the south coast of Bermuda from Hungry Bay to Gurnet Rock and its southeasterly boundary is approximately ½ mile from Cooper’s Island.

The Fisheries (Protected Areas) Order 1990 and its amendments provide protection to certain marine areas as there are restrictions on fishing and anchoring in these areas. Four of the marine protected areas, “The Cathedral”, “Kate”, “Pelinaion” and “Rita Zoveta”, are in close proximity to Coopers Island (Figure 17). The latter three sites are

centred on shipwrecks. Fishing is prohibited year round in all four areas.

Marine Protected Area	Approx. Distance from Coopers Is.
“The Cathedral”	0.5 miles
“Kate”	2.3 miles
“Pelinaion”	0.8 miles
“Rita Zoveta”	1.0 miles

Figure 17: Local ship wreck sites

Apart from a few patch reefs near Goat Bay, the main area of coral reef is at the southern tip of Cooper’s Island. Both hard and soft coral are present on these reefs and colourful reef fish are abundant.

However, this is an exposed area which has strong currents and access is very much dependent on the weather. There is a boat channel which runs around the tip of the island. For these reasons, this area is not considered to be a site which lends itself to snorkeling or SCUBA diving from the shore.

2.14.2. Seagrass Beds

Three of the four known species of seagrass are present in beds around the Cooper’s Island peninsula. The three species found around Cooper’s Island are turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and shoal grass (*Halodule wrightii*) (Figure 18).

Seagrass beds are important for a number of reasons. Seagrass blades produce oxygen which fish and other animals need to survive. The blades are also food for many marine organisms. When seagrasses die and decompose, they form detritus (decaying organic matter). Fish and many small

invertebrates utilise the detritus as a food source. The leaves provide a surface on which other plants and animals can attach and grow. In turn, these epibionts provide an important food source for fish and invertebrates. Seagrass beds are a nursery habitat for young fish. They provide hiding places for juvenile fish which would otherwise be targets for larger predators.

The leaves and upright stems of the seagrass reduce water velocity which causes suspended particles to fall to the bottom where they are trapped by the dense mat of seagrass stems and underground roots, thus maintaining water quality and reducing turbidity in adjacent habitats such as coral reefs. The reduction in water velocity probably encourages the larvae of many marine organisms to settle in the seagrass. Seagrasses encourage binding and accretion (building up) of bottom sediments, thus reducing erosion and protecting shorelines.

The seagrass community supports many species of fish and invertebrates during some part of their lifecycle. Without healthy seagrass beds, these fish populations are compromised as are commercial and recreational fishing. Spiny lobsters, yellowtail snappers, grey snappers, black grouper, porgies, grunts, hogfish, tarpon and bonefish are all examples of species that rely on the seagrass beds. Newly settled spiny lobsters live in the seagrass and then move to the coral reef as they become larger. Adult spiny lobsters hide on the reef during the day but at night they leave the reef to forage for food in the seagrass. Adult grunts also live on the reef during the day but feed on the seagrass beds at night.

Around Bermuda, seagrass beds are threatened by the increasing number of boat moorings which are often placed in sheltered bays where there are established seagrass beds. The swinging mooring chains scrape the seagrass from the bottom creating a circle of bare sand around the mooring weight. Physical destruction by boat propellers, groundings and trampling by humans are also a problem. Unlike corals, seagrass beds are not currently protected by legislation.

2.14.3. Sea Turtles

Seagrass is the main food source for green sea turtles and the cropped seagrass around Clearwater, Cooper's Island and Nonsuch Island clearly indicates that the turtles are using these beds as feeding grounds. Since the late 1970s, the Bermuda Turtle Project (BTP) has been studying green sea turtles around Bermuda. As part of this study, turtles are caught, tagged and then released. In July 2003, thirteen turtles were tagged in Annie's Bay and two more were tagged in Goat Bay. Turtles are also frequently sighted at Well Bay, Clearwater Beach/Turtle Bay and Long Bay. These turtle sightings provide excellent opportunities for ecotourism at Cooper's Island.

In 1990 and 2004 clutches of sea turtle eggs on the southern end of Clearwater Beach/Turtle Bay were discovered. In the first instance these eggs were transferred to the aquarium where they were incubated, resulting in loggerhead hatchlings and in the second the eggs were allowed to hatch naturally.

Since the 1930s, these are the only evidence of turtles nesting around Bermuda. Well Bay and Long Bay are

two of the few remaining beaches remote from development; therefore these beaches have potential for restoring a turtle rookery.

In recent years the Bermuda Aquarium, Museum and Zoo has recorded a marked increase in the number of turtles injured or killed through boat collisions and entanglement in discarded fishing lines. Discouraging motorized boat traffic and banning fishing within the bays around Cooper's Island would benefit the turtles.

2.14.4. Queen conch

Queen conch is another species which is dependent on seagrass. They feed on the algae, which grows on the seagrass blades. Queen conch were once abundant around Bermuda but due to over-harvesting their numbers declined to such an extent that in 1978 they were given protection by the Fisheries (Protected Species) Order 1978. Despite this protection, the Queen conch populations have not recovered. Recent surveys have only documented presence of the Queen conch at four sites in Bermuda, one of which is the seagrass beds around Cooper's and Nonsuch Islands.

2.14.5. Submerged forest

In Well Bay, there is evidence, in the form of peat layers, tree roots and stumps, of a submerged forest (Figure 18). Further studies are required to determine the age and type of forest but it is likely to be thousands of years old. It is certainly a site of special scientific interest and provides both scientific and educational opportunities. The relic forest is in approximately 6 to 10 feet (2 to 3 metres) of water and easily accessible from the shore, therefore it

makes it an ideal site for learning about changes in sea level over time.

2.14.6. West Indian top shell and bleeding tooth

The rocky intertidal zone (the area of shore between high and low tide) around the peninsula is of significance to two marine snails, the West Indian top shell and the bleeding tooth.

The West Indian top shell is an intertidal mollusk with a distinctive large black and white shell. It is considered to be a delicacy in some parts of the Caribbean and it was once plentiful around Bermuda but disappeared in the mid to late 19th century. In 1982, West Indian top shells from Turks and Caicos were released around Nonsuch Island. This reintroduction was successful and now the West Indian top shell can be found along the intertidal zone of Cooper's Island. This species has been fully protected since 1989 under the Fisheries (Protected Species) Order 1978.

The bleeding tooth, another marine snail, is also found in the intertidal zone around Cooper's Island. Anecdotal evidence suggests that this snail is not as common around Bermuda as it used to be but that the population on Cooper's Island does appear to be stable. This animal is not currently a protected species.

2.14.7. Marine activities

Swimming is permitted in areas including Clearwater Beach, Turtle Bay, Long Bay and Fort Hill Bay but boats and jet ski traffic are actively discouraged by the Marine Police from the existing Cooper's Island Nature Reserve area.

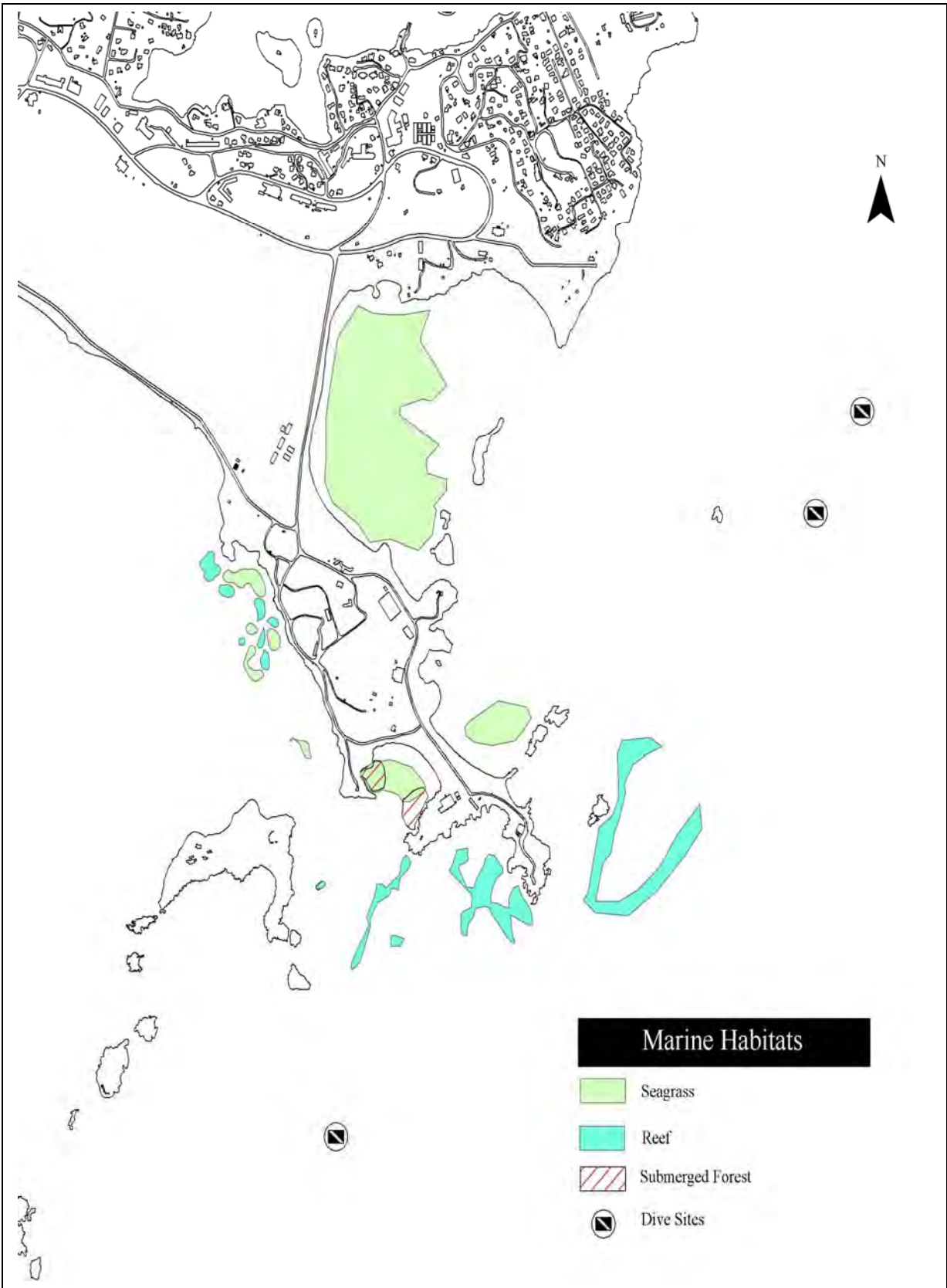


Figure 18: Marine habitats

Section 3.0 Challenges & Opportunities

In determining the suitability of future land uses for Cooper's Island and assessing the challenges and opportunities that the site offers, the following issues were addressed.

3.1. Key Issues

3.1.1. Land use & management

- (a) The benefits that this site will have at a local, national and international level.
- (b) The nature and potential impact that neighboring uses will have on possible land uses.
- (c) The economic, social and physical implications of the end use.
- (d) The means of implementing the chosen end uses and management of those land uses.

3.1.2. Builtform & utilities

- (a) The current state, visual impact and compatibility of buildings, structures and utilities to potential land uses (including the presence and use of the small fire arms range on the site).
- (b) The siting of existing utilities.
- (c) The siting of existing development which is centralized in the interior of Cooper's Island with limited development along the coastline.

3.1.3. Access and Security

- (a) The impacts of vehicular access into Cooper's Island.
- (b) The impacts of marine access to Cooper's Island.

3.1.4. Topography

- (a) The potential flooding impacts that severe weather will have on the site

and the consequences that this will have on future land uses.

- (b) Exposure to the elements and the effect that this will have on maintenance of existing and future builtform.

3.1.5. Environment and Recreation

- (a) The urgent need for more public open space in Bermuda and the importance of open space to the human psyche.
- (b) The sensitivity and potential of dive sites.
- (c) Existing legislation and policies protecting neighbouring sites (such as Nonsuch Island).
- (d) The potential for existing Government Departments to manage the site.
- (e) The strategic location of Cooper's Island in relation to surrounding nature reserves and the impacts that potential long term uses at the site will have on them and the endangered Cahow.
- (f) The potential for incorporating the use of adjacent sports and recreational facilities.

3.1.6. Environmental Mitigation

- (a) Potential problems (past, present and future) specifically as they relate to the environment and any necessary actions for cleanup, decontamination and removal of existing builtform.
- (b) The degree, extent and cost of any environmental clean up which will be determined by the choice of end use.
- (c) The financial cost of clean up of the former NASA buildings and lands to accommodate the chosen end use.

3.2. Consultees

The following Government Ministries and Departments and non-governmental organisations were consulted in an initial round of consultations as part of the formulation of this Plan for Cooper's Island:-

- The Department of Airport Operations
- The Department of Conservation Services
- The Department of Education
- The Department of Environmental Protection
- The Department of Parks
- The Department of Planning
- The Department of Youth and Sports
- The Ministry of Tourism & Transport
- The Ministry of Works, & Engineering
- The Bermuda Land Development Company (BLDC)
- The Bermuda National Trust
- Bermuda Audubon Society
- Bermuda Zoological Society

Figure 19: Consultees

A comprehensive series of public consultation exercises were undertaken with the general public in April 2005. These consisted of interpretive panels displayed during the full 3 days of the Annual Exhibition 2005 and for the following month of May during normal work hours at the Botanical Gardens' Visitor Centre.

The Plan was amended to reflect the findings of these consultations.

3.3. Consultation Summary

A number of different potential land uses and activities were considered for Cooper's Island and discussed in the consultation meetings.

Using the information gained from the consultation, a summary of the potential positive and negative impacts of each was produced (Appendix 2). In assessing the potential benefits and negative impacts of each potential land use, some general conclusions could be drawn.

Not only do open spaces have an environmental benefit in that they increase and protect biodiversity; the importance of open space to the human psyche cannot be overstressed. Open spaces provide children with healthier places to live and play and areas for adults to enjoy for recreation and relaxation. Open spaces also promote proven and tangible health benefits by helping to reduce stress levels.

Bermuda is developing at an prodigious rate and it is widely considered that there is insufficient publicly accessible open space for the Island's population. Cooper's Island provides Bermuda's residents and visitors with the only remaining unspoiled public open space to restore for everyone's benefit.

Cooper's Island is strategically located next to the "Cahow islands" and the Nonsuch Island Living Museum project and as such is an extremely important site environmentally both locally and internationally. Cooper's Island provides the last opportunity for Bermuda to preserve a large area as a Nature Reserve and Wilderness Area. The area is isolated enough to enable the

successful restoration and protection of Bermuda's native and endemic plant and animal life in the same way as has been achieved on Nonsuch Island. In addition, Cooper's Island is easily accessible by road making it an attractive destination for school children, visitors and residents.

Cooper's Island is particularly suitable for providing environmental education, passive recreation and eco-tourism opportunities. It could be a "living museum" for children and adults to learn hands-on about Bermuda's flora and fauna, endangered species and environmental stewardship. There is a great opportunity to provide Bermuda's schools with a purpose-built environmental field centre. The site and the field centre could be used to teach primary, middle and senior level science and social studies programs.

In addition, there is a unique opportunity to build a Museum and Visitors Centre at Cooper's Island, which celebrates the history of the US bases in Bermuda. The Museum could have exhibits of the war effort, the space race and Bermuda's role in these. This could be a huge visitor attraction.

Ideally funds could be made available from the Bermuda Government, international foundations, private local donors as well as some modest economic return from charging an entrance fee and raising revenue through tours to fund the Nature Reserve and National Park. It is recommended that every effort be taken to exhaust these funding options prior to permitting any type of "enabling development" on the site such as residential or hotel development as a means of generating revenue for the

Nature Reserve. Whilst residential and tourism related developments on the site may reap high economic returns, some of which could be channeled into the Cooper's Island Nature Reserve and National Park, the danger is that the juxtaposition of these uses may create serious environmental and social problems.

Use of all or part of the site for a tourist resort or residential development could lead to privatization of the site and perhaps some of the beaches. There would be environmental and planning factors to take into account including potential noise and light pollution, pest encroachment, traffic generation, flood risk and noise from the adjacent airport. These factors would pose a serious threat to the area's and Island's biodiversity. The costs of rehabilitating the area for human habitation would also be significant.

There are very few places in Bermuda which remain "sacred" from development and there are very few places in Bermuda that are of such ecological importance as Cooper's Island. It is considered that there are ample opportunities within other parts of the island, including the former baseland areas, for tourism related or residential development to take place.

3.4. Market Analysis

3.4.1. Stakeholder competition

The site and future plans of the Reserve have and will have numerous stakeholders including Government Ministries, Quangos, Non Government charities, the general public and international visitors.

A. Government: The Reserve complements and is an extension of Bermuda's strategy on sustainability and bio-diversity strategy & action plans. It falls naturally within the mandate of the Ministry. While new resources will have to be allocated, there is a substantial infrastructure, capacity and some funding for the proposed activities.

With the exception of the Doppler Radar site, Police Firing Range and water storage facilities there are no other competing interests on site.

Agreement has been reached that BLDC would continue to utilise the water storage facilities, with the Ministry of the Environment drawing off the same facilities to meet the low level needs of the Nature Reserve.

The Doppler Radar site can be accommodated on site as it is relatively benign and in keeping with the general theme of environmental science.

The police firing range is the only main conflicting use. While it can remain for the short term (2-5 years) it will have to be relocated to another facility.

