

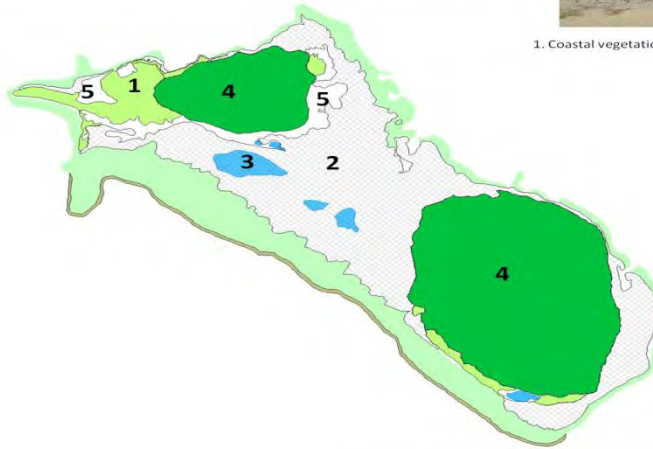
Prepared for:



15 – 17 Duke Street
Kingston
Jamaica

ENVIRONMENTAL MANAGEMENT SCOPING of THE PORTLAND BIGHT AREA, Inclusive of THE GOAT ISLANDS FINAL REPORT

Goat Island Above-Water Environment



1. Coastal vegetation assemblage on sand



2. Mangrove Wetland



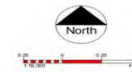
3. Brackish Water Bodies



4. Dry Limestone Forest



5. Salina



October 16, 2013



CONRAD DOUGLAS & ASSOCIATES LIMITED

14 CARVALHO DRIVE, KINGSTON 10, JAMAICA W.I.

(876)929-0023/0025/8824

info@cdaestech.com; cdaestech@hotmail.com; conraddouglasnassociatesltd@gmail.com

www.cdaestech.com

ENVIRONMENTAL MANAGEMENT SCOPING
of
THE PORTLAND BIGHT AREA,
Inclusive of
THE GOAT ISLANDS
Final Report

Prepared for:



15 – 17 Duke Street
Kingston
Jamaica

Submitted by:



CD+A
CONRAD DOUGLAS & ASSOCIATES LTD.

CONRAD DOUGLAS & ASSOCIATES LIMITED

Suite #2, 14 Carvalho Drive, Kingston 10
Jamaica, W.I.

Tel:- (876) 929-0023/0025/8824

Fax:- (876) 960-2014

Email: info@cdaestech.com

Website: www.cdaestech.com

October 16, 2013

Proprietary Restriction Notice

This document contains information proprietary to **Conrad Douglas and Associates Limited (CD&A)** and **Port Authority of Jamaica (PAJ)** and shall not be reproduced or transferred to other documents, or disclosed to others, or used for any purpose other than that for which it is furnished without the prior written permission of **CD&A** and/or **PAJ**.

Furthermore, this Environmental Management Scoping Report is the sole property of **CD&A and PAJ** and no portion of it shall be used in the formulation of now or in the future, by the agencies and/or persons who may see it in the process of its reviews, without written permission of **CD&A** and/or **PAJ**.

This document is an Environmental Management Scoping Report and is not an Environmental Impact Assessment nor an Environmental Impact Statement

CD&A have not seen the designs and plans for the Transshipment Port & Logistics Hub