B. Local communities. The Reserve and its beaches will become extremely popular with the general public as indicated by the usage levels of the adjacent Clearwater Beach.

C. Tourism: Key to the concept of Cooper's Island is its "development" as an eco-tourism day tour destination. This concept acknowledges Bermuda's small geographical area, its limited range of attractions. The growing market of nature based adventure tourist and the

idea that an on site hotel implies "ownership" of the site.

Consultation found that the Island could be better served with a "shared" eco-tourism facility that all of the island's hotel industry could send their visitors too.

Other sectors which would benefit from this strategy will be the taxi and mini-bus operators with increased demand for more numerous and longer trips.

3.4.2. Competitors & alternatives

The proposed eco-tourism based Cooper's Island Nature Reserve will be unique to Bermuda.

All national parks and nature reserves have free entry and do not run any active programs such as proposed for Cooper's Island. This will be a new concept for the general public and may initially be resisted.

The nearby St. George's World Heritage Site and related Fortifications and Bermuda Aquarium Museum and Zoo with its live exhibits both appeals to separate visitor markets.

The only other sites with similar orientation is located at "9" Beaches in the west end.

There will be no competition to or for Cooper's Island either locally or island-wide.

Section 4.0 Vision

4.1. Mission Statement

The Mission is to restore Cooper's Island as Bermuda's National Nature Reserve and Environmental Education Centre, a "Living Museum" that will provide residents and visitors with a unique place to experience and learn about its cultural and environmental heritage. As such Cooper's Island Nature Reserve will:

"Seek to educate and promote conservation and an interest in all aspects of marine and terrestrial conservation through the establishment of a diverse range habitats; develop compatible facilities, programs, economic initiatives and support services in order to facilitate its conservation mission, while serving as a passive park and nature reserve."

4.2. Objectives

The following objectives for Cooper's Island reflect a focus on the value of conserving Bermuda's biodiversity and environmental heritage as a whole and in particular Bermuda's commitment to the guiding principles and objectives of the Environment Charter and the Convention on Biological Diversity (Appendix 3).

4.2.1. Resource management & protection

Objective (a) To preserve and enhance Cooper's Island in part as a National Park and in part as a Nature Reserve that will provide residents and visitors with a unique place to experience

Bermuda's cultural and natural heritage.

- ◆ To protect Cooper's Island and Clearwater Beach Park under the National Parks Act 1986.
- ◆ To remove all structures and roadways which are deemed unsightly, undesirable and unnecessary to the operation of the National Park and Nature Reserve
- ◆ To allow only minor siteworks and structures to be built that are essential to the maintenance, conservation or enhancement of the National Park and Nature Reserve and for future planning regulations to reflect this.
- ◆ To provide an efficient public transport hub and visitor parking within the Clearwater Beach Park and Cooper's Island National Park areas.
- ◆ To create a system of 'layered' access which encourages pedestrian access only within the National Park and Nature Reserve, while allowing access for emergency and maintenance vehicles.
- ◆ To investigate the use of alternative energy sources on the site.
- ◆ To provide and maintain potable fresh water sources.
- ◆ To reduce hard surfaced roads within the reserve.

- ◆ To create an efficient joint management.
- ◆ To provide a safe, secure and enjoyable place to visit and work.

Objective (b) To restore part of Cooper's Island as a 'Living Museum' and wilderness area.

- ◆ To introduce, in the new Nature Reserve, a phased restoration programme based on the original 'Living Museum' programme designed for the adjacent Nonsuch Island.
- ◆ To develop as complete a series of habitats and "sanctuaries" for Bermuda's flora and fauna.

Objective (c) To preserve the marine environment surrounding Cooper's Island peninsula.

- ◆ To create and protect a marine park around Cooper's Island.
- ◆ To protect the unique marine assets of the park such as the submerged forest as a site of special scientific interest.
- ◆ To protect, conserve and propagate, where possible endangered species as per the requirements of the Protected Species Act 2005.
- ◆ To discourage all boat traffic, including jet skis, from anchoring in seagrass beds and from landing on the Reserve's beaches.

4.2.2. Tourism, Sports & Recreation

Objective (d) To provide new and exciting opportunities for environmental education, recreation and eco-tourism.

- ◆ To establish Cooper's Island as Bermuda's main environmental education field centre where children can learn hands-on about Bermuda's terrestrial and marine environment.
- ◆ To establish Cooper's Island as a 'Living Museum and Laboratory' to teach environmental stewardship to primary, middle school and senior students through the science and social studies school curricula.
- ◆ To offer guided walks, eco-tours, whale watching, bird watching, scuba, snorkeling and kayaking tours.
- ◆ To offer opportunities for supervised camping in strategic locations within the Nature Reserve to schools and community groups.

Objective (e) To provide new visitor attractions and activities.

- ◆ To restore the former Mission Control building as a combination Visitor and Recreation Centre. The centre will include facilities such as museum, education/conference centre, accommodation and facilities for children, visiting sports teams and eco-tourists.
- ◆ To denote the location of Pembroke Fort as one of the first defense fortifications built to defend Bermuda and showcase examples of the defenses erected when the

reserve was U.S. army base and tracking station.

- ◆ To provide passive recreational activities which will have minimal environmental impact.

Objective (f) To create employment and revenue generating opportunities that are compatible with conserving and enhancing the National Park and Nature Reserve and that will help to finance the long term restoration of Cooper's Island.

- ◆ To provide for a range of job opportunities that will support the mission of the reserve.
- ◆ To introduce and support revenue-generating initiatives that are in keeping with the mandate of the Reserve.
- ◆ To establish partnerships with international and local conservation groups.
- ◆ To pursue international designations and explore the possibility of securing international funding.
- ◆ To prepare a sustainable business strategy which:-
 - Clearly identifies the economic possibilities that exist for the creation of the Cooper's Island National Park and Nature Reserve.
 - Clearly illustrates the financial viability of the Park and Reserve.
 - Addresses the financial implications of environmental clean up works.

- Illustrates the financial viability of the Park and Reserve through the examination of other precedents and case studies internationally.
- Outlines possible sources of financial aid for the clean up of the site.
- Identifies financial opportunities to enable the establishment, implementation and management of the National Park and Nature Reserve including government sources and enabling development funds.
- Investigates international designations that will help in the securing of international financial aid.
- To convert existing structures where possible to new uses that are compatible with the mission statement.

4.2.3. Management & administration

Objective (g) To create and support an efficient management structure that allows Cooper's Island Nature Reserve to meet its mission statement.

4.2.4. Environmental education outreach & scientific research

Objective (h) To interpret and promote Cooper's Island Nature Reserve.

- ◆ To develop an integrated signage and interpretation system for the Reserve.
- ◆ To develop a series of tour packages for visitors.
- ◆ To develop self guided brochures for adults and children.

- ◆ To develop and maintain a web site dedicated to the promotion and programs of the reserve.
- ◆ To host conferences and environmental delegations in support of local and world wide conservation efforts.
- ◆ To offer international research opportunities in environmental and conservation programs.

Objective (i) To develop training initiatives and programs for staff and volunteers

- ◆ To commit to training all staff and volunteers on the importance of preserving Bermuda's environmental heritage.
- ◆ To develop new teaching initiatives based on existing programs and extensive teaching tools developed and run by the Bermuda Zoological Society.



Figures 20: Cahow fledgling 2003

Section 5.0 The Masterplan & Development Strategy

5.1. Concept

The goal of the masterplan is to establish an infrastructure that will support the exhibits and guide the restoration of Cooper's Island as a 'Living Museum'; showcasing Bermuda's environmental heritage.

5.1.1. Restoration, sustainability & "Un-development" of Cooper's Island.

Cooper's Island be restored to its pre-World War II condition, through a phased restoration program pioneered by the original 'Living Museum' program on Nonsuch Island.

Integral to the Reserve will be the removal of all "unnecessary" structures and roadways and the minimization of any new development within the Nature Reserve. The majority of the infrastructure of the former NASA Tracking Station will be demolished as it has now deteriorated to the point that this infrastructure is dangerous and/or because they have limited potential for conversion to other uses compatible with the Reserve.

In their place new habitats and sanctuaries for Bermuda's native and endemic flora and fauna will be created and interpreted.

The masterplan recognizes existing agreements, leases and commitments of the Government namely (Section 5.2.).

- The temporary Police firing range;
- The Doppler Radar and weather station;
- The water catch and storage facility;

- Electrical substation/generator.

5.1.2. Access. Critical to the success of the Reserve is the support of Bermuda's public and international visitors for the preservation of its sanctuaries.

While public access will be guaranteed to the sites beautiful beaches, trails and habitats every effort will be made to minimize vehicular intrusion and trash generation within the Reserve.

As such the masterplan has been designed in such a way as to minimize such intrusion. The main car park and transport hub will be developed on the perimeter of the Reserve. These facilities will serve not only the Reserve but Clearwater and Turtle Bay Beach, as well as the Southside Motocross facility.

Accommodation will be made for visitor drop off in the vicinity of the Reserve's Visitor Centre.

All other access will be restricted to maintenance and emergency vehicles within the Reserve.

5.1.3. Environmental education initiatives & scientific research.

The Reserve is committed to educating the local public, especially children in the importance of Bermuda fragile environment and international visitors.

Facilities will be constructed to support this mandate which will include:

- A multi-purpose educational facility in the visitor center;
- Multi-purpose camp ground(s).

The majority of programs will interpret the natural habitats of Cooper's Island and adjacent Nonsuch Island.

5.1.4. Eco-Tourism. The majority of the tourism initiative does not need major investment in infrastructure as they are capitalizing on the natural assets of the site. Related improvements will concentrate the following:

- Improving access and where possible creating disabled access that does not negatively impact on the sensitive environments of the Reserve. These will include infrastructure such as boardwalks, docks, step/ramp combinations, surfaced pedestrian paths.
- Developing an integrated interpretive program for the site.
- Developing ancillary structures such as bird blinds and a whale-watching tower.
- Lifeguard and storage facilities for water and beach related activities.

5.1.5. Sports and Recreation.

The Clearwater area is used extensively for Triathlon type sports training. The Reserve will develop facilities and programs that will support these uses and that are compatible with its mandate.

5.1.6. Utilities. Where possible in the short term the Reserve will restore and reuse existing infrastructure with the intention of moving to alternative and/or eco-friendly energy sources and facilities in the long term.

A. Electricity. The demolition and removal of the majority of the existing

defunct infrastructure, the mainly daylight operations of the Reserve and the low level use of the Reserve will significantly reduce the needs of overall utility demand and costs for the site. Demand will be predominantly restricted to the Visitor Centre and the Plant Nursery/Yard.

Where possible all ancillary structures will use solar power, as they are relatively low key operations.

B. Water. Will in the short-medium term be supplied by the existing water catch and storage facilities.

The two 40,000 gallon Reverse/Osmosis plants will be assessed and restored if cost effective.

Potable water demand will primarily be needed at the Visitor Centre and the Plant Nursery. The majority of the utility lines already exist.

C. Sanitation. The existing facilities at the new visitor centre will be restored.

The Reserve will introduce compost toilets in strategic areas of the reserve. These units have proved to be highly successful in the National Park System, with limited maintenance and high sanitary conditions.

5.1.7. Interpretation & Signage.

Using the Railway Trail Integrated Signage Strategy as a national standard, a similar system will be designed for the Reserve. This will create directional, locational and interpretive signage for each sanctuary/district.

Signs will be supplied by the following manufacturer.

Fossil industries Inc
 #44 Jefryn Boulevard
 Deer Park NY 11729
 U.S.A
 T: 800-244-9809, 631-254-9200
 F: 631-254-4172
 Email:<http://www.fossilinc.com>



Figure 22: Typical interpretive sign

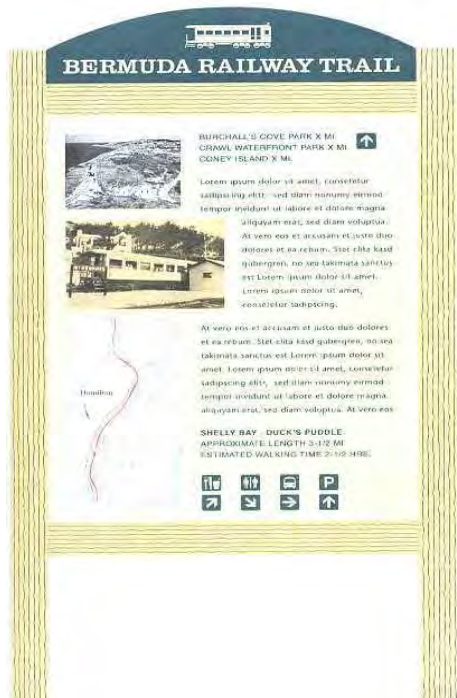


Figure 21: Typical Entrance sign



Figure 23: Typical directional sign

5.2. Special Areas & Sanctuaries

The management plan will create 17 districts representing as diverse a range of habitats as possible in the Reserve, showcasing the flora and fauna unique to each type (Figure 25).

District 1: Exposed rocky coastland

Cooper's Island, as the northeastern extreme of Bermuda, is a critical stop over point for many species.

The outer peninsula of the Reserve will see the demolition of all existing buildings and restoration of the outer peninsula as a rocky coastal habitat and vista point for migrating species such as whales, cahow and the tropic long tail to name a few key species.

Artificial Long Tail "igloos" and skink burrows will be added along the coast, two existing radar mounts will be converted to a bird watching/star gazing facilities with mounted telescopes. Interpretative signage will be placed along the paths.

Commemoration will be made of the original location of Pembroke Fort as one of the first defenses of Bermuda.

District 2: Turtle Reserve

The main beaches of Cooper's Islands and surrounding dune will be restored as beautiful passive recreation areas and as protected habitats for critical species such as the loggerhead and green turtle, and Bermuda beach cricket.

Apart from interpretive signage, lifeguard equipment, concession equipment storage and turtle fencing, little infrastructure will be needed for this area.

Extensive culling of invasive species will be undertaken followed by the replanting of native and endemic plant species suitable for dune habitat.

Activities such as snorkeling, scuba diving and kayak tours will allow visitors and school children to explore the submerged sunken forest, reefs and marine life of the area.

District 3: Cahow Islets

Public access will not be permitted onto the Cahow islets as these are the last remaining nesting areas of Bermuda's critically endangered national bird.

Due to their low lying topography and the danger of storm surge damage, artificial burrows will be added as needed to ensure adequate nesting areas for the Cahow.

District 4: Visitor & Recreation Centre

As the hub and main entry point of the Reserve, the former NASA Mission control building will be converted into the Cooper's Island Visitor Centre and Museum.

This multi-purpose visitor facility will provide the following primary functions/facilities.

- Curator office
- Volunteer office
- "Barrack" style accommodation for teams, children and visitors
- Kitchen facilities & snack bar
- Restrooms/changing facility
- Ticket booth
- Multi-purpose event/education rooms
- Video room
- Museum exhibits

The Electrical Substation/ Generator located will be demolished as redundant.

- Proposed Museum Exhibits**
- ❖ NASA’s mercury programs
 - ❖ The presence of the US army in Bermuda, such as the massive work undertaken building Kindley Field airport.
 - ❖ Importance of Nonsuch Island, surrounding islets, re-discovery of the Cahow and the “Living Museum” program.
 - ❖ Environmental programs being undertaken by the Reserve, interpretive exhibits on sanctuaries within the reserve and species visitors are likely to encounter or learn about e.g. turtles, whales and their migration, & mangrove habitat.
 - ❖ The History of St. David’s, including Fort Pembroke
 - ❖ Meteorological exhibits including Hurricanes, the importance of the Gulf Stream, the Doppler Radar and the Cooper’s Island weather station.

Figure 24: Proposed visitor centre exhibits

District 5: Water catchment & storage facility. It is proposed that these facilities be retained under the existing management structure (BLDC) with a formal agreement that the Reserve will have access to use the fresh water for its needs.

In the long term (10 years), as new facilities come on line, the physical plant of the water catch will be reassessed with the possibility of reducing its physical size.

District 6: Butterfly Sanctuary
This sanctuary will focus on providing habitat for Bermuda’s native and migratory butterfly species. Infrastructure will be minimal and restricted to environmental remediation of the area, earthworks, establishing a path network, nectar, host and attractant planting with interpretive signage.

District 7: Fern Sanctuary
Currently the site is used as a Police Firing Range. This facility will be maintained under its current 5 year lease. At that point it will be relocated to another suitable location. During the interim period warning signs and flags will be erected to inform the public when the facility is in operation and to alert the public of no-go areas.

The significant rock cut and cliffs around the site provide for opportunity to create a sanctuary for ferns. There will be a need for the creation of an artificial buffer to provide more shelter in the exposed area. This will become a sanctuary for critically endangered ferns such as the Governor Laffan Fern, 10 day Fern and the Virginia Chain Fern. This area is also expected to be good habitat for the Barn Owl and Butterfly species attracted to fresh water.

A re-circulating fresh water cascade over the cliffs to a shallow pool reservoir and a peat basin will assist greatly in providing the right conditions for the ferns.

In addition to the demolition of the existing buildings, addition of a water source, new paths will be built and burrows created for the endangered Barn Owl.

District 8: The Weather station

This facility currently consists of the weather related and telecommunication facilities e.g. Doppler Radar.

These will be maintained in their current location under the current lease. The area will be fenced to ensure visitor safety and the facility will be interpreted through static exhibits, signage and perimeter tours.

District 9: Protected Rocky Coastland

This rocky foreshore area stretches along the western coastline of the reserve and is home to protected species such as the West Indian Top Shell and Egrets.

This area is the only protected stretch capable of housing a dock facility. This dock will be used for accessing Nonsuch Island and the Cahow Islets for scientific research, maintenance, inspection and the tour program.

It will be necessary to limit unsupervised docking at this facility and CCTV camera will be added to the dock with controls in the adjacent Plant Nursery.

It is proposed that with the exception of demolition of existing structures, new signage, repair to existing paths and the addition of Longtail Igloos, there will be little other new infrastructure in the area.

District 10: Upland Hillside Woodland

Located on the more exposed portion of the Reserve, this area will be remediated as Upland Hillside habitat. This area will showcase the typical native and endemic woodland mix found on Bermuda's hillsides.

Work in this area will be largely restricted to the demolition of existing

structures and culling of invasive species. When replanting the area with native and endemic species, consideration will be given to creating new pedestrian paths and glades for use as designated camping areas by schools and community groups.

District 11: Lowland valley woodland

Located in the more protected interior of the site this area will be culled and replanted with a native and endemic mix suitable for dells and valleys.

A timber observation tower will be constructed in this area to act as a bird blind and allow surveillance of the north portion of the reserve.

Both types of woodland areas will see the introduction of blue bird boxes, bat houses and barn owl hollows.

Area/District 12: Plant nursery & yard. The site of the former recycling centre will be converted into a plant nursery and yard facility for the maintenance crew. The facility will include the following:

- Office building for superintendent & lunchroom/locker room for crew with toilets and maintenance/equipment area
- Greenhouse/shade area
- Potting up area
- Dry material storage area
- Plant set out beds
- Parking

Water will be drawn from the existing water storage tank.

District 13: Public transport hub and parking area.

A new bus stand and public car/bike parking area will be

developed to service both Clearwater Beach Park and Cooper's Island Nature Reserve. The surrounding woodland will be cleared of invasive species and winding rural paths will be added showcasing Bermuda's coastal woodland.

District 14: Salt water marsh

The existing overgrown salt water marsh will be remediated, access improved and the habitat interpreted. Physical improvements will include excavation of dumped fill to recreate conditions for a salt marsh and the construction of a timber boardwalk with interpretative signage will be added.

District 15: Freshwater pond

There are very few fresh water pond areas in Bermuda and access to fresh water is both critical and an attractant to main species. It is envisaged that this habitat will play a very active role in education of children with interactive features such as a bird blind, pond dipper and telescope.

Physical improvements will include excavation and construction of a lined pond. the construction of a timber boardwalk, and the infrastructure noted above. Interpretative signage will be added.

District 16: Mangrove Reserve

Formally known as Officer's Beach the beach and surrounding area will be cleared of all debris and replanted with native and endemic coastal species. At the core will be a new mangrove reserve for both red and black mangrove species.

Mangrove habitat is critical to many juvenile fish species and is one of the most efficient and productive habitats.

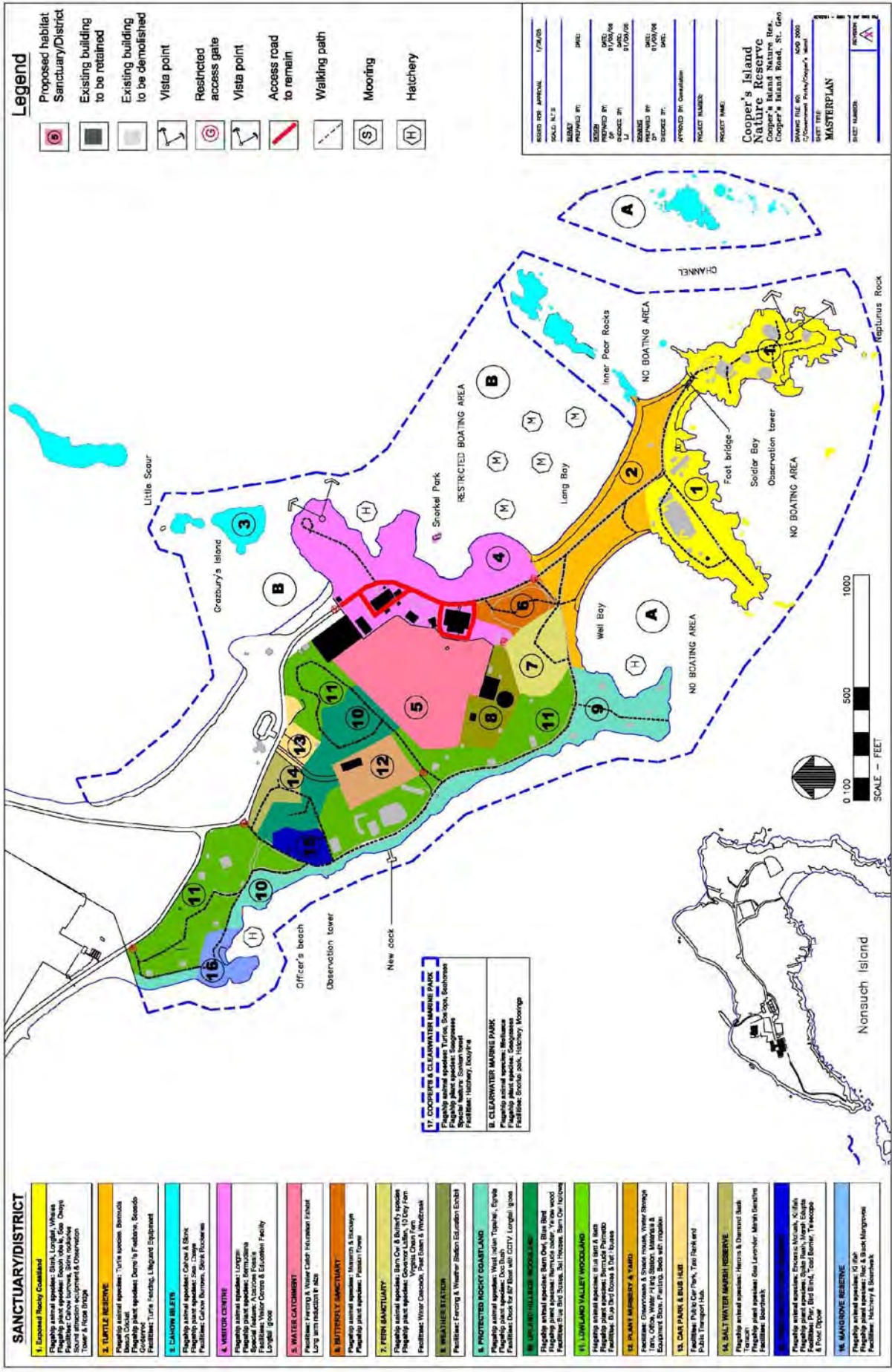
In addition to a small boardwalk will be created and an experimental fish hatcheries introduced.

District 17: Cooper's Island Marine Park. In addition to the terrestrial reserve, a new marine park will be created, taking in the Reserve, the Cahow Islets and Clearwater Beach.

This area will be a preserve for protected species such as the West Indian Topshell, the Sunken Forest in Well Bay, adjacent reefs and to assist in the protection of terrestrial species and swimmers in the reserve.

In order to protect these unique and fragile habitats, boats will not be permitted to anchor within a 100 metres radius of the peninsula. Instead designated moorings will be providing for use by the boating public.

An experimental fish hatchery will be established close to the Visitor Centre and a new snorkel park with an underwater trail that will provide interpretation to visitors snorkeling without a guide.



Sanctuary/District	Proposed habitat	Sanctuary/District to be retained	Existing building to be demolished	Vista point	Restricted access gate	Vista point	Access road to remain	Walking path	Mooring	Hatchery
1. Exposed Rocky Coastland	Propagule animal species: Lizard, Whiskered Tern, Fairy Tern, Masked Booby, Frigatebird, Brown Noddy, Great Frigatebird, Christmas Island Frigatebird, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater, Christmas Island Petrel, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater									
2. TURTLE RESERVE	Propagule animal species: Turtle, Laysan Duck, Brown Noddy, Christmas Island Frigatebird, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater									
3. CAKAOV BEACH	Propagule animal species: Christmas Island Frigatebird, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater									
4. VISITOR CENTRE	Propagule plant species: Lycopodium, Christmas Island Frigatebird, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater									
5. WATER CATCHMENT	Propagule animal species: Christmas Island Frigatebird, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater									
6. BUTTERFLY SANCTUARY	Propagule animal species: Christmas Island Frigatebird, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater									
7. PINE SANCTUARY	Propagule animal species: Christmas Island Frigatebird, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater									
8. WINDMILL STEINBERG	Propagule animal species: Christmas Island Frigatebird, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater									
9. PROTECTED ROCKY COASTLAND	Propagule animal species: Christmas Island Frigatebird, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater									
10. LAYAN VALLEY WOODLAND	Propagule animal species: Christmas Island Frigatebird, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater									
11. LAYAN VALLEY WOODLAND	Propagule animal species: Christmas Island Frigatebird, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater									
12. GRASSLAND SANCTUARY	Propagule animal species: Christmas Island Frigatebird, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater									
13. CAKAOV BEACH	Propagule animal species: Christmas Island Frigatebird, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater									
14. SALT WATER MARSH RESERVE	Propagule animal species: Christmas Island Frigatebird, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater									
15. MANGROVE RESERVE	Propagule animal species: Christmas Island Frigatebird, Christmas Island Gull, Christmas Island Noddy, Christmas Island Booby, Christmas Island Albatross, Christmas Island Petrel, Christmas Island Shearwater									

Figure 25: Master Plan, Cooper's Island Nature Reserve 2007

Section 6.0 Implementation

The following section looks to implement the physical improvement program for Cooper's Island Nature Reserve, establish an effective management and economic structure for the reserve.

6.1. Responsibility for site

Responsibility for the site will be transferred from the various government stakeholders to the Ministry specifically:

- ◆ Bermuda Land Development Company will transfer ownership of the areas known as Clearwater & Turtle Bay Beach to the Park System.
- ◆ The Ministry of Works, Engineering & Housing will transfer the site of the Former NASA Tracking Station at Cooper's Island to the Park System.

6.2. Legislation & Development Zoning

A. Legislation

Cooper's Island Nature Reserve will be protected under the National Parks Act 1986 and National Parks Regulation 1988.

" to be managed in a manner to encourage conservation and enjoyment of the natural, historic, and educational features of these areas with a minimum of commercial activity."

The area in the general vicinity of the existing vehicular entrance, to be designated as Cooper's Island Park, including Clearwater beach, will be added to the First Schedule of the Act as National Park. The remainder of the site will be added to the First schedule as Nature Reserve (Figure 26).

Other legislation, such as the Protected Species Act 2004, will be supported as required.

B. Development Zoning

Cooper's Island Nature Reserve will be added to the revised Bermuda Plan and will be zoned as a combination of Nature Reserve and National Park under the revised Bermuda Plan 1992.

The zoning will correspond to the boundaries as set by the National Parks Act 1986 (Figure 26).

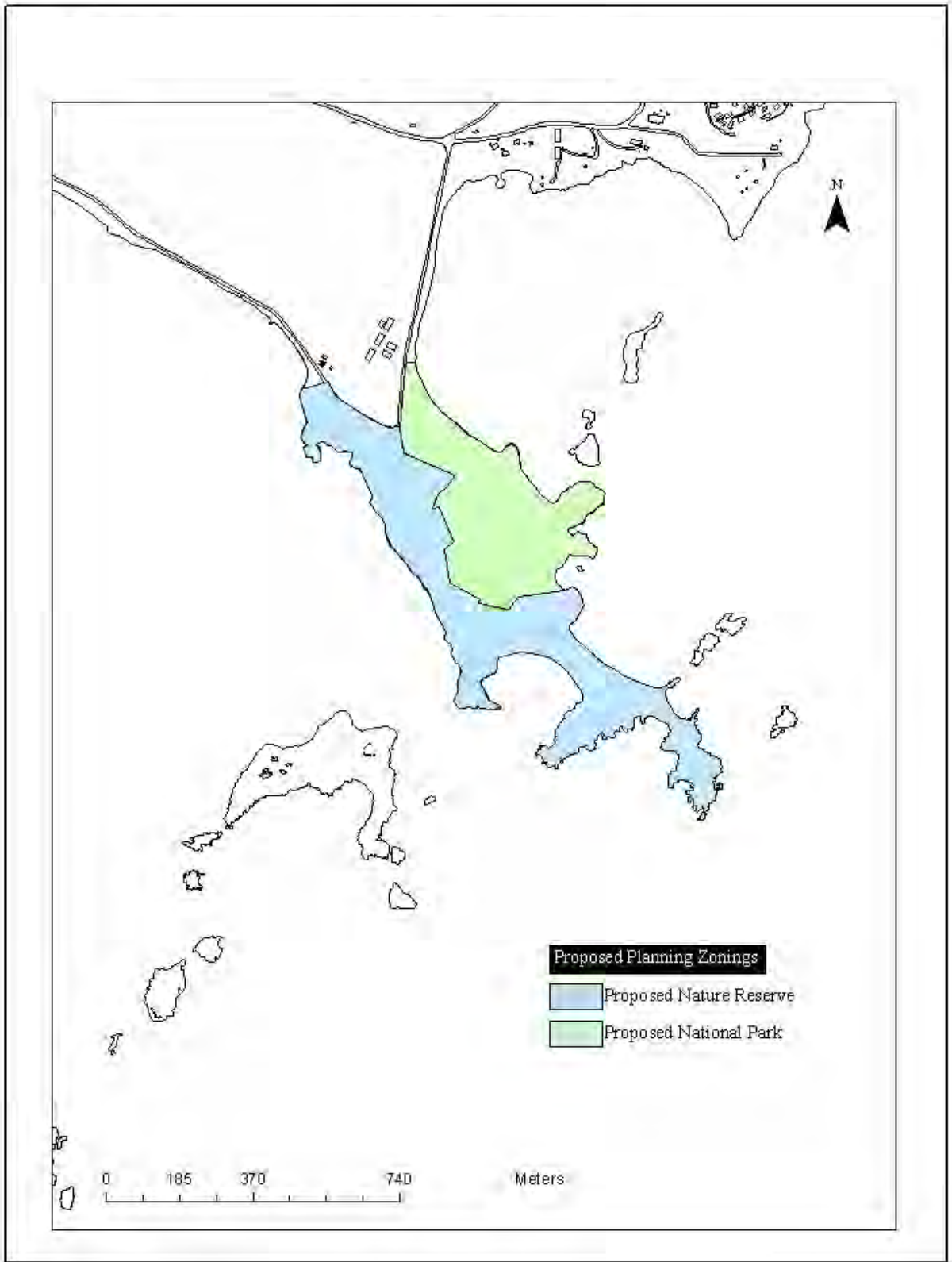


Figure 26: Proposed legislation & planning zones

6.3. Phasing & Capital Improvement Strategy

The 8 year capital improvement program has been organized into 4 phases, each phase will be 2 years in duration.

The approximate total for all park improvements is estimated at \$ 7 Million dollars (Figures 28 & 29).

Phase 1: Focuses on health & safety projects such as:

- Environmental remediation, demolition of dangerous buildings, removal of defunct utilities;
- Assessing and designing new major capital improvement projects;
- Culling invasive species.

Phase 2: Looks at creating the priority infrastructure improvements to the reserve such as:

- Visitor centre
- Habitats
- Signage
- Program development

Phase 3: Continues the development of priority infrastructure with a focus on program development and interpretation. It also recognizes the end of the lease period on the Firing Range.

Phase 4: Is the culmination of the main development of the Reserve and the regular maintenance with minor improvements.

The management plan will be reviewed and adjusted as necessary every two years, to reflect achievements and needs of the physical facilities and staff.

6.4. Hours of operation.

It is proposed that the Reserve will be open to visitors seven days of week and public holidays.

Hours of operation will be restricted to day light hours similar to BAMZ. Visitor access will not be allowed at night unless approved by the appropriate authorities.



Figure 27: Bunker in dangerous state of disrepair.