TABLE OF CONTENTS

	Page Number
LIST OF FIGURES	iii
LIST OF TABLES	v
LIST OF PLATES	vi
LIST OF APPENDICES	viii
List of Acronyms.....	ix
1.0. Executive Summary	1
1.1. Background & Introduction.....	1
1.1.1. Origin.....	1
1.1.2. Purpose.....	1
1.2. Approach & Methodology.....	2
1.3. Findings.....	3
1.4. Conclusions.....	8
1.5. Recommendations.....	10
2.0. Background & Introduction	13
2.1. Purpose.....	13
2.2. Approach & Methodology.....	13
3.0. Location	20
4.0. Legal Status of Portland Bight Protected Area	22
4.1.1. Management of the PBPA	28
5.0. Historical Review.....	32
6.0. Regulatory Framework.....	41
6.1. International and National Policies, Legislation, Regulations and Standards which may applicable to the Development of a Trans-shipment Port and Protected Areas	41
7.0. Description of the Physical Environment.....	58
7.1. Topography.....	58
7.2. Geological Profile.....	59
7.3. Hydrological Profile.....	62
7.4. Oceanography	65
7.5. Bathymetry	70
7.6. Meteorology.....	72
7.6.1. Climate	72
7.6.2. Rainfall	72
7.6.3. Wind.....	76
7.7. Natural Hazard and Risk Assessment.....	78
7.7.1. Seismic Activity & Earthquakes	78
7.7.2. Hurricanes	85
7.7.3. Flooding.....	85
8.0. Description of the Biology	87
8.1. Introduction.....	87
8.2. The Goat Islands Terrestrial and Marine Environment.....	94
8.2.1. Above-water Environment (Terrestrial).....	94

8.2.2.	Below-Water Environment.....	97
8.3.	Mainland Terrestrial and Marine Environment	105
8.3.1.	Above-water Environment.....	105
8.3.2.	Mainland Below-water Environment.....	108
9.0.	Description of the Socio-cultural Environment	110
9.1.	Social and Economic Context.....	110
9.2.	Population and Gender Distribution.....	110
9.3.	Main Population Centers	115
9.4.	Present Land Use	115
10.0.	Fisheries	123
10.1.	Background.....	123
10.2.	Overview of Fishing Areas & Target Fisheries of Jamaica.....	124
10.3.	Overview of the Management of Special Fishery Conservation Areas in the Portland Bight Protected Area	124
10.4.	Outline of Fishable Resources near the Goat Islands of the Portland Bight Protected Area.....	126
10.4.1.	Habitats.....	127
10.4.2.	Fishable species composition.....	127
10.5.	Ecological links.....	131
10.6.	Overall species composition in the entire Portland Bight.....	132
10.7.	Employment Options for Fishers	133
11.0.	Conclusions	135
12.0.	Recommendations.....	138
13.0.	Glossary	I
14.0.	Bibliography.....	V

LIST OF FIGURES

	Page Number
Figure 1: Traverses Taken by Boat over the Marine Sections of the Study Area (white lines).	17
Figure 2: Traverses Taken by Foot over the Little Goat Island Section of the Study Area (red lines).....	18
Figure 3: Traverses Taken by Foot over the Great Goat Island Section of the Study Area (red lines).....	18
Figure 4: Traverses Taken by Foot over the Great Goat Island Section of the Study Area (red lines).....	19
Figure 5: Location of Portland Bight Protected Area.....	21
Figure 6: Relationship between Naturalness and IUCN Protected Area Categories (Dudley et al. 2008).....	24
Figure 7: Location of Proposed and Declared Protected Areas located.....	26
Figure 8: Map of the Portland Bight & Ridge Protected Areas.....	27
Figure 9: Land Use Profile on the PBPA (Mona Geoinformatics 2013).....	31
Figure 10: Little Goat Island with US Naval Installation: 1943 (Reid 2009).....	35
Figure 11: Goat Island with US Naval Installation: 1943.....	36
Figure 12: Little and Great Goat Islands: 2012.....	36
Figure 13: The American flag is raised in 1941 on Little Goat Island, situated at Old Harbour Bay, the United States naval base acquired from Great Britain. <i>Source: The Jamaican Gleaner</i>	37
Figure 14: Historical Timeline of Portland Bight, Ridge, Cays and Goat Islands.....	40
Figure 15: Regulatory Framework Timeline.....	45
Figure 16: Topography of the Goat Islands (height in Meters, contour interval =20m).....	59
Figure 17: Summarized Geology of the Goat Islands.....	60
Figure 18: Terrestrial and Marine Life form Assemblages and Approximate Areas of Goat Islands.....	61
Figure 19: Terrestrial and Marine Life form Assemblages for the General Study Area.....	61
Figure 20: Land use Areas (Excluding Goat Island) for the General Study Area.....	62
Figure 21: Drainage within the Portland Bight Protected Area (Mona Geoinformatics 2013)	64
Figure 22: Extract from Tidal Predictions for Port Royal Jamaica (http://tides.mobilegeographics.com) for the Drogue study Period.	67
Figure 23: Drogue Measurement Results – Galleon Harbour (Date -September 24, 2013, time -between 0830-0930hrs).....	68
Figure 24: Prevailing Water Currents in the Vicinity of the Goat Islands (influenced by night time land breezes).....	69
Figure 25: Bathymetry of the Portland Bight & Ridge Protected Areas.....	70
Figure 26: General Water Depths around the Goat Islands.....	71
Figure 27: Jamaica 30 Year Rainfall Mean (1951-1980).....	73
Figure 28: Clarendon Long-Term Mean Rainfall (mm) 1951-1980.....	73