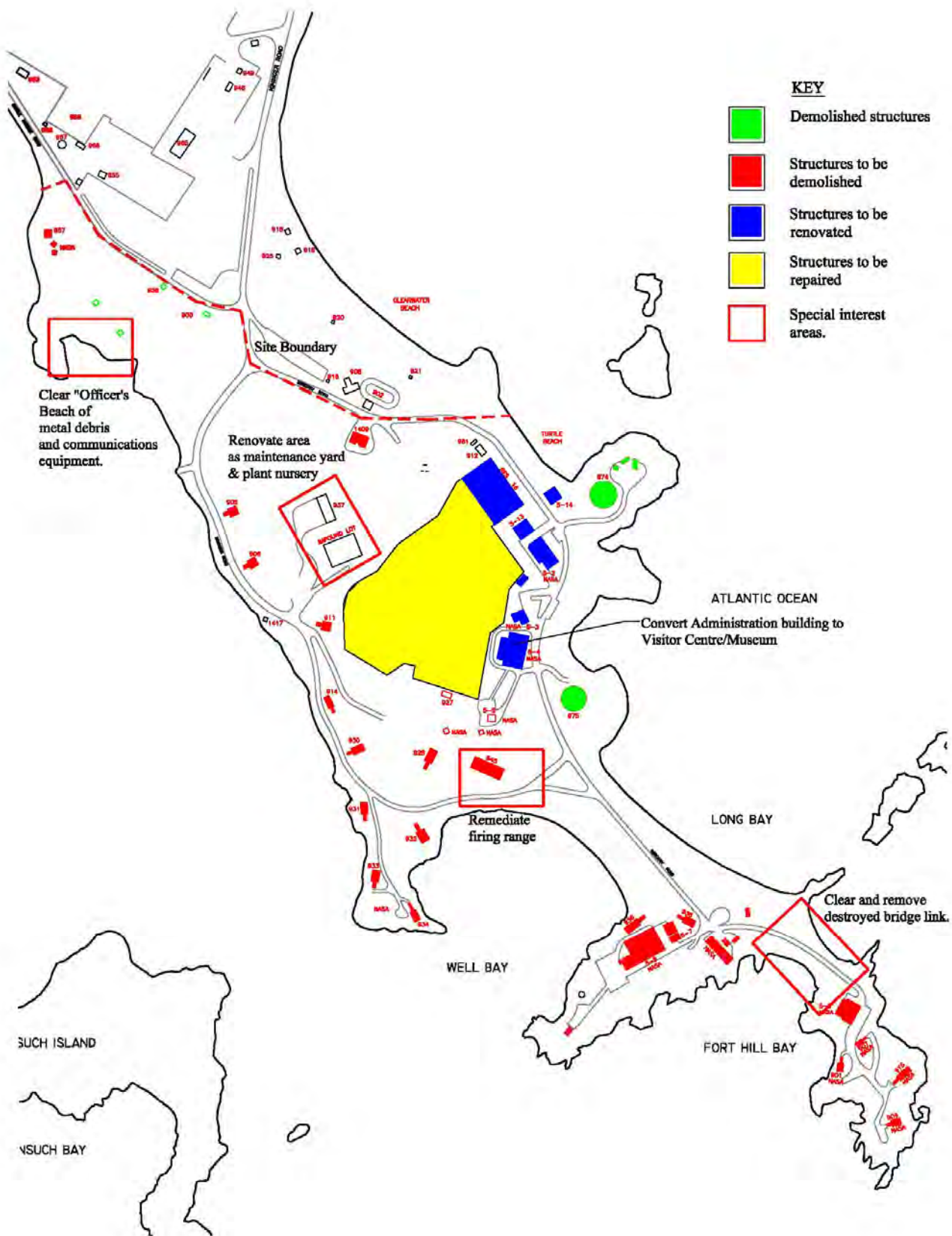


Figure 28: Proposed demolition plan

Exposed Rocky coastland						
Area #	Project	Estimate	Undertaker	Phase	Potential funder	
1	1 Assess 2 radar bases for retention and bridge link	\$10,000	W/E&H	1		
1	2 Demolish telemetry building, garage and workshops. Remove underground utilities & temporary Landfill across damaged bridge link	\$500,000	Contractor	1		
1	3 Remove all tarmac and surface concrete	\$100,000	Contractor	1		
1	4 Demolish radar building & bunkers	\$400,000	Contractor	1		
1	5 Supply and spread sand/topsoil mix	\$40,000	Contractor	1		
1	6 Remove hurricane damaged bridge	\$200,000	Contractor	2		
1	7 Convert 2 radar bases into observation towers with telescopes for migrations & star gazing	\$70,000	Contractor	2	YES	
1	8 Add new bailey bridge style bridge link	\$150,000	Contractor	2		
1	9 Construct double compost toilet	\$25,000	Contractor	2		
1	10 Add longtail igloos and skink rockeries	\$10,000	MOE	2		
1	11 Interpretive signage-Whales, Cahow, Longtail migrations & surrounding wrecks	\$25,000	MOE	2		
1	12 Habitat creation - Exposed rocky coastland	\$5,000	MOE	2		
		District Total(\$)	\$1,535,000			
Turtle Reserve						
Area #	Project	Estimate	Undertaker	Phase	Potential funder	
2	1 Reduce asphalt road to 8' maximum	\$30,000	Contractor	3		
2	2 Add turtle fencing	\$5,000	MOE	1		
2	3 Construct lifeguard tower and install equipment	\$40,000	Contractor	1		
2	4 Storage shed for concessions	\$50,000	Contractor	2		
2	5 Interpretive signage- Turtle, Sunken Forest, Dune habitat	\$25,000	MOE	1		
2	6 Habitat creation- Sand dune & beach	\$5,000	MOE	2		
		District Total(\$)	\$155,000			
Cahow Islets						
Area #	Project	Estimate	Undertaker	Phase	Potential funder	
3	1 Construct cahow burrows and skink rockeries	\$5,000	MOE	1		
3	2 Add regulation signage	\$2,500	MOE	1		
		District Total(\$)	\$7,500			

Figure 29: Capital development strategy

Visitor Centre						
Area #	Project	Estimate	Undertaker	Phase	Potential funder	
4	1	\$50,000	WE&H	1		
4	2	\$10,000	WE&H	1		
4	2	\$50,000	Consultant	1		
4	3	\$1,500,000	Contractor	2	YES	
4	4	\$500,000	Contractor	2	YES	
4	5	\$30,000	Contractor	2		
4	6	\$100,000	Contractor	2		
4	7	n/a	WE&H	1		
4	8	\$200,000	Consultant	2	YES	
4	9		Consultant	2		
4	10		Consultant	2		
4	11	\$2,500	Consultant	1		
4	12	\$20,000	MOE	2		
		District Total(\$)	\$2,462,500			

Water catchment						
Area #	Project	Estimate	Undertaker	Phase	Potential funder	
5	1	\$10,000	WE&H	1		
5	2	\$10,000	WE&H	1		
5	3	\$40,000	WE&H	2		
5	4	unknown	WE&H	2		
		District Total(\$)	\$60,000			

Butterfly sanctuary						
Area #	Project	Estimate	Undertaker	Phase	Potential funder	
6	1	\$10,000	Contractor	3		
6	2	\$30,000	Contractor	3		
6	3	\$20,000	Contractor	3		
6	4	\$20,000	Consultant	4		
6	5	\$5,000	Moe	4		
		District Total(\$)	\$85,000			

Fern sanctuary

Area #	Project	Estimate	Undertaker	Phase	Potential funder
7 1	Demolition of firing range buildings	\$100,000	Contractor	2	
7 2	Remediation of site	\$150,000	Contractor	3	
7 3	Create windbreak	\$30,000	Contractor	3	
7 4	Create fresh water cascade, lined pools and re-circulating pump	\$100,000	Contractor	3	
7 5	Create peat basin	\$50,000	Contractor	3	
7 6	Path improvements	\$50,000	Contractor	3	
7 7	Construct barn owl burrows	\$2,500	MOE	3	
7 8	Interpretive signage- Ferns & mosses	\$10,000	Consultant	3	YES
7 9	Habitat creation-Ferns & mosses with butterfly plants	\$5,000	MOE	3	
		District Total(\$)	\$497,500		

Weather station

Area #	Project	Estimate	Undertaker	Phase	Potential funder
8 1	Assessment and removal of any superfluous infrastructure not needed by weather station	\$20,000	Contractor	1	
8 2	Fence improvements	\$25,000	Contractor	1	
8 3	Add small interactive weather station outside perimeter of main facility to include for wind speed, rainfall measurements and interpretive signage of Doppler Radar & water collection	\$15,000	Contractor	3	
		District Total(\$)	\$60,000		

Protected Rocky Coastland

Area #	Project	Estimate	Undertaker	Phase	Potential funder
9 1	Demolition of bunkers & several small ancillary sheds	\$100,000	Contractor	1	
9 2	Design and permission for dock suitable for 50' length boat.	\$10,000	W/E&H	1	
9 3	Construct dock with lighting, CCTV and access improvements	\$400,000	Contractor	2	
9 4	Interpretive signage- flora & fauna of typical Rocky Coastland	\$5,000	MOE	2	
9 5	Habitat creation- Rocky coastland	\$5,000	MOE	1	
		District Total(\$)	\$520,000		

Upland Hillside Woodland

Area #	Project	Estimate	Undertaker	Phase	Potential funder
10 1	Demolition of bunkers and removal of concrete pads of former NASA buildings (demolished)	\$75,000	Contractor	1	
10 2	Construct new path network	\$25,000	Contractor	3	
10 3	Major culling of invasive species	\$5,000	MOE	3	
10 4	Habitat creation-Upland Hillside	\$5,000	MOE	3	
10 5	Add blue bird boxes, bat houses and barn owl hollows	\$5,000	MOE	3	
10 6	Construct double compost toilet	\$25,000	Contractor	3	
10 7	Interpretive signage- flora & fauna of Upland Hillside Woodland	\$10,000	Consultant	3	
		District Total(\$)	\$150,000		

Lowland Valley Woodland

Area #	Project	Estimate	Undertaker	Phase	Potential funder
11 1	Demolition of bunkers and removal of concrete pads of former NASA buildings (demolished)	\$50,000	Contractor	1	
11 2	Construct new path network	\$25,000	MOE	2	
11 3	Construction of observation tower with telescope and for interpretive signage	\$75,000	Contractor	3	YES
11 4	Major culling of invasive species	\$5,000	MOE	2	
11 5	Habitat creation-Lowland valley woodland	\$5,000	MOE	2	
11 6	Add blue bird boxes, bat houses and barn owl hollows	\$5,000	MOE	2	
11 7	Construct double compost toilet	\$25,000	Contractor	3	
11 8	Interpretive signage- flora & fauna of Lowland valley Woodland	\$5,000	Consultant	2	
		District Total(\$)			
		\$145,000			

Plant Nursery/Maintenance Yard

Area #	Project	Estimate	Undertaker	Phase	Potential funder
12 1	Assessment and demolition(if necessary) former recycling centre	\$10,000	Consultant	1	
12 2	Repair fencing and add windbreak	\$15,000	Contractor	1	
12 3	Design new nursery/yard facilities: To include water storage tank & pump room, green house	\$20,000	MOE & Consultant	1	
12 3	shade unit, Office/toilet/locker room/storage facility			1	
12 4	Develop new nursery/yard facilities: To include water storage tank & pump room, green house	\$300,000	Contractor	2	
12 4	shade unit, Office/toilet/locker room/storage facility			2	
12 4	Access and car park improvements with CCTV & lighting	\$50,000	Contractor	2	
12 4	Set out plant beds & irrigation	\$5,000	MOE	2	
		District Total(\$)			
		\$400,000			

Car Park & Public Transport Hub

Area #	Project	Estimate	Undertaker	Phase	Potential funder
13 1	Demolition of 1 building	\$50,000	Contractor	1	
13 2	Design car park and public transport hub with bus shelter, bus turn around & taxi stand	\$30,000	Consultant	1	
13 3	Construct car park and public transport hub with bus shelter, bus turn around & taxi stand	\$200,000	Contractor	2	
13 4	Construction of perimeter fencing	\$40,000	Contractor	2	
13 5	Directional signage	\$5,000	Consultant	2	
		District Total(\$)			
		\$325,000			

Salt water marsh

Area #	Project	Estimate	Undertaker	Phase	Potential funder
14 1	Survey, design & permissions of salt marsh remediation with boardwalk	\$5,000	MOE&W/E&H	1	
14 2	Construction of salt marsh remediation with boardwalk	\$250,000	Contractor	1	
14 3	Habitat creation- salt marsh	\$5,000	MOE	1	
14 4	Interpretive signage-flora & fauna saltmarsh & karst geology	\$10,000	Consultant	1	
		District Total(\$)			
		\$270,000			

Fresh water pond						
Area #	Project	Estimate	Undertaker	Phase	Potential funder	
15 1	Survey design & permissions of lined fresh water pond with boardwalk	\$5,000	MOE&W/E&H	3		
15 2	Construction of fresh water pond with load barrier boardwalk with bird blind, pond dippers	\$250,000	Contractor	4		
15 3	Habitat creation- Fresh water pond	\$5,000	MOE	4		
15 4	Interpretive signage-flora & fauna fresh water pond	\$10,000	Consultant	4		
		District Total(\$)				
		\$270,000				

Mangrove Reserve						
Area #	Project	Estimate	Undertaker	Phase	Potential funder	
16 1	Remediation of former Officer's beach	\$100,000	Contractor	1		
16 2	Excavation, grading & soil amendment	\$50,000	Contractor	3		
16 3	Habitat creation	\$5,000	MOE	3		
16 4	Path improvements	\$20,000	Contractor	3		
16 5	Interpretive signage-flora & fauna of mangrove habitat	\$10,000	Consultant	3		
		District Total(\$)				
		\$185,000				

Marine Park						
Area #	Project	Estimate	Undertaker	Phase	Potential funder	
17 1	Denoting boundaries with buoy line	\$30,000	MOE	1		
17 2	Assessment and construction of moorings in Long Bay	\$20,000	MOE	1		
17 3	Create hatchery - Mangrove sanduary	\$5,000	MOE	2		
17 4	Create hatchery - Vicinity of Turtle Cove	\$5,000	MOE	2		
17 5	Create "snorkel Park" -Vicinity of Turtle Cove	\$10,000	MOE	3		
		District Total(\$)				
		\$70,000				

GRAND TOTAL OF PROJECTS

\$7,197,500

Cost per phase of capital improvements	
\$2,080,000	Phase 1 (1-2 years)
\$4,090,000	Phase 2 (2-4 years)
\$777,500	Phase 3 (4-6 years)
\$290,000	Phase 4 (6-8 years)

6.5. Management Core Functions:

6.5.1. Critical functions

It is important to understand the business and core functions of the Reserve in order to effectively gauge the resources needed to meet the objectives established for Cooper's Island Nature Reserve.

These core functions can be broken down into 4 categories and 14 programs.

This exercise allows for the analysis of the resources currently available and those that will need to be created for the development of an effective management structure and business strategy. Additionally will allow for setting of benchmarks for future analysis of programs and outputs of the Reserve.

Investments or one-time improvements that are required have been dealt with separately from the programs listed below (Section 6.3.).

a. Resource management & protection Category.

Includes all programs to protect, preserve, study and restore the natural and cultural resources in the Reserve. This will be accomplished via the following programs:

- **Wildlife management, habitat restoration program.** Seeks to improve the visitor experience by allowing safe access to the Reserve's highlights and enjoyment of the Reserve's unique feature, while minimizing damage and impacts to wildlife and vegetation. Activities include culling of invasive species and replanting with native and endemic species and removing hazards, erosion control.
- **Patrolling & enforcement program.** Seeks to protect the integrity of the Reserve's natural and cultural resources by preventing illegal taking in the Reserve.

This will be accomplished through daily patrols of trails. Other work will include patrolling the marine reserve, camping, reporting illegal activity and enforcement of reserve rules and prosecution for violators of these rules.

Seeks to maintain the integrity of the Reserve and its resources through clear and accurate demarcation of boundaries and use zones. By placing and maintaining clearly understood marker signs around boundary of the Reserve, accidental and illegal entry into the Reserve, helping to maintain the integrity of the reserve and its resources.
- **Scientific monitoring & research program.** Seeks to establish baseline data on species in the reserve and a monitoring of key indicator species to help managers make decisions based on science. With proper data, managers can understand impacts to the Reserve and take actions to address these impacts. Without these data the Reserve could suffer local extinctions of species unknowingly, resulting in irreparably damaged ecosystems. The reserve wants to attract researchers, students, and volunteers into the Reserve to help

conduct more robust scientific research.

b. Tourism & recreation. Includes all programs relating to visitation the Reserve.

- **Visitor safety & protection.** Seeks to keep visitors and staff safe by minimizing accidents and improving staff ability to respond quickly and effectively when accidents do occur. Annual training in first aid, CPR and emergency procedures. Creating and maintaining signs regarding safety issues.
- **Visitor education & interpretation program.** The programs aim to educate visitors about the ecosystems of the Reserve and to increase visitor awareness of the value of protecting Bermuda's natural resources.
- **Concession & recreation special uses program.** Seek to increase revenue to the reserve while at the same time including local community members in prospering from the Reserve's visitation. Concessions can help share the workload of managing the Reserve with business and community stakeholders and thus minimize reserve-staffing needs as well as provide economic value to the local community.
- **Cultural resource management program.** Seeks to maintain and preserve the historical aspects of the Reserve.

c. Management & administration.

Seeks to develop an efficient management structure to undertake the following functions:

- **Management & administration program.** Program day to day management of the Reserve, including logistical and technical support from staff to allow for effective resource operations. This program also seeks to improve the management capacity and productivity of the reserve staff through training and by providing leadership and performance evaluation. This program strives to create a work environment that is pleasant and that increases staff motivation.

Strives to ensure proper financial accounting and move to sustainability by ensuring that reserve management is aware of the reserve's financial position.
- **Funding.** Undertake good financial reporting, involving production of any required financial reports necessary for maintaining good relations with donors and funding agencies.
- **Planning program.** Develop comprehensive long-term planning, annual work plans, management plans, contract management that will promote the goals of the Reserve.
- **Partnership relations program.** Seeks to create and maintain alliances and relationships with non-government agencies, local communities, the business

community and other stakeholders and increase capacity to manage the reserve. Grants, are written to secure funding for operations, special projects, partner exchanges, meetings, seminars, workshops are attended to cultivate and maintain relationships.

The management of Cooper's Island will actively seek to forge partnerships with local interest groups, in order to gather support for the restoration initiatives being proposed for Cooper's Island. International funds will also be sought for the restoration of Cooper's Island Nature Reserve, in order to help offset costs associated with its environmental rehabilitation.