Figure 29: Annual Precipitation (mm) at Monymusk, Clarendon for the Period 2000-2007 74

Figure 30: Annual Precipitation (mm) at Salt River, Clarendon for the Period 2000-2007. 75

Figure 31: Total Mean Monthly Rainfall (mm) at Bodles Research Station located at Old Harbour, St. Catherine for the Period 2002-2011 76

Figure 32: Wind Rose for Norman Manley International Airport, Jamaica (1976-2005) 77

Figure 33: Epicentres of earthquakes occurring between 1998 and 2001 in the vicinity of Jamaica (Source: The Earthquake Unit, UWI)..... 79

Figure 34: Epicentres of earthquakes occurring between 1998 and 2001 located in and around Jamaica. (Source: The Earthquake Unit, UWI)..... 80

Figure 35: Horizontal ground acceleration with 10% probability of exceedance in any 50-year period. Contour interval is 25 gals (“Seismic Hazard Maps: Jamaica” 2001) 82

Figure 36: Expected maximum Mercalli Intensity with 10% probability of exceedance in any 50-year period (“Seismic Hazard Maps: Jamaica” 2001)..... 83

Figure 37: Horizontal ground velocity with 10% probability of exceedance in any 50-year period. Contour interval is 2 cm/sec (“Seismic Hazard Maps: Jamaica” 2001)..... 84

Figure 38: Flood Hazard Map of the PBPA 86

Figure 39: Known location of Rare, Threatened, and Endangered Species within the Portland Bight Protected Area 89

Figure 40: The Goat Islands Above-Water Environment 94

Figure 41: The Goat Islands below Water Environment 99

Figure 42: Video Transect Locations at the Goat Islands 100

Figure 43: Observations at Transect 1 –The Goat Islands. The direction of movement was from shoreward to seaward. 1: Turtlegrass bed close to shore | 2-3: Reef slope | 4: Base of reef slope and sand/silt plain (depth indicated on gauge – 20ft) 101

Figure 44: Observations at Transect 2 –The Goat Islands The direction of movement was from shoreward to seaward. 1: Turtlegrass bed close to shore | 2-3: Transition from seagrass to reef slope | 4: Base of reef slope and sand/silt plain (depth indicated on gauge – 20ft) 102

Figure 45: Observations at Transect 3 –The Goat Islands (Careening Island) The direction of movement was from seaward to shoreward. 1: Base of reef slope and sand/silt plain (depth indicated on gauge – 20ft) | 2: Remnants of Staghorn Coral (*Acropora cervicornis*) | 3: Fire Coral colony (*Millepora* sp) | 4: Turtlegrass bed in shallows 103

Figure 46: Observations at Transect 4 –The Goat Islands. The direction of movement was from seaward to the mangroves and back to seaward. 1: Turtle Grass bed (depth 1.3m) 2: Mangrove prop roots with Schoolmaster Snapper Juveniles (*Lutjanus apodus*) present | 3: Manatee grass (*Syringodium filiforme*) close to Mangrove Prop Roots | 4: Turtle Grass. ... 104

Figure 47: Description of Above-water Environment Surrounding the Goat Islands 106

Figure 48: Description of Above-water Environment Surrounding the Goat Islands 107

Figure 49: Description of Below-water Environment Surrounding the Goat Islands 109

Figure 50: Population Pyramid showing the Gender Percentage Distribution within the Portland Bight Protected Area (St. Catherine and Clarendon)..... 111

Figure 51: Population Pyramid showing the Gender Percentage Distribution within the Selected EDs and Special Areas within a 10 km Sphere of Influence 112

Figure 52: Boundaries of Special Fisheries Conservation Areas in the Portland Bight Protected Area.....125

Figure 53: Geographic boundaries of area, Port Esquivel (left arrow), the Goat Islands (centre arrow) and Galleon Harbour (right arrow). (*Source: Google Earth Image*).126

Figure 54: Percentage Finfish species composition in all areas sampled across the entire Portland Bight (Old Harbour Bay, St. Catherine), 1997-1998 (adapted from Aiken, 1998). These data include Port Esquivel and Galleon Harbour.133

Figure 55: Risk Management and Acceptance CriteriaXXVI

Figure 56: Major Steps in Risk AssessmentXXVIII

LIST OF TABLES

	Page Number
Table 1: Profiles on IUCN Categories of Protected Areas (Dudley et al. 2008).....	23
Table 2: Major Ecosystems within the PBPA.....	28
Table 3: Major Industrial, Agricultural, Commercial and Residential Activities within the Portland Bight Protected Area.....	29
Table 4: Summary of International Agreements Relevant to Protected Areas and Trans-shipment Ports.....	46
Table 5: National Legislation Relevant to Protected Areas and Trans-shipment Ports.....	49
Table 6: Standards that are relevant to Protected Area	55
Table 7: Policies Relevant to Protected Areas and Trans-shipment Ports.....	57
Table 8: Earthquakes known to have occurred in the parish of Clarendon between 2003 and 2007.....	81
Table 9: Jamaica's Indigenous and Endemic Species (Planning Institute of Jamaica and National Environment and Planning Agency)	87
Table 10: List of Rare, Threatened and Endangered Species of Plants Present within the Portland Bight Protected Area (adapted from CD&A (1992))	91
Table 11: List of Rare, Threatened and Endangered Species of Invertebrates Present within the Portland Bight Protected Area (adapted from CD&A (1992)).....	92
Table 12: List of Rare, Threatened and Endangered Species of Vertebrates present within the Portland Bight Protected Area (adapted from CD&A (1992)).....	93
Table 13: Top 10 EDs with the Largest Populations	113
Table 14: Population Rank of EDs within the Portland Bight Protected Area for EDs within the 10 km Sphere of influence of the Goat Islands.....	114
Table 16: Species and Relative Numbers of Fishable Organisms Found at Galleon Harbour & Port Esquivel, St. Catherine in 1997 & 1998 (Aiken 1998) - <i>Ranked for Galleon Harbour only.</i>	128