- **Facility operations & maintenance program.** Seeks to preserve the integrity of buildings and grounds to prolong their useful life and to provide a pleasant experience for visitors and staff. Activities include repairing, maintaining and cleaning buildings, docks, boardwalks and bridges, maintenance of solar panels, plumbing/compost toilets, trash removal, mowing and trimming park areas and grounds and pest control.

d. Environmental education outreach & scientific research

- **Formal environmental education program.** Seeks to use the reserve as a classroom for Bermudian children to create awareness and appreciation of protected areas and promote good stewardship of

Bermuda's natural resources. The program will work with schools to include environmental awareness in the school curriculum, prepare educational materials and give interpretive lectures in schools.

- **Public outreach & information program.** Seeks to develop positive relationships with the general public to create awareness of and appreciation for the Reserve and Bermuda's eco-systems. Engage stakeholders to help minimize illegal activities in the reserve and include them where possible in protecting the park. To publicize the Reserve and its programs to increase visitation.
- **Staff training program.** Seeks to educate both staff and volunteers in the importance of identifying and maintaining Bermuda terrestrial and marine eco-systems.

Section 6.6. Management Responsibilities

In order to successfully meet the mission statement and specific objectives for Cooper's Island it will be necessary to create an effective management structure. This will be as follows:

6.6.1. The Ministry of the Environment and Sport

a. Minister.

Is mandated by the National Parks Act 1986 and the Bermuda Parks Regulations 1988 to protect and manage National Park System.

b. National Parks Commission (NPC).

On behalf of the Minister of the Environment the NPC, as mandated by the National Parks Act 1986, is the public advisory body responsible for guiding the policy and oversight of the Department of Parks. The NPC approves major capital projects and policy within the Park System.

The NPC will be responsible for providing advice to the Estates Section of the Ministry of Works and Engineering on proposed leases and uses for all buildings in the National Park System.

The NPC will continue to actively support the development and management of the National Park System.

c. Departmental Responsibility.

The Department of Conservation Services will have primary responsibility for Cooper's Island Nature Reserve with assistance from the Department of Parks

and the Department of Environmental Protection.

d. Department of Conservation

Services. The Department of Conservation Services is uniquely placed to manage Cooper's Island Nature Reserve.

The mandate of the Department of Conservation Services is to conserve and restore Bermuda's natural heritage.

The objectives of the new Department of Conservation are:

- To promote the conservation and sustainable use of Bermuda's natural resources;
- To assess the status of Bermuda's unique habitats and species and to promote the preservation and restoration of threatened species and habitats;
- To produce and deliver educational materials and exhibits to promote appreciation and care of Bermuda's natural heritage;
- To engage the community in the pursuit of responsible and sustainable use of home gardens, farming, fishing, diving and horticulture.

The Department currently manages facilities such as the Bermuda Aquarium Museum and Zoo and is the coordinator of the Bermuda Bio-diversity Strategy & Action Plan.

The department has a unique partnership with the Bermuda Zoological Society (BZS), combining the resources of the Government with a charity arm that can draw on a very active volunteer resource

base and has potential for securing private donations.

With some minor additions and changes to its existing management structure and by forming partnerships with its sister departments, the Department of Conservation services will manage Cooper's Island Nature Reserve and undertake the following primary functions:

- ❖ Co-ordinate the physical development of the infrastructure the nature reserve;
- ❖ Co-ordinate and undertake the phased culling of invasive species;
- ❖ Undertake the phased creation of the proposed terrestrial and marine habitats and "sanctuaries";
- ❖ Develop and co-ordinate the day to day management of the reserve, visitor centre and related facilities;
- ❖ Develop new education programs for children and visitors;
- ❖ Develop integrated signage and promotion strategy;
- ❖ Develop tour packages;
- ❖ Co-ordinate site security.

Director of Conservation Services. is responsible for the management of the Department of Conservation Services and will manage the strategic development of the Nature Reserve, co-ordinate requests for assistance from other Departments and Ministries, the BZS and assist in the development of private sector grants, both local and international.

Ecologist. As team leader, the Ecologist will co-ordinate and lead the development of Cooper's Island Nature Reserve.

Terrestrial & Marine Conservation Officers. In consultation with the Ecologist and Director of Conservation Services will guide the culling of invasive species and development of new habitats in a phased and coordinated manner under the supervision of the relevant officer, using existing maintenance personnel.

Proposed Curator of Cooper's Island Nature Reserve. Due to the importance, the depth of commitment and level of investment that the Government will be making of Cooper's Island Nature Reserve, it will be necessary to create a new coordinator civil servant post.

The new curator post will be based on the BAMZ and the Botanical Reserve models.

The Curator will be responsible for liaising with the public, coordinating the education and interpretation programs, overseeing the day to day management of the site, cataloguing liaising with the volunteers of the BZS and assisting in creating proposals for grants.

The Curator post will be filled by a professional with experience in one or more of the following areas:

- Horticulture
- Facility management
- Botany
- Environmental management

Proposed Superintendent of Horticulture. In order to allow the Curator the ability to undertake the administrative functions of the reserve and facilitate the improvement of the Reserve it will be necessary to create a new superintendent post whose primary

function is to guide the maintenance of the Reserve.

The Superintendent will be under the direct supervision of the Curator. Responsibilities will include:

- Leading the landscaping maintenance and improvement program.
- Managing the day to day operation of the yard and plant nursery.
- Assisting in the development of material orders.
- Managing of the maintenance team.

It should be considered that the existing Conservation Crew be transferred from the Conservation Officer to the new Superintendent. This would allow the Conservation Officer greater time to pursue critical conservation programs.

The Superintendent post will be filled by a professional with experience and education in the following areas:

- Horticulture and plant nursery management;
- Soft landscaping maintenance.

Proposed cashier position. It will be necessary to create a new cashier position to take entry fees should this program come on line. This position would not be needed until Phase 2 or 3 of operation.

There is a possibility that this position could be assumed by the Bermuda Zoological Society.

Proposed Maintenance Team.

Recognizing the size, existing resources and intended use of the Nature Reserve, it will be necessary to create a minimum of 4 new industrial horticulturalist posts. These new positions will be under the

direct supervision of the Superintendent of Horticulture.

Responsibilities of the team will include the culling of invasive species, general landscaping maintenance, woodland management and propagation of native and endemic species.

Additional Posts. The posts as proposed will allow the Reserve to function at a satisfactory level and to move forward in its development.

It is envisaged that as the Reserve develops additional posts will need to be created in order to expand the programs and meet the demands of the facility.

These need not necessarily be the entire responsibility of Government, but could be contributed through donor funds or as in the case of the BAMZ/BZS model through a non-profit organization envisaged for the Reserve (Figure 30).

e. Department of Parks. The mission of the Department of Parks is to provide safe and accessible facilities for active and passive recreation; to develop, enhance and maintain an island-wide system of National parks including the Railway Trail; and to maintain school playing fields and other public lands throughout Bermuda.

The Parks Department will assist the Department of Conservation Services primarily, but not restricted to the following activities:

- ❖ Design, development of RFPs and project management of capital improvements.
- ❖ Daily terrestrial security
- ❖ High season tours

- ❖ Remedial tree work
- ❖ Plant supply from the Government Plant nursery (until such time as the Reserve's plant nursery is able to meet its needs).

Director of Parks. Is responsible for the management of the Department of Parks. All non-routine requests for assistance will be requested by the Director of Conservation Services and authorized by the Director of Parks prior to their undertaking.

Park Planner & Assistant Park Planner. Both planners will be responsible for project managing and designing capital improvements under the direction of the Director of Parks and on behalf of the Director of Conservation Services.

The Senior Superintendent of the Parks Department. Will co-ordinate work orders submitted by the Director of Parks on behalf of the Director of Conservation Services.

Specific tasks will typically include, but not restricted to, the culling of invasive species in a phased and coordinated manner under the supervision of the relevant Superintendent, using existing maintenance personnel.

Park Officer & Park Ranger Section. The Park Officer will co-ordinate and supervise the Park Ranger section in enforcing and interpreting the Reserve as required.

f. Department of Environmental Protection. As the Department responsible for protecting and legislating the island's terrestrial and marine environments, the Department will be

responsible for routine patrolling of the Marine park.

Additionally requests may be made to remove or relocate feral animals within the parks as occasions permit.

g. Planning Department. Provides the land use and conservation policy for Bermuda.

The Department of Parks and the Ministry of Environment will submit for approval all development proposals and major developments as required by the Planning Act 1974 and current Bermuda Plan.

6.6.2. Key Government Partners

A. Ministry of Works & Engineering. As the landlord for Government, the Ministry will continue to be responsible for all buildings within the National Park System and leases

Estate Section. In consultation with the National Parks Commission, the Estate Section will continue to assist in the issuing of leases, the granting of easements and similar which affect fortifications and historical structures within the National Park System.

Survey Section. In consultation with the Department of Parks, the Surveys Section will continue to assist in the development of topographical surveys as requested.

Structures Section. In consultation with the Department of Parks, Structural Engineers will continue to assist with structural assessments and designs. Work undertaken by this section will require funds being provided by the

Department of Parks in order for the works to be carried out.

Maintenance Section. The regular maintenance of the buildings will be made the responsibility of the building maintenance section. It should be noted that the majority of existing structures would be demolished as unsuitable or for safety/liability reasons.

b. Bermuda Land Development Company (BLDC): BLDC is the Quango that is responsible for the strategic long-term development of the former military base lands.

BLDC will release the Clearwater Beach area and Cooper’s Island Nature Reserve to the Ministry as protected open space.

To re-affirm BLDC will continue to manage the water catch and water storage area as a critical facility for their operations.

The Ministry will continue to work with BLDC to develop partnerships and infrastructure of the Southside area.

c. Ministry of Education. The mandate of the Ministry is to provide education and training to Bermuda’s children and adult population.

In conjunction with the Ministry of Education, the Ministry of the Environment & NGO partners will expand the environmental programs run by BZS to further enhance the national science curriculum, allowing Bermuda’s school children to learn and embrace the importance of preserving Bermuda’s fragile environment.

d. Ministry of Tourism & Transport. The Bermuda Department of Tourism is responsible for the coordination of the efforts of promotion, sales and product development and to encourage and foster tourism in Bermuda. The department is a key partner in the development of the cultural tourism market.

The Ministry will develop further partnerships with the Ministry of Tourism & Transport and other key stakeholder groups to develop new promotional packages, interpretation and tours based on the eco-tourism mandate of the reserve.

As a unique “destination” the Reserve will give both tourists and locals options for full day excursions, where they can “lose” themselves in the unique habitats and beaches, away from the “hustle & bustle” of the main tourist centres.

e. Ministry of Community and Cultural Affairs. Provides promotion, research and documentation of the cultural heritage of Bermuda.

In conjunction with the Ministry of Tourism & Transport and other stakeholders, the Ministry of the Environment tours and education materials promoting Bermuda’s environmental heritage.

f. Department of Sports. Promotes a diverse range of sports and active recreational pursuits.

In conjunction with the Department of Sports, the CINR will provide accommodation, support and where appropriate training facilities for local and visiting sport teams.

g. Bermuda Police Service. The Service will assist where necessary the Park Ranger Service to protect and enforce the regulations of the Reserve. In the short term the police service will continue to run the SFAR. In consultation with the Ministry of the Environment a schedule of use will be developed that will minimize impact on the Reserve. Warning signs and flags will be erected to inform the public when the facility is in operation and to alert the public of no-go areas.

6.6.3. Major Non-Government stakeholders

Advice and consultation will be had with the following stakeholders where appropriate.

a. Bermuda Zoological Society.

The Bermuda Zoological Society (BZS) was established in 1973 as a not-for-profit organization that supports the exhibits at the Bermuda Aquarium, Museum and Zoo, as well as conducting research and educational programs.

The goal of the BZS is to “to inspire appreciation and care of island environments.”

Its current focus is on the enhancement of the Bermuda Aquarium Museum & Zoo for the benefit of Bermuda, its residents and visitors. The Bermuda Government provides continuous support of the physical plant and operational needs, while the BZS undertakes and develops its education programs.

BZS has adopted the Bermuda Biodiversity Project as the umbrella

name for all research at the BAMZ facility, including projects conducted in conjunction with other organisations. The conservation and research programmes focus on Bermuda and are funded primarily by the Bermuda Government, U.K and U.S. Governments and private donations. Currently BZS offers over 30 classes and 3 camps to preschools, primary, middle and high schools on a variety of life science and Bermuda natural history topics. Classes are designed to complement the Ministry of Education's science curricula so that school groups can achieve curriculum objectives via their outing to BAMZ.

- Opportunities for Students...
 - The Schools Programme
 - Community Service Days and Career Days
 - The Nonsuch Island Natural History Camp
 - The Environmental Youth Conference
 - Stempel Foundation Summer Internships for Bermudian Students
 - Junior Volunteer Programme

- Opportunities for Teachers...
 - Teacher Workshops
 - The Bermuda Natural History Course Publications
 - Resource Boxes
 - Book Bags
 - Learning Through Landscapes Bermuda

- Encouraging Environmental Stewardship Through Education of Bermuda's Community
 - The Discovery Room Exhibit
 - The Bermuda Natural History Course Nature Encounters

Summer Aqua Camps
Winter and Spring Camps

It was agreed during the consultation period that BZS would expand its current operations to actively support the Cooper's Island Nature Reserve as the formal non-government partner.

It was seen that the mission and goals of the Reserve were a natural extension of its works at BAMZ and that of the Bermuda Bio-Diversity Strategy & Action Plan.

Support for the Reserve would include the following primary duties:

1. Developing and conducting the tour program for the Reserve.
2. Staffing the Visitor Centre.
3. Undertaking a donor capital campaign for the physical development of the Reserve.
4. Developing and running an educational program(s) for school children based on the national science curriculum.
5. Coordinating volunteer clean up, invasive clearance and planting days for the reserve.

b. St . David's Historical Society. The society looks to preserve the unique cultural history of St. David's Island.

The Ministry will work with the Society to promote and preserve St. David's cultural heritage primarily through exhibits and tours.

c. St. George's World Heritage Committee. The purpose of the St. Georges World Heritage Committee is to

co-ordinate and implement the World Heritage Management Plan.

Additionally the committee gives advice to the Planning Department and property owners regarding proposed developments and preservation standards.

As a standing member of the Committee, the Parks Department will continue to assist in the guidance and coordinating of the management of the World Heritage site, of which Cooper's Island is a major destination and neighbor.

d. Bermuda National Trust.

The purpose of the Bermuda National Trust is to preserve buildings, lands, artifacts and places of beauty or historic interest, and to promote their appreciation.

The Ministry will work in partnership with the Trust to offer programs, tours and promotion of the Reserve as opportunities arise.

e. Bermuda Institute of Ocean Sciences (BIOS).

BIOS conducts world-class science and education from its unique mid-Atlantic location. We seek to improve society's understanding of marine ecosystems, ocean/atmospheric interactions and ocean health, and their influence on man's habitat and health. BBSR, an independent U.S. non-profit research organization and Bermuda Registered Charity, provides well-equipped facilities for scientists and students from Bermuda and around the world.

The Ministry will work in partnership with BIOS to offer programs, tours and promotion of the Reserve as opportunities arise.

6.6.4 Procurement of Consultant Service.

At times private sector consultants and contractor services will be required in order to effectively and efficiently facilitate the development and management of the Reserve.

Civil Professional Consultation.

Such expertise will be secured following Bermuda Government's Procurement Standards & Procedures policy.

This will generally entail the development of a Request for Proposals (RFP) or a Request for Quote (RFQ). Subsequently the RFP or RFP will be advertised and put out for open tender to qualified firms.

Structural Engineering.

Where structural assessment and or design are necessary, the Department of Parks will first request the assistance of the Structural Section of the Ministry of Works & Engineering.

Surveying Services.

Where the development of a topographical surveying is necessary, the Ministry will first request assistance of the Surveying Section of the Ministry of Works & Engineering.

Architectural Services.

Where architectural building survey and design is necessary and the work cannot be undertaken in house, the Ministry will first request assistance of the Architectural Section of the Ministry of Works and Engineering.

Where Government assistance is not available and/or cannot be provided in the stipulated time period, the Ministry will contract out such work to qualified

private sector firms as per the requirements of Bermuda Government's procurement policies.

Artifact Conservation.

Any objects recovered from a Government owned area or structures, including a National Park belong to the Bermuda Government. Items recovered will be conserved and catalogued by the participating organization, but remain the property of the Bermuda Government.

Exhibits.

Consultant exhibition designer(s) with a specialization in museum exhibitions will be contracted to develop and install appropriate exhibits.

Civil Contractor Services.

All work to be carried out by private contractors will be undertaken as per the Bermuda Government's Procurement Standards & Procedures policy.