LIST OF PLATES

	Page Number
Plate 1: Geomorphology of the Little Goat Island –viewed from Galleon Harbour to the north.....	58
Plate 2: Geomorphology of the Great Goat Island – viewed from Galleon Harbour to the north.....	58
Plate 5: Cactus (believed to be Columnar Cactus) interspersed between Century Plants observed on the Great Goat Island	95
Plate 3: Century Plants observed on the Great Goat Island.....	95
Plate 4: Broom Thatch Palm observed on the Great Goat Island	95
Plate 6: The Mangrove Tree Crab <i>Aratus pisonii</i>	97
Plate 7: The Arboreal Gastropod <i>Littorina angulifera</i>	97
Plate 8: Large Smooth Startlet Coral (>1m diameter) Observed near to the Southern Shore of the Great Goat Island	98
Plate 9: Remnants of Branching Staghorn Coral on Reef Area South of the Little Goat Island	99
Plate 10: Facilities & Communities within the PBPA	117
Plate 11: Significant Natural Heritage, Recreational and Industrial Features at Salt River	118
Plate 12: Tarentum Industrial Estate at Salt River, Clarendon	118
Plate 13: Salt River Community and Salt River Spring.....	119
Plate 14: JAMALCO’s Rocky Point Port and Adjacent Area which was permitted in 2008 for Establishment of a Port to Accommodate PANAMAX Sized Vessels.....	119
Plate 15: Burial Point and Wetlands in proximity to JAMALCO’s Rocky Point Port	120
Plate 16: Port Esquivel – Windalco’s Port and Jamaica Broilers Ethanol Plant.....	120
Plate 17: Longville Park Community and Environs.....	121
Plate 18: JPSCo Old Harbour Power Plant and JEP Barges	121
Plate 19: Old Harbour Bay Community	122
Plate 20: <i>Agave harrisii</i> (endemic)	XXX
Plate 21: <i>Galactia pendula</i> (endemic)	XXX
Plate 22: <i>Cordia bullata</i> (endemic)	XXX
Plate 23: <i>Bumelia rotundifolia</i> (endemic)	XXX
Plate 24: Bastard Lignum Vitae (<i>Ziziphus sarcomphalus</i>) (endemic)	XXX
Plate 25: Wild Orange (<i>Esenbeckia pentaphylla</i>) (endemic)	XXX
Plate 27: Black Birch (<i>Bursera lunanii</i>) (endemic)	XXXI
Plate 26: Velvet-leaved Maiden Plum (<i>Comocladia velutina</i>) (endemic)	XXXI
Plate 28: Broom Thatch (<i>Thrinax parviflora</i>) (endemic).....	XXXI
Plate 29: Jamaican silver thatch (<i>Coccothrinax jamaicensis</i>) (endemic)	XXXI
Plate 30: <i>Calliandra pilosa</i> (endemic)	XXXI
Plate 31: <i>God Okra (Hylocerus triangularis)</i> (endemic)	XXXI
Plate 32: Blood Red Broughtonia (<i>Broughtonia sanguinea</i>) (endemic) - Source: http://www.orchidphotos.org/gallery2/v/Broughtonia/slideshow.html	XXXII
Plate 33: Jackie's Saddle (<i>Peperomia amplexicaulis</i>) (endemic) Source: http://buixuanphuong09blogspot.blogspot.com	XXXII

Plate 35: <i>Brunfelsia membranacea</i> (endemic).....	XXXII
Plate 34: Jamaican Euphonia (<i>Euphonia Jamaica</i>) (endemic) <i>Source: Steve Metz, http://www.pbase.com/stevemetz/image/122025384</i>	XXXII
Plate 36: Jamaican Mango Hummingbird (<i>Anthracothorax mango</i>) (endemic) - <i>Source Lee Hunter, http://www.avianweb.com/jamaicanmangos.html</i>	XXXII
Plate 37: Jamaican Vireo (<i>Vireo modestus</i>) (endemic) - <i>Source: Ken Havard, http://ibc.lynxeds.com/photo/jamaican-vireo-vireo-modestus/perched-bird</i>	XXXII
Plate 38: Jamaican Woodpecker (<i>Melanerpes radiolatus</i>) (endemic) - <i>Source: Lee Hunter, http://ibc.lynxeds.com/</i>	XXXIII
Plate 39: Jamaica Tody (<i>Todus todus</i>) (endemic) - <i>Source; Mikko Pyhälä, http://ibc.lynxeds.com/</i>	XXXIII
Plate 40: Jamaican boa (<i>Epicrates subflavus</i>) (endemic) - <i>Source: Tim Vickers, commons.wikimedia.org</i>	XXXIII
Plate 43: Blue tailed galliwasp (<i>Celetes duquesneyi</i>) (endemic)	XXXIII
Plate 41: Sad Flycatcher (<i>Myiarchus barbirostris</i>) (endemic) - <i>Source: http://www.mun.ca/serg/Jamaica_trip.html</i>	XXXIII
Plate 42: Olive-throated Parakeet (<i>Aratinga nana</i>) (endemic) - <i>Source: http://www.hondurassilvestre.com</i>	XXXIII
Plate 44: Loggerhead sea turtle (<i>Caretta caretta</i>) (endemic).....	XXXIV
Plate 45: Hawksbill sea turtle (<i>Eretmochelys imbricata</i>) is critically threatened - <i>Source: Carolne Rogers, http://www.costaricaturtles.org/costa_new_seaturtles.html</i>	XXXIV
Plate 46: American crocodile (<i>Crocodylus acutus</i>) is threatened - <i>Source: http://www.vivanatura.org/Crocodylus%20acutus%20ExtraPhotos.html</i>	XXXIV
Plate 47: Leather back sea turtle (<i>Dermochelys coriacea</i>) is critically threatened - <i>Source: http://www.tartarugas.avph.com.br/tartarugadecouro.html</i>	XXXIV
Plate 48: Grahams anole (<i>Anolis grahami</i>) (endemic) - <i>Source: Garden State Hiker</i>	XXXIV
Plate 49: Jamaican Iguana (<i>Cyclura collei</i>) (endemic and critically endangered) - <i>Source; Terraristic-free-wallpapers/Lizard/The-Jamaican-Iguana-(Cyclura-collei).html</i>	XXXIV
Plate 50: Skink (<i>Mabuya mabouya</i>) vulnerable threatened - <i>Source http://reptile-database.reptarium.cz/species?genus=Mabuya&species=mabouya</i>	XXXV
Plate 51: Jamaican Giant anole (<i>Anolis garmani</i>) endemic - <i>Source: http://www.saumfinger.de/agarmanipics/3-garmani-1_0.jpg</i>	XXXV
Plate 52: Dwarf Snake (<i>Trophidophis stullae</i>) endemic and vulnerable threatened - <i>Source: http://www.reptileradio.net/boa-constrictor/12502-very-rare-boa.html</i>	XXXV
Plate 53: West Indian manatee (<i>Trichechus manatus</i>) vulnerable threatened - <i>Source: http://qpanimals.pbworks.com/w/page/5925200/West%20Indian%20Manatee</i>	XXXV
Plate 54: Jamaican fig-eating bat (<i>Ariteus flavescens</i>) identified, is currently endemic - <i>Source: R. J. Baker, http://www.planet-mammiferes.org/drupal/en/nod</i>	XXXV
Plate 55: Jamaican Coney (<i>Geocapromys brownie</i>) identified, is currently endemic and vulnerable threatened - <i>Source: http://www.jamaica-allspice.com/green_ja_species.html</i>	XXXV
Plate 56: Limestone Formation of the Hellshire Hill projecting into the sea from Rodney's Arms.....	XXXVI
Plate 57: Typical xerophytic plants found at Rodney's Arms Hellshire Hill	XXXVI
Plate 58: Great Salt Pond, Hellshire Hill (Viewed from Hellshire Main Road).....	XXXVII

Plate 59: Sign on Hellshire Main Road used to notify the public of the Portland Bight Wetland and Cay Zone under the Ramsar Convention.....	XXXVII
Plate 60: Entrance to Half Moon Bay and Hellshire Beach	XXXVIII
Plate 61: Hellshire Beach	XXXVIII
Plate 62: Fisherman Scaling the Catch of the Day	XXXIX
Plate 63: Red and Button Mangroves surrounding the fringes of the Hellshire Coast	XXXIX
Plate 64: View of Hellshire Beach from Hellshire Hills	XL
Plate 65: Limestone out-cropping in the hills of Hellshire	XL
Plate 66: Typical Xerophytic Plants found in Hellshire Hills	XLI
Plate 67: Prevailing Land use at Half Moon Bay Hellshire coast and The Hellshire Hill	XLI
Plate 68: Open Land in Old Harbour Bay	XLII
Plate 69: Sign posted at Old Harbour Bay used to notify the public of the Portland Bight Wetland and Cay Zone under the Convention of Ramsar.....	XLII
Plate 70: Brown Pelican.....	XLIII
Plate 71: Major Culvert through Old Harbour Bay Fishing Village.....	XLIII
Plate 72: JPSCo's Old Harbour Bay Power Plant.....	XLIV
Plate 73: Goat Islands (background) as seen east of main access road to JPSCo's Old Harbour Bay Power Plant.....	XLIV
Plate 74: Entrance to Port Esquivel	XLV
Plate 75: Jamaica Broilers Ethanol Plant	XLVI
Plate 76: Spring along Salt River Road	XLVI
Plate 77: Great Egret (Top right) hunting in Salt River.....	XLVII
Plate 78: Moorhen.....	XLVII
Plate 79: Green Backed Heron	XLVIII
Plate 80: Illegal Activities Within the Salt River Community.....	XLIX
Plate 81: Wisco Sugar Factory Warehouse (decommissioned), along Salt River road. Adjacent to entrance of Salt River	L
Plate 82: Enforcement and Conservation Signs along Salt River entrance	51
Plate 83: Mangrove Forest with black and red mangroves	LII
Plate 84: Mangrove Forest with Red Mangroves.....	LII
Plate 85: JAMALCO's Rocky Point Port.....	LIII
Plate 86: Marsh lands located at Portland Cottage.....	LIV