**DEPARTMENT OF CONSERVATION SERVICES
PROPOSED ORGANISATIONAL CHART**

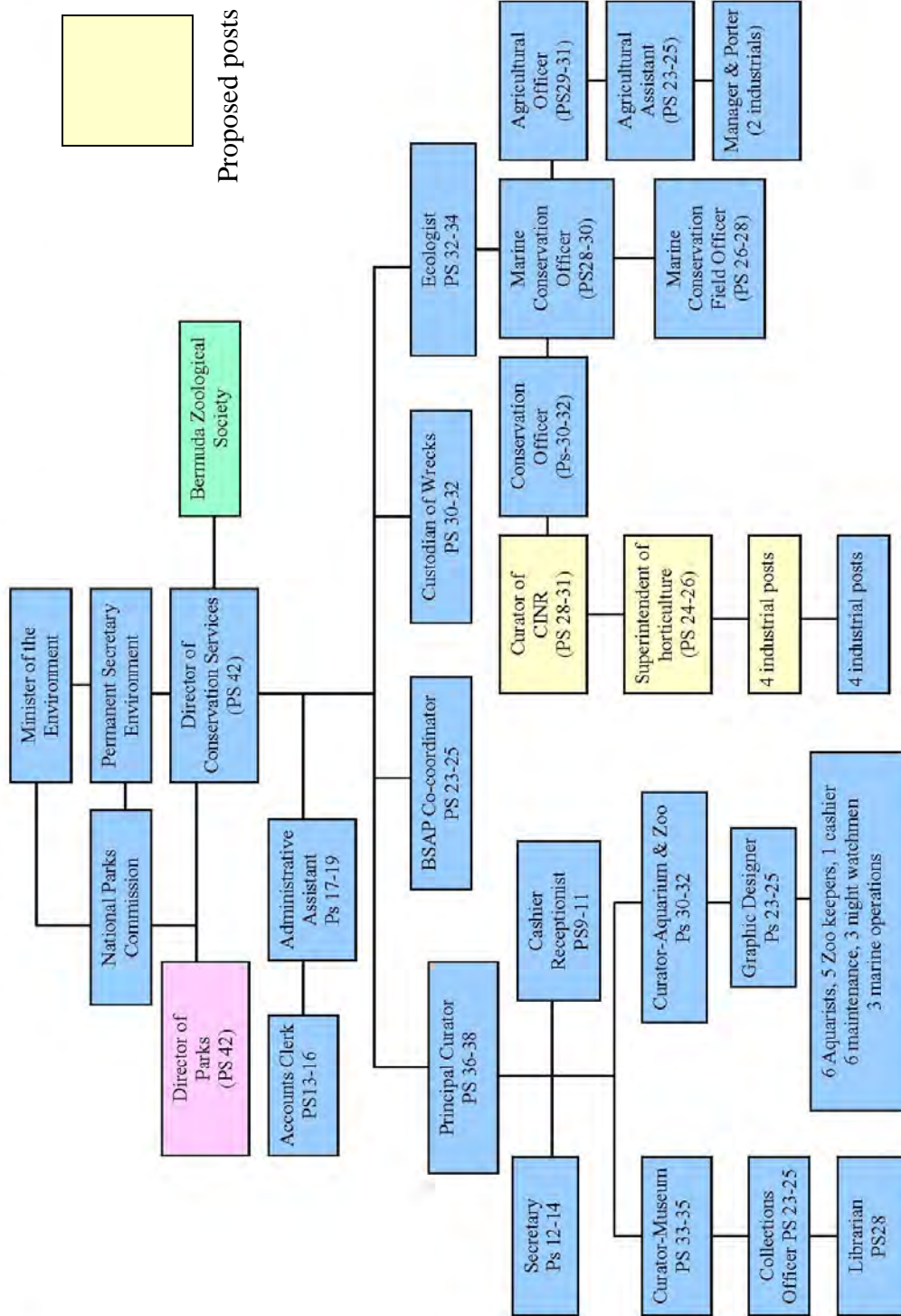


Figure 30: Organization chart: Department of Conservation Services

6.7. Business Functions

6.7.1. International & local modeling

As the concept of transforming Cooper's Island Nature Reserve into a self-sustaining eco-tourism/education centre is unique to Bermuda, extensive research was undertaken into how similar protected areas are managed in the Caribbean, specifically Belize, the U.S, the Galapagos Islands and South African safari parks (Bibliography).

The findings of this research have been incorporated, along with stakeholder consultation and the experiences of the existing successful models currently employed by the Department of Conservation services/BZS and the Department of Parks/Bermuda Botanical Society.

6.7.2. Financial Objectives

In order to effectively manage and develop the vision of Cooper's Island Nature Reserve as Bermuda's premier eco-tourism destination it is critical to establish a financial strategy.

While the Bermuda Government will always be the major supporter of the Reserve, it must recognize its commitments in all its other sectors of business.

As such the Government must develop partnerships with non-profit groups and the private sector in order to ensure that the Reserve becomes more financially sustainable.

Currently there are no formal resources applied to the Cooper's Island Nature Reserve. However there is potential and a certain level of capacity and expertise in the Ministry which could be utilized.

As a business Cooper's island must strive for the following:

- Achieve financial sustainability
- Clearly identifies the economic possibilities that exist for the creation of the Cooper's Island Nature Reserve.
- Clearly illustrates the financial viability of the Park and Reserve.
- Address the financial implications of environmental clean up works.
- Outlines possible sources of financial aid for the clean up of the site.
- Identify financial opportunities to enable the establishment, implementation and management of the Reserve including government sources and enabling development funds.
- Investigates international designations that will help in the securing of international financial aid.

6.7.3. Functional area analysis

It is useful to reiterate the core functions of the Reserve in order to clearly identify future budget obligations and commitments:

- Infrastructure improvements
- Resource management & protection
- Patrolling & enforcement
- Scientific monitoring and research
- Wildlife management and habitat restoration
- Cultural resource management
- Tourism & recreation
- Visitor safety & protection
- Visitor education & interpretation
- Concession & recreation special uses
- Management & administration
- Financial management & administration
- Planning
- Partnership relations

- Community development & outreach
- Formal environmental education
- Public outreach & information
- Facility operations & maintenance

6.7.4. Funding & budget analysis

The main costs associated with successfully meeting the vision of Cooper’s Island Nature Reserve include the following:-

(a) Infrastructure improvements

Investment projects are one time expenditure that improve the infrastructure or increase the intellectual capital of the protected area. These include:

- Demolition of redundant buildings and utilities;
- Removal of hard surfacing;
- Environmental clean-up works;
- New capital projects;

- An integrated interpretation system. As described in Section 6.3. it is estimated that it will cost, over an 8-year period approximately \$7.1 million dollars to create the infrastructure for the reserve.

(b) Annual operating costs

In order to effectively manage the Reserve it will be necessary to allocate additional funds to the annual operating budget of the Department of Conservation Services.

During the first phase (1-2 years), the Reserve will be in active physical transition with substantial demolition and development being undertaken. As a result the Reserve will need to be restricted to public access and there will be limited need for major administration support until the infrastructure is in place.

In the second phase (3-4 years) the proposed budget of \$650,000 will cover key re-occurring costs. This budget must be revisited in the fourth year of operation in order to accommodate un-anticipated costs and allow for the full potential of the Reserve to be reached.

Item	Item Description	Per annum cost (\$)
1	Curator of Cooper's island	\$75,000
2	Superintendent of Horticulture	\$60,000
3	Gardener	\$45,000
4	Gardener	\$45,000
5	Gardener	\$45,000
6	Tradesman-propagator	\$54,000
7	Skilled laborer	\$50,000
8	Publications & promotions	\$20,000
9	Consultant fees	\$50,000
9	Security	\$50,000
10	Minor improvement works	\$100,000
11	Equipment & horticulture supply	\$20,000
12	Office supply	\$15,000
13	Fleet maintenance & fuel	\$9,000
13	Electrical	\$10,000
14	Telephone	\$3,000
15	Water	n/a
TOTAL ANNUAL BUDGET		\$650,000

Figure 31: Phase 2: approximate operating costs

6.8. Potential Revenue Sources

A long term steady and diverse income stream is necessary for financial stability.

One of the Reserve's key objectives is to become as financially sustainable as possible. It is imperative to strike a balance between meeting urgent needs, developing long term streams of revenue and setting aside some income to build contingency fund for the future.

There are 3 streams of funding that can be pursued in order to support and improve Cooper's Island Nature Reserve.

1. Government funds
2. Concessions & fee strategies
3. Donations

6.8.1. Government funds

Ministry of the Environment does not have the financial or physical resources to implement all of the proposed policies, programs and improvement proposals in the immediate future.

Currently there is no direct allocation of Government funds and these will have to be applied for.

Initially it will be necessary for Government to allocate additional spending for start up costs for the Reserve. However it is envisaged as other revenue streams are generated that Government's financial commitment will be reduced significantly.

a. Government Zero Based Budget

The Department of Conservation Services will be responsible for applying for funds will be incorporated into its annual Zero Based Budget submissions.

Line items will include cost centers for:

- ◆ Annual Staffing
- ◆ Maintenance
- ◆ Facility operation
- ◆ Minor works

b. Government Capital Expenditure Program

Proposed restoration projects with cost estimates over \$100,000 will be submitted to the Government Capital Expenditure Program (CEP) on an annual basis.

6.8.2. Concessions & fee strategies

It is possible that through government management staff, BZS volunteers or a combination of both, that the following strategies could be introduced as means of providing revenue for the Reserve.

All revenue will be collected by the Bermuda Zoological Society following existing procedures. All funds will be allocated to the restoration and improvement of Cooper's Island Nature Reserve.

a. User fees

Such fees are a very effective revenue source and is the income source with the highest potential for providing a relatively steady source of income, particularly in the high season of the summer months.

Cruise ship tourism is growing rapidly in Bermuda and is expected to continue into the near future . With this increase in cruise ship tourism, the cruise ship industry and tour operators will need to expand their tourism offerings, as there are few destinations that have the infrastructure to handle large volumes greater than they currently receive.

Damage to Bermuda's main eco-tourism destinations such as Horseshoe Bay has not been documented, but the carrying capacity either has or will soon be met.

Cooper's Island Nature Reserve has a significant carrying and will serve as a major eco-tourism destination, relieving strain on existing destinations.

It is becoming accepted practice to introduce and for tourists to pay entry fees. This is not the norm for the Bermuda general public who are used to free access to public beaches and parks.

For some comparison BAMZ has approximately 100,000+ persons come through its doors annually. While the Botanical Gardens, though free, conducts tours and these account for an estimated 80,000-100,000 per annum.

Two scenarios exist:

A. Introduce a modest entrance fee to the Nature Reserve of \$2 per person is introduced for all.

Or

B. The Local public is admitted for free and tourists are charged \$10 per persons;

Collection of these fees will be a major cost, effecting profit.

Taking scenario B, it could be estimated that if 30,000 international visitors came through the doors annually, this would generate a possible \$300,000 per annum, subtracting collecting and administration costs of perhaps \$60,000 in wages. This would generate approximately \$240,000 per annum.

b. Tour programs

It is intended that entry into the museum will be covered by the general entrance free to the Reserve. However special guided tours of the Reserve will be an additional cost to the general entrance fee.

Similar eco-tours of Nonsuch Island have proven very popular with visitors and there is an acknowledged market for this type.

One of the benefits of Cooper's Island Nature Reserve is its size and visitor carrying capacity.

Nonsuch Island has proven that once the carrying capacity of an eco-system has been reached that eco-system can easily be damaged.

Cooper's Island can easily handle a much greater volume than Nonsuch Island and the tour program can be designed in such a way as groups leaving at staggered times at on different routes will never encounter each other.

Following a similar system as employed in the Botanical Gardens, tickets could be bought for different tour packages from the visitor centre. Tour prices could range for a long tour program at \$5 and the short tour program at \$2 per head.

Additionally at different times of the year specialty tours will be developed focusing on the migration of key species such as the longtail, cahow, and whale. Tour prices could range from \$20 per head that would raise approximately \$20,000 per annum.

c. Mooring strategy

Due to the sensitive habitats surrounding Cooper's Island, Cooper's Island Marine Park will have restricted access to general boat traffic.

It is proposed that approximately 5 moorings will be installed in Long Bay and rented to tour boat operators.

It is unlikely that these mooring will generate a large amount of revenue, however they will most likely cover their maintenance cost and that of any marine park markers.

d. Concessions and tourism operators

Cooper's Island Nature Reserve will support beach and water based activities. These activities such as kayak tours & rental, snorkeling equipment etc will be put out to open tender.

Tourism operations will primarily be tour boat operators and will mainly linked to the mooring strategy.

Beach side concessions will most likely be seasonal. The existing rates of such activities are basically nominal as they provide a valuable service at no cost to the protected area they are located in.

e. Merchandising/gift shop Selling Reserve branded products

The visitor center will have a gift shop component. The reserve gift shop should specialize in high quality local, recycled and eco-friendly products that would be of interest to the eco-tourist.

In addition consideration should be given to Reserve branded merchandise such as hats, sunscreen, shirts, mugs, posters, photo books, maps and guide books.

Following the Bermuda Botanical Society Model, this gift shop could also be a coffee/snack bar and run via a paid manager who also co-ordinates the volunteer base for the Reserve.

f. Snack bar

The visitor centre will house a coffee bar/snack bar concession. It is envisaged that a full restaurant would not be viable and would generate too much trash and attract pest species.

This format will allow for flexibility in menu and service, reflecting seasonal needs.

To keep costs to the minimum it is proposed that the snack bar is coordinated by a paid Snack Bar/Gift Shop manager of BZS but staffed predominantly by volunteers.

Or

the concession is put out to open tender to the private sector.

Approximate revenue generation per annum \$10,000 per annum.

g. On-site education classes & camps

BZS will develop extensions to and new programs for Cooper's Island. These will follow in the steps of the BZS educational programs and the Aqua camp currently run at BAMZ.

These classes and camps will probably not generate revenue but will sustain themselves and provide a valuable services to the Reserve and act as positive extensions to public outreach and education.

h. Native & endemic plant sales

The Reserve will look to sell the full range of native and endemic plants to the general public. Specifically to support future woodland management schemes and landscaping schemes as one of the tenets of the Sustainable & Development Plan.

6.8.3. Donation Strategies

It is not ethical for the Bermuda Government to solicit funding from the Private Sector.

However the Bermuda Aquarium Museum & Zoo has benefited greatly through its formal registered charity wing, as has the Bermuda Hospital.

As BZS has agreed to be the formal charity of the Reserve, the following programs could be introduced for revenue generation:

a. Adopt-an-area program

This program is limited by the size of the Reserve. There is approximately 45 acres of Reserve land excluding Clearwater Beach and the water catchment area.

However this program could generate some steady annual income and help foster long term partnerships with the private sector and donor community.

Visitors/private donors could adopt ½ acre of the Reserve's 45 acres for \$1,000 per annum. In exchange the donor would receive a certificate acknowledging the adoption and its wildlife, as well as updated information on progress with in the Reserve. Certificates could be sold online and could be presented as gifts.

It is realistic to expect over time, due to the limited size of the Reserve all of the acreage to be adopted and that this program could generate at full capacity \$90,000 per annum.

b. Weekly hotel interpretation programs

The Reserve could offer interpretive programs about fish, coral, terrestrial life at various hotels each week in the high tourist season. The program would be designed to teach visitors about what they see on the reefs and sanctuaries around the reserve and Bermudian general, as well as potential threats to Bermuda's eco-system.

The program should also stress the work being done by Government, its associated NGOs and the protection of its environmental resources and end with a plea for donations to assist with the work.

The program could be free but a request could be made for a voluntary donation to attend.

This programs could generate, depending on the size of the audience and receptivity somewhere between \$500-\$1,000 per event or perhaps \$20,000 per season.

This type of event could used to build support for other programs such as the Adopt-An-Area, Add-on-Programs and membership programs.

c. Voluntary add on to hotel & restaurant bills

Another way to gain additional revenue is to ask restaurants and hotels to place a line on the bill asking guests to donate

an optional 2-5% of the total bill to Cooper's Island Nature Reserve.

The reserve would have to work closely with the restaurants and hotels to demonstrate the value the Reserve provides and to provide marketing material to inform potential donors of its benefits.

Revenue generation is unknown but it could be estimated that this program might raise \$20,000 per annum.

d. Collect spare currency

Many tourists find themselves in possession of extra Bermuda currency as they prepare to depart the country. Many of them might be willing to donate to a good cause that assisted them in having an enjoyable visit to Bermuda.

Preferred locations for collection boxes would be at the international airport and the cruise ship terminals in Hamilton. Dockyard and St. George's. Additionally envelopes could be provided that tourists could mail back any leftover currency after they return home.

Revenue generation is unknown but it could be estimated that this program might raise \$10,000 per annum.

e. Volunteers/in kind goods & services.

Soliciting the service of volunteers can dramatically reduce costs of operating the Reserve. BZS has proven very effective in developing a very active volunteer base.

Its student oriented education programs engender a sense of loyalty to BZS and ensure that future generations will

become the next volunteer base for the charity.

Volunteers could be expected to assist in:

- Debris clean up
- Culling and replanting
- Acting as tour guides
- Scientific monitoring

Additionally many businesses and firms might be willing to donate equipment and manpower to specific projects, this would be greatly beneficial for demolition projects scheduled in the first phase of restoration.

f. Endowment fund

A good source of long term revenue is a trust fund. While returns will vary from year to year, it does allow for continual generation of revenue.

Due to fluctuations it is general practice to withdraw somewhere near 5 percent of the fund's average value over the last 2 years without drawing down on the fund over time.

For example if the Reserve could raise \$5 million it could safely withdraw in the region of \$250,000 each year while still maintain a stable balance in the fund.

In order to keep up with inflation, additional monies would need to be added to the fund.

This type of donation is very palatable to the private sector as it seen as long term "investment" into sustaining a protected space such as Cooper's Island Nature Reserve.

An endowment fund could assist greatly in financing the basic operating costs of the Reserve.

g. Membership drives & the Bermuda Zoological Society

While local entry fees might not be seen as “palatable” there is scope to pursue a special membership to Cooper’s Island.

Offers could be made to join BZS entitling friends of BAMZ and the Reserve entry and participation in special events generally not open to the public or tourists.

This could be an added category to the membership drive already offered by BZS.

h. International donations

It is expected that international and local funding could be available for particular projects such as environmental clean-up, demolition of buildings, tree planting/landscaping, restoration of the salt marsh and environmental education.

A list of potential international funding sources is provided in Figure 34.

#	Program	Unit	\$ per unit	Cost	Total annual revenue
1	Adopt-an-area program	90	\$1,000	\$0	\$90,000
2	Entry fees	30,000	\$10	\$60,000	\$240,000
3	Beach Concession				\$1,000
4	Gift shop				\$10,000
5	Snack shop				\$10,000
6	Long tour program	2,000	\$5	\$0	\$10,000
7	Short tour program	2,000	\$2	\$0	\$4,000
8	Speciality migratory tours	300	\$20	\$0	\$6,000
9	Restaurant add on			\$0	\$20,000
10	Native & endemic plant sales	1500	\$7		\$10,500
11	Membership drive			\$0	\$10,000
TOTAL					\$411,500

Figure 32: Summary of potential annual revenue

Foundation / General Info	Funding Range	Application Procedure
The George T. Baker Trust <ul style="list-style-type: none"> Grants for land conservation, wildlife preservation and environmental education 	\$10,000 - \$100,000	Letter of Inquiry
The Bancker-Williams Foundation <ul style="list-style-type: none"> Natural Resource conservation and protection and wildlife preservation and protection 		Letter of Inquiry
The Bay Foundation <ul style="list-style-type: none"> Biodiversity, marine science research and environmental education 	\$3,000 - \$25,000 Median \$6,000	Official application form.
The Chevron Companies <ul style="list-style-type: none"> Wildlife and habitat preservation, conservation and environmental education 	\$5,000 - \$125,000 Median \$10,000	Local approach
The John D. and Catherine T. MacArthur Foundation <ul style="list-style-type: none"> Ecosystem conservation 	\$10,000 - \$1,500,000 Median \$50,000	Letter of Inquiry
The Ambrose Monell Foundation <ul style="list-style-type: none"> Urban Reserve and parks 	\$25,000 - \$2,250,000 Median \$50,000	
Charles Stewart Mott Foundation <ul style="list-style-type: none"> Environment 	\$6,000 - \$300,000 Median \$80,000	Letter of Inquiry
Norcross Wildlife Foundation <ul style="list-style-type: none"> Land and habitat conservation, species protection 	\$500 - \$20,000 Median \$5,000	Preliminary request for funding
The Turner Foundation <ul style="list-style-type: none"> To defend biodiversity by protecting habitats – to support ecosystem-wide habitat protection with particular emphasis on locally developed strategies for private and public lands 	\$5,000 - \$100,000	Full proposal
Ernest Kleinwort Charitable Trust <ul style="list-style-type: none"> Environmental Conservation 	50 GBP – 100,000 GBP	
JJ Charitable Trust <ul style="list-style-type: none"> Environmental education in schools 	Up to 150,000 GBP Median 13,000 GBP	

Figure 33: Potential International Funding Sources

6.9. Proposed Business Strategy

Acknowledging the possible alternative funding sources it is recommended that the following be implemented.

This proposed strategy looks to factors such as moving forward efficiently, the practicality of setting up a unique government owned reserve supported by Non-Government Organizations and increasing financial sustainability of the Reserve.

6.9.1. Phase 1 (1-2 years)

a. Infrastructure improvements.

The primary focus will be on remediating the site and creating an infrastructure and health & safety projects such as:

- Environmental remediation, demolition of dangerous buildings, removal of defunct utilities;
- Assessing and designing new major capital improvement projects;
- Culling invasive species;
- Capital campaign;
- Formalizing and developing Government/NGO partnership.

The majority of these costs will be undertaken by Government via application by the Ministry of the Environment for Capital Expenditure to demolish and remediate the site.

There is scope for international and in kind donation for demolition and environmental remediation.

Additionally there will need to “seed” money for design costs of new capital projects for phase 2.

In partnership with the Bermuda Zoological Society, the Ministry of the Environment will, in conjunction with the approved Cooper’s Island Management Plan; develop specific project briefs for such projects.

These projects will be developed and project managed in house by existing Ministry of the Environment staff in accordance with Government Financial instructions.

Costs will include approximately \$1.5 million dollars. The Department of Conservation Services will submit Proposals for Capital Expenditure.

** This may be reduced depending on the success of local in kind and international donations.*

b. Operating Costs

In the first phase there will be limited need for an operating budget for the Nature Reserve.

c. Local NGO Partnerships

The partnership between the Department of Conservation Services and the Bermuda Zoological Society should be formalized.

Activities will likely be restricted to in kind donations such as volunteer:

- ◆ Volunteer clean up events
- ◆ Volunteer culling and replanting
- ◆ Preparation of international funding bids for phase 1 projects (In conjunction with the Ministry of the Environment).

d. Revenue Generation and Funding Opportunities

The Department of Conservation Services will apply for funds to start a

capital campaign and marketing strategy in its annual Zero Based Budget.

Preparation will begin on setting up programs for revenue generation including the following:

- ◆ User fees
- ◆ Mooring strategy
- ◆ Concessions
- ◆ Collecting spare change
- ◆ Weekly hotel interpretation program
- ◆ Voluntary-Add-On-programs
- ◆ Tour programs

e. NASA & US Army

Separate to environmentally oriented international fund submissions and in partnership with BZS, the Department of Conservation Services will approach NASA and the US Army to renovate the Visitor Centre and exhibit development.

6.9.2. Phase 2 (3-4 years)

a. Infrastructure improvements.

Improvements will continue with a focus on the Visitor Center and creation of new habitats.

Approximate costs for phase will be \$4.5 million dollars.

The Department of Conservation Services will submit Proposals for Capital Expenditure.

** This will be reduced depending on the success of local in kind and international donations.*

b. Operating Costs

It is expected in the second phase that the infrastructure of the Reserve will start to come on line and their will be a corresponding increase in operating costs for tours, maintenance and administration of the reserve.

It will be necessary to incorporate these in to the Zero Based Budget for the Department of Conservation Services. Line. Items will include cost centers for:

- ◆ New management & maintenance posts
- ◆ Facility management costs
- ◆ Promotion
- ◆ Development of education programs
- ◆ Development of tours
- ◆ Maintenance
- ◆ Minor improvement works

The total amount will be approximately \$650,000 per annum.

c. NGO Partnerships

Bermuda Zoological Society activities will be significantly expanded.

In kind donations will continue, such as:

- ◆ Volunteer clean up events
- ◆ Volunteer culling and replanting
- ◆ Preparation of international funding bids for phase 2 projects (In conjunction with the Ministry of the Environment).

New programs will include:

- ◆ Tour guide program
- ◆ Staffing of visitor centre
- ◆ Development of education programs
- ◆ Weekly hotel interpretation
- ◆ Accounts administration

d. Revenue Generation and Funding Opportunities

The capital campaign will be fully committed.

The following revenue generating programs will be initiated:

- ◆ User fees
- ◆ Mooring strategy
- ◆ Concessions
- ◆ Collecting spare change
- ◆ Weekly hotel interpretation program
- ◆ Voluntary-Add-On-programs
- ◆ Tour programs

Revenue could expect to be at 20% level. This would generate approximately \$80,000 per annum.

This revenue will be applied by BZS to Phase 3 administration and capital projects.

e. NASA & US Army

Utilizing the developed design for the Visitor Centre NASA and the US Army new exhibits will be designed and installed as part of the fit out.

6.9.3. Phase 3 (5-6 years)

a. Infrastructure improvements

Development of priority infrastructure with a focus on fit out of the visitor centre, program development and interpretation. It also recognizes the end of the lease period on the Firing Range.

It is expected that costs for infrastructure will be significantly reduced to approximately \$780,000.

It is expected that these costs will be the assumed by a combination of Government, the charity arm of the Reserve and donations.

b. Operating Costs

It is expected that operating costs will continue at phase 2 levels:

- ◆ New management & maintenance posts
- ◆ Facility management costs
- ◆ Promotion
- ◆ Development of education programs
- ◆ Development of tours
- ◆ Maintenance
- ◆ Minor improvement works

The total amount will be approximately \$650,000 per annum.

Any new posts will be assumed through revenue generation and the capital campaign.

c. NGO Partnerships

Bermuda Zoological Society activities Will continue as per phase 2. Programs will continue to be developed as demand increases.

d. Revenue Generation and Funding Opportunities

The Capital campaign will be complete and the focus will switch to promotion.

The following revenue generating programs will be fully underway:

- ◆ User fees
- ◆ Mooring strategy
- ◆ Concessions
- ◆ Collecting spare change
- ◆ Weekly hotel interpretation program
- ◆ Voluntary-Add-On-programs
- ◆ Tour programs

Revenue could expect to be at 60% level. This would generate \$240,000.

6.9.4. Phase 4 (7-8 years):

a. Infrastructure Improvements.

Is the culmination of the main development of the Reserve and the regular maintenance with minor improvements

It is expected that costs for infrastructure will be significantly reduced to approximately \$290,000.

It is expected that these costs will be the assumed by the charity arm of the Reserve.

b. Operating Costs

It is expected that operating costs will continue at phase 3 levels:

- ◆ New management & maintenance posts
- ◆ Facility management costs
- ◆ Promotion
- ◆ Development of education programs
- ◆ Development of tours

- ◆ Maintenance
- ◆ Minor improvement works

c. NGO Partnerships

Bermuda Zoological Society general activities will continue as per phase 3. Existing programs will expand and continue to be developed as demand increases.

d. Revenue Generation and Funding Opportunities

The following revenue generating programs will be fully underway

- ◆ User fees
- ◆ Mooring strategy
- ◆ Concessions
- ◆ Collecting spare change
- ◆ Weekly hotel interpretation program
- ◆ Voluntary-Add-On-programs
- ◆ Endowment program
- ◆ International donor requests
- ◆ Tour programs

Revenue could expect to be at 90% level. This would generate \$370,000.

APPENDICES

APPENDIX 1: Visual Structural Assessment

The following is based on a recent visual assessment of the station (2006) and the *GN Infrastructure Survey, BDA STDN Station, Cooper's Island, Bermuda (June 1993)* compiled by AlliedSignal Technical Services Corporation (GN Report), the latest known report completed before the closure of the NASA Tracking Station.

A more thorough structural assessment will have to be undertaken by a certified structural engineer to reassess the buildings in today's condition, however this preliminary survey does provide a good description and assessment of the condition of the buildings prior to the final closure of the base.

The survey looks at the following areas:

- ◆ Structural
- ◆ Masonry
- ◆ Moisture & thermal control
- ◆ Doors, Windows & glass
- ◆ Finishes
- ◆ Equipment
- ◆ Furnishings
- ◆ Mechanical
- ◆ Fire protection
- ◆ Electrical

*Utilities are covered under section 2.8.

The assessment focuses on 6 major buildings on site. No investigation was made into the remaining small ancillary buildings, as they are considered minor in nature providing little impact to the future of the site.

Operations Building

- ◆ Former Usage: Operations, administrative office, space, conference room, and building utilities
- ◆ Original construction date: 1960
- ◆ Square footage: 10,536
- ◆ Floors: 1

The operations building is constructed of concrete masonry block on a structural concrete foundation. The exterior masonry has a stucco finish. There are intermediate reinforced concrete columns and reinforced concrete tie beams at the top of the masonry walls. The roof consists of steel joists with an SKB type roofing system. Areas and rooms inside the building are partitioned using masonry block and gypsum board construction. Suspended ceiling has been installed throughout most of the building and the operations area has a raised access floor. Most of the office and corridor flooring is tiled however, two offices are carpeted.

Air conditioning is provided by a chilled water system and air handlers. New chillers were installed in 1993. The building has a complete fire protection system consisting of a wet pipe sprinkler, fire detection and alarm devices and a fire alarm control panel.

Structure: The building structure was in good condition in 1993. The bathrooms were original and were due for renovation in 1993. No foundation problems or settlement cracks were observed.

Thermal & moisture protection: The entire roof was replaced with an SKB roofing system in 1983. The roof was resealed in 1992 and appeared to be in good condition but the roof fascia clips were rusted. Today roof state unknown.

Doors & Windows: In 1993 the steel doors, frames and hardware were noted to be in poor condition and were not replaced. In 2006 the doors are now open allowing further exposure to the elements and unauthorized entry.

Finishes: Interior finishes are peeling. Carpets and tiles are buckled.

Mechanical: The Operations Building was constructed in 1966 and most of the mechanical equipment is original. In 1993 the chillers and water pumps were replaced. At the time the air handlers had noticeable vibration and the water supply pumps were of below average condition, and the plumbing fixtures were in below average conditions with hairline cracks.

The domestic water was provided by roof catchment that drained to a storage tank on the north side of the building. It was assessed that the system was in good condition in 1993.

Fire protection: Protected with a complete fire protection system consisting of a wet-pipe sprinkler system, fire alarm and detection devices and a fire alarm control panel. The fire alarm system was installed in 1989 and was in good condition in 1993.

Electrical: In 1993 the electrical system in the Operations building was in generally in good condition, with the exception of the oil filled transformer

mounted outdoors at the southeast corner of the building. This 750 KVA transformer was corroded and in need of refurbishment. The motor control center, located in the mechanical room, was in relatively good condition although most of the equipment was at least 25 years old and most of the original motor starters and circuit breakers were reaching the end of their normal service lives.

The existing lighting system was noted as antiquated and consisted of a combination of surface mounted and hanging fluorescent fixtures as well as recessed incandescent fixtures. Many of the units are either missing, discolored or damaged.

General recommendation:

In 2006 the overall structure is in good condition with some internal damage to the interior. Due to its location, general layout, and its original multi-purpose function this building is suitable for conversion to other uses compatible with the overall use of the site. A full structural assessment undertaken to facilitate the conversion of this building



Operation Centre taken just after the station closed (2002)



Operation Centre front door (2006)



Main room with limited damage (2006)



Utility room with little visible damage (2006)



Corridor with limited physical damage. However the centre has been broken open and some minor vandalism has taken place (2006).



Raised flooring with obsolete wiring (2006)

Power Plant Building

- ◆ **Former usage:** Houses power generating equipment and associated switchgear, waste heat recovery system, waste lube oil system, office space and shop area. The Station's central fire alarm control panel in this building since the building was manned 24 hours per day.
- ◆ **Original construction date:** 1966
- ◆ **Square footage:** 5,040
- ◆ **Floors:** 1

The Power Plant building is constructed of concrete masonry on a structural concrete foundation. The exterior masonry block has a stucco finish. There are intermediate reinforced concrete columns and reinforced concrete tie beams at the top of the masonry walls. The roof consists of steel joists of steel joists; metal deck and insulation topped with a 2-inch concrete slab. The original built up roof has been sealed with an SKB system.

The building is basically divided into 2 main areas separated by a masonry wall with 8 observation windows. One area houses the diesel engine-generator sets and the second set houses the electrical switchgear. There is also provision for limited storage of materials, a battery room, shop areas and toilet facilities.

The generator room and shop areas have painted concrete floors with an open steel joist ceiling. All walls and floors appurtenances have been painted. Large roof top exhaust ventilators were installed in 1992 and fresh air intake louvers were installed in the west wall of the generator room. The diesel engines

were installed outside on the west side of the building.

The switch gear room and office has a vinyl tile floor finish and suspended ceilings. Both rooms are air-conditioned and the building has a complete fire protection system consisting of a wet pipe sprinkler, fire detection and fire alarm control panel.

Structure: In 1993 the building was assessed in generally good condition and the roof was sealed with SKB coating. No foundation problems or settlement cracks in the masonry were observed.

Doors & windows: The condition of the steel doors was assessed in 1993 to be below average and were slated for replacement. Today these doors remain sealed and the building free from vandalism.

Finishes: In 1993 the condition of the finishes varied with the painting and tile flooring of below average condition. The painted metal decking and steel joists were noted to cause constant maintenance issues and the suspended ceiling was recommended for immediate replacement. As this building remains sealed no further internal assessment has been carried out.

Mechanical Equipment: The power plant is of 1966 vintage and many of the components were assessed in 1992 as nearing the end of their service life. The diesel engines were last reconditioned in 1991. These engines were the primary source of power for the station and were constantly maintained. Caterpillar Inc had committed to continue industry supply of spare parts until 2000 when

scheduled replacement of the engines would have been required.

The air-conditioning system was well maintained in 1993 but was assessed as nearing the end of its life as a result of the severe saline environment and was scheduled for replacement.

The large exhaust fans for the generator room were installed in the 1990s and at the time were in above average condition.

Domestic water was provided from the operations building. The oil water separator and waste oil storage tank had failed in 1993 and were scheduled for replacement.

Fire protection: The building was protected by a complete wet-pipe sprinkler system and fire alarm control panel installed in 1989. It was assessed in good condition in 1993. Condition unknown today.

Electrical: As noted most of the power plant and switch gear is at least 35 + years old. In 1993 it was noted that most of the switch gear was not suited for any future power plant upgrading.

The building grounding system was tied into the site ocean ground system and lightning protection was provided by 2 air terminals mounted in telephone poles to the west side of the building.

Emergency lighting was via fluorescent fixtures and was recommended for replacement in 1993.

General recommendation: The building is in average condition but all the mechanical systems are now obsolete

and do not comply with today's' EPA standards. Further study should be to see if it is viable to upgrade the building for its present use. If not, the building should be demolished.