LIST OF APPENDICES

	Page Number
Appendix 1: Draft Terms of Reference	XV
Appendix 2: Risk Assessment.....	XXV
Appendix 3: Some endemic, rare, threatened and endangered species of plants and animals in the Portland Bight Protected Area (PBPA)	XXX
Appendix 4: Photo Inventory	XXXVI

List of Acronyms

CARICOM- Caribbean Community and Common Market

CBD-Convention on Biological Diversity

CCAM-Caribbean Coastal Area Management Foundation

CITES-Convention on International Trade of Endangered Species

COP- Conference of the Parties

ED-Enumeration District

EIA-Environmental Impact Assessment

FAO-Food and Agricultural Organization

FD- Fisheries Division

GDP-Gross Domestic Product

GOJ- Government of Jamaica

IUCN-International Union for the Conservation of Nature

JalCOMOS-Jamaica National Committee on the International Council on Monuments and Sites

JAMALCO-Jamaica Alumina Company

JEP- Jamaica Energy Partner

JNHT- Jamaica National Heritage Trust

JPSco Jamaica Public Service Company

MOA- Ministry of Agriculture

MoA- Memorandum of Agreement

NEPA- Natural Environmental and Planning Agency

NGO-Non Government Organization

NRCA- Natural Resources Conservation Authority Act

NSWMA- National Solid Waste Management Authority

ODPEM- Office of Disaster Preparedness and Emergency Management

PAJ – Port Authority of Jamaica

PBPA- Portland Bight Protected Area

RFP- Reinforced Fiberglass Plastic

SFCA- Special Fisheries Conservation Area

STATIN- Statistical Institute of Jamaica

TCPD- Town and Country Planning

TNC- The Nature Conservancy

ToR-Terms of Reference

UWI-University of West Indies

USA-United States of America

UN-United Kingdom

UNCLOS- United Nations Convention on the Laws of Seas

WINDALCO- West Indies Alumina Company

WISCO- West Indies Sugar Company

WRA-Water Resource Authority

1.0. Executive Summary

1.1. Background & Introduction

1.1.1. Origin

The Government of Jamaica (GoJ) is engaged in discussions with China Harbour Engineering Company (CHEC) to establish a Transshipment Port and related facilities at the Goat Islands, St. Catherine. It was previously indicated that the proposed port and its facilities were to be located at Fort Augusta in proximity to the Transshipment Port in Kingston Harbour. However, it was later determined that Fort Augusta was too small to accommodate the project.

Based primarily on archival research, supported by limited ground truthing in the terrestrial and marine environment, a preliminary description of the biological, physical and socio-cultural profile and the general environmental setting of the Portland Bight and Ridge Protected Area was carried out. This also included preparation of an international and national regulatory framework, which may relate to the project. Other relevant outputs of the study were as follows:

- The international and national regulatory framework, which may be applicable to the establishment of a Transshipment Port and Logistics Hub in a protected area.
- Preparation of a Proposed Draft Terms of Reference for conducting an Environmental Impact Assessment
- A brief profile of the key elements of what should be taken into account in conducting Risk