Rear façade with gasoline station (2006)



Front facade (2006)



Corrosion of roof top exhaust vents (2006)

Fire Pump House

- ◆ Former usage: Houses 2 diesel fire pumps and one electric jockey pump
- ◆ Original construction date: 1975
- ◆ Square footage: 752
- ◆ Floors: 1

The fire pump house is constructed of masonry block on a structural concrete foundation. The exterior masonry brick has a stucco finish. There are intermediate reinforced concrete columns and reinforced concrete tie beams at the top of the masonry walls. The roof structure consisted of reinforced concrete beams and a reinforced concrete slab. The original insulation and built up roofing has been replaced with an SKB sealant.

The building is not air-conditioned, Ventilation is provided by an exhaust fan and louvers. The building has a complete fire protection system, detection and alarm control panel.

Structure: In 1992 the building structure was deemed in good condition, however roof leaks were noted and reinforcing steel exposed. No foundation or masonry cracks observed. In 2006 problems were noted with cracking to exterior walls, discoloration of the walls and corrosion around louvers and piping.

Moisture protection. The entire roof was noted to be in poor condition and recommended for replacement.

Doors & windows. In 1993 the steel doors, frames and hardware were noted to be in poor condition and were not replaced. In 2006 the doors are now open allowing further exposure to the elements and unauthorized entry.

Mechanical: See utility section

Electrical: See utility section

General recommendation

The building is rapidly degrading and systems is now obsolete. Building should be demolished.



Pumping station just after closure (2002)



Pumping station in neglected state (2006)



Corrosion of HVAC systems (2006)

Telemetry & Control building **(T&C Building)**

- ◆ **Former usage:** Logistics, administration office, logistics storage, and conference room facility and mission support.
- ◆ **Original construction date:** 1960 & 1971
- ◆ **Square footage:** 13,940
- ◆ **Floors:** 1

The original T&C building was constructed in 1960 as a pre-engineered metal building on a structural concrete foundation. A masonry block addition was added to the building in 1971 on the south side. All interior rooms have suspended ceilings and most rooms have a vinyl tile floor. Interior rooms are partitioned using metal studs and gypsum board. All walls are painted. In 1992 there was 4,200 sq.ft of raised access flooring that no longer served its original purpose.

In 1993 no deficiencies were noted to the structure and masonry. However in 2006 visual inspection noted cracking along the roof and major corrosion of the pre-engineered metal walling.

Thermal & moisture protection: In 1992 the metal roofing was assessed as in average condition. Some minor hairline fractures were noted in the 2inch concrete slab roofing. In 2006 interior inspection revealed several major leaks indicating failure of the roof in some areas.

Doors & windows: In 1993 the condition of the doors and windows varied with the exterior steel doors and frames being in below-average condition. In 2006 all doors have been

forced open by vandals. Door windows have been smashed and the hardware no longer functions.

Finishes: In 1993 the interior of the building had just been renovated. Today the interior of the building is in poor condition and some areas, due to the suspended flooring, is a health and safety hazard. Hurricane damage, vandalism and exposure have caused major internal corrosion of all metal fixtures in the vicinity of the entrances, failure of both floor and ceiling tiling. All walls show moisture issues.

Mechanical: The air conditioning units were originally installed in 1972 and in 1993 were approaching their life expectancy. The plumbing fixtures were noted as being in below average condition. The fire protection systems were typical of the station. All systems have lain dormant since the closure of the station. It is assumed that exposure; lack of use and maintenance has rendered them inoperable.

Electrical: In 1993 as part of the upgrading of the station two new 4160 volt dry type transformers were installed in the T&C vault. New 4160-volt feeders were installed in a new duct bank and tied to the vault. Additionally the 800amp power disconnect breakers was replaced.

The motor control center equipment was not replaced and was at the end of its predicted life span.

In 1993 the major concern was the outdated light fixtures.

General recommendation:

The building is of mixed construction type. In 2006 the pre-engineered portion, which makes up 2/3rd of the building, is failing rapidly due to exposure and lack of maintenance.



T&C building entrance recently broken open (2006)



Damage to suspended ceiling (2006)



Corrosion of prefabricated cladding on all section of the building (2006)

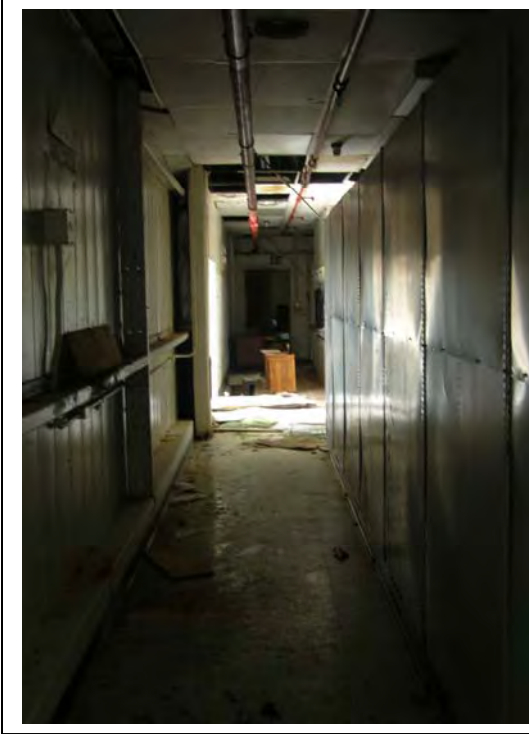


T&C building shortly after station closure. Southern facade (2006)



T&C building. Southern facade (2006)





Main corridor (2006)



Typical damage to raised floor and corrosion of all interior finishes (2006)

Workshop

- ◆ Former usage: Carpentry, paint and mechanical shops, tool storage, houses saltwater hydropneumatic tanks and pumps
- ◆ Original construction date: 1960
- ◆ Square footage: 2,817
- ◆ Floors: 1

The workshop was originally constructed as the station's power plant that housed the diesel generator set and switch gear. A new power plant was built in 1966 to replace both.

The workshop is a framed with steel columns and beams, similar to a pre-engineered building. The interior and exterior walls are constructed of concrete masonry block. The exterior masonry block has a painted stucco finish. The original roof of corrugated asbestos sheets. The interior wall and ceiling are painted and the floors are bare concrete, except in the toilet facility.

Part of the building is air-conditioned and the building has a complete fire protection system typical of the station.

General condition: In 1992 the building structure was assessed as in average condition. Some rusting of the steel columns was noted and leaks showed that water was penetrating the building. Some settlement cracks were observed. In 2006 the building was assessed as in poor condition. Corrosion of all steelwork is pervasive, there are major settling cracks in the north end of the building and the asbestos roof is still in

place. The toilet facilities are in poor condition.

Doors & windows. In 1993 the exterior steel doors and frames were in poor condition and scheduled for replacement. In 2006 these doors remain and several have been forced open during dormancy of the site.

Finishes: The condition of the painted surfaces is in poor condition.

Mechanical: In 1993 the plumbing fixture were in poor condition and scheduled for replacement as were the domestic water supply, steel pressure tank, pumps, HVAC systems and salt water systems. In 2006 it can be expected that these systems will be further degraded.

Electrical. In 1992 a new transformer was installed with a new 4160-volt feeder and enclosed in the masonry block addition on the west wall of the building. Problems were noted with the outdate lighting systems.

General recommendation.

The building is in poor condition and not easily convertible to other uses. This building should be demolished.



Workshop shortly after station closure. Southern facade (2006)



Workshop (2006)



Bathroom with extensive damage (2006)



Corrosion of beams & spawling of roof (2006)

Radar building

- ◆ Former usage: Operations, office space, electrical shop and building utilities
- ◆ Original construction date: 1960, 1965, 1971
- ◆ Square footage: 8642
- ◆ Floors: 2

The radar building was originally constructed a two separate buildings; the north building in 1960 and the south building in 1965 in support of two radar systems. In 1971 an intermediate building was constructed that connected the two larger buildings.

The building(s) is constructed of concrete masonry on a structural concrete foundation. The exterior masonry block has a stucco finish. There are intermediate reinforced concrete columns and reinforced concrete tie beams at the top of the masonry walls. The roof consists of steel joists of steel joists, metal deck and insulation topped with a 2-inch concrete slab. The original built up roof has been sealed with an SKB system.

General structure: In 1993 the exterior of the reinforced concrete columns and concrete beams were noted to be spalling severely as a result of chloride penetration. In 2006 this has continued and there are noted cracks and discoloration in the exterior walls indicating water penetration into the building.

Thermal & moisture protection: The SKB roof was installed in 1989. No maintenance has been done on this structure and there were noted leafages indicating failure in some areas of the roof.

Doors & windows: In 1993 the condition of the doors and windows varied with the exterior steel doors and frames being in below-average condition in 2006 all doors have been forced open by vandals. Door windows have been smashed and the hardware no longer functions.

Finishes. In 1993 the condition of the interior finishes varied. The existing suspended roof and vinyl floor tile was assessed as below-average condition and recommended for replacement. Hurricane damage, vandalism and exposure have caused major internal corrosion of all metal fixtures in the vicinity of the entrances, failure of both floor and ceiling tiling. All walls show moisture issues.

Mechanical. In 1993 the existing HVAC systems were installed in 1966 and had deteriorated to the point where they are not cost effective to maintain. In 2006 it was noted that in addition to extensive corrosion, plywood had been used as replacement ducting for the HVAC systems

In 1993 the plumbing fixtures were of below average condition as was the roof drain catchment system.

Electrical. In 1992 a new transformer was installed with a new 4160 volt.

General recommendation. The building is located on the most exposed peninsula of the site. The building is in poor condition and its condition will continue to worsen due to further exposure to storm damage, salt corrosion and vandalism.

All its underground utility systems were completely destroyed during Hurricane Fabian (2003).

Due to its specialized service and its phased growth it would be very difficult to convert this building to another useful purpose. It is recommended that the building be demolished.



Exposed reinforcing bar, spawling concrete and loss of metal railings. (2006)



Lintel cracking above ground floor entrance (2006)



Radar building shortly after station closure. Southern facade (2006)



Radar building. Southern facade with notable damage to ventilators, stucco finish, corrosion of all metal. (2006)



Corrosion of HVAC systems. Also noted that the duct systems are repaired with duct tape and plywood (2006)

APPENDIX 2: Potential Landuse analysis

Land use type	Benefit	Challenge
Residential	Economic benefits. Increased housing supply. The site has high amenity value.	There are other less sensitive site elsewhere. High level of environmental clean up required.
Tourism	The site has high amenity value. Boost to tourism in the East End.	Potential noise and light impacts on wildlife. Housing will generate pests such as rats and feral cats.
Institutional Retail Utilities Office Industrial	May alleviate pressure on other sites.	Loss of public access to beaches. Loss of endemic and native vegetation. High visual impact on development on the coastline.
Recreation	Complements uses at adjacent Clearwater Beach.	High level of flood risk. Additional infrastructure required. Traffic generation.
National Park	Respects ecological sensitivity of the site. Potential eco-tourism destination. Minimizes risk of flooding damage caused by severe storms. Potential re-use of several existing buildings. Environmental education opportunities. Additional public open space opportunities.	Modest economic benefits. Restrictive development potential.
Nature Reserve	Minimal environmental cleanup required. Minimal new infrastructure required. Preservation of one of Bermuda's last open spaces. Potential to create an extension to the Nonsuch Nature Reserve. Social and psychological benefits associated with open space. complements uses at adjacent Clearwater Beach. Will support and not detrimentally harm endangered species in adjacent nature	Modest economic benefits. Most restrictive development

APPENDIX 3: Environmental Agreements

Whilst this management plan concentrates primarily on Cooper's Island in the east end of Bermuda, the recommendations contained within it reflect a much broader focus on the value of conserving Bermuda's biodiversity and environmental heritage as a whole.

The framework for the preparation of this proposals plan has been provided by the guiding principles and objectives of two international environmental agreements and one significant, local environmental strategy.

The Environment Charter

In September 2001, the UK Overseas Territories, including Bermuda, became signatories to the UK Environment Charter. The recommendations included in this proposals plan for Cooper's Island meet some of the key guiding principles of the Environment Charter. They are:-

- *To safeguard and restore native species, habitats and landscape features, and control or eradicate invasive species.*
- *To encourage activities and technologies that benefit the environment.*
- *To study and celebrate our environmental heritage as a treasure to share with our children.*

This proposals plan also addresses one of Bermuda's key objectives in satisfying its commitment to the Environment Charter. This objective is to:-

“ensure the protection and restoration of key habitats, species and landscape features through legislation and appropriate management structures and mechanisms, including a protected areas policy, and attempt the control and eradication of invasive species.”

The Convention on Biological Diversity

The Convention on Biological Diversity originated from the Earth Summit in Rio de Janeiro in 1992. This convention provides an agreement between nations to act co-operatively to protect habitats, species and genes, to adopt sustainable patterns of resource use and to ensure that the benefits of natural resources are equitably shared across local, regional, national and global societies. The UK was one of 153 countries which signed the Convention in 1992 and also signed on behalf of its Overseas Territories. Bermuda is planning to make its own commitment to the convention in Spring 2004.

The development of this proposals plan for Cooper's Island and its recommendations support Bermuda's commitment to the principles of the 1992 Convention on Biological Diversity.

The Bermuda Biodiversity Strategic Action Plan

The Bermuda Biodiversity Strategic Action Plan (BSAP) is a five year plan which provides a framework in the form of objectives and key actions for achieving realistic conservation targets for the Island. The aim of BSAP is:-

“To conserve Bermuda’s natural diversity through the care of our unique island environment in order to enhance the quality of life for present and future generations.”

In preparing Bermuda’s BSAP, a number of guiding principles were developed and adapted (from the BSAP’s of other jurisdictions) by local Bermudian participants. A number of these guiding principles for Bermuda’s BSAP are reflected in the recommendations put forward in this proposals plan for Cooper’s Island, in particular, the following principles:-

- *We recognise that the conservation of Bermuda’s biodiversity is of critical importance for the continued social and economic well-being of present and future generations and contributes to the wider goal of sustainable lifestyles and quality of life.*
- *Successful biodiversity conservation and sustainable use can only be achieved through integrated and realistic approaches to the planning and implementation of activities with the full participation of all stakeholder groups.*
- *We recognise that the effective conservation of Bermuda’s*

biodiversity and biological resources requires ecosystems and natural habitats and that in Bermuda, active intervention is essential for the maintenance and recovery of native species and habitats.

- *We recognise the importance of our endemic and native species and the threat posed by the introduction of exotic and invasive species to them and to our fragile natural environment.*
- *Where a threat of significant reduction or loss of biodiversity is posed from certain activities but the link has not been established conclusively, the precautionary principle will be adopted i.e. the assumption will be that such activities should be avoided.*
- *In cases where environmentally harmful activities cannot be avoided, they should be transferred to those locations where their impacts on biodiversity can be minimised or should be managed when relocation is not possible.*
- *We recognise that substantial investments and commitments are required to conserve our biodiversity and that there is an expectation that these will lead to a broad range of environmental, economic and social benefits.*

One of the key objectives in Bermuda’s BSAP is:-

*“Objective I:
To strengthen the level of protection, where appropriate, through the re-designation of existing protected areas and to increase the area of*

fully protected nature reserves and marine protected areas through land acquisition or re-designation by 25% and 10% respectively; and to ensure the effective management of the protected areas network by 2007.”

All 5 key actions stated in the BSAP for achieving this objective are addressed by the preparation of this management plan for Cooper’s Island. They are:-

- (1) To identify existing and potential protected areas, including marine and terrestrial parks, in public and private management;*
- (2) To increase the coverage of the protected areas system in both terrestrial and marine habitats;*
- (3) To improve the management of terrestrial and marine protected areas;*

- (4) To strengthen the level of protection for protected areas; and*
- (5) To identify and designate for protection areas which show potential for restoration.*

Another key objective of the BSAP is:-

*“Objective J:
To develop new and revise existing management plans for all key species and habitats and to ensure their implementation by 2007.”*

Whilst this proposals plan for Cooper’s Island is not a management plan as such, it nevertheless sets out some broad recommendations for the management of Cooper’s Island and the adjacent Clearwater Beach Park which should feed into any future management plan(s) developed for these areas.

Appendix 4: Useful website links

www.conservationfinance.org

Website of the Conservation Finance Alliance (CFA). The CFA was created to catalyze increased and sustainable public and private financing for biodiversity conservation to support the effective implementation of global commitments to conservation. The website has an extensive library of economic/environmental-related papers, associated business plans and web links.

www.parks.tas.gov.au/publications

Website with examples of related management and business plans prepared by the Tasmania Parks & Wildlife service.

<http://www.biodiversityeconomics.org/index.html>

An extensive background site with more than 1300 links to publications (380) and other web sites (670 pages) dealing with business, finance, incentives, trade, assessment and valuation.

<http://www.biodiv.org/financial/sources.asp>

These pages on the Convention on Biological Diversity website point to sources for funding, institutions involved in sustainable financing for conservation and other useful references on financial resources for conservation.

<http://www.ecofondos.net>

Ecofondos.net is a web portal full of information on the financing of nature conservation and sustainable development. It is Ecofondos' hope that people in Latin America who are developing programs and projects related to environmental conservation and sustainable development (government officials, NGO staff, university professors, etc.), as well as others who are just interested in these issues, will visit this site to get information on sources of funding and on writing grant proposals and will also join their listserv.

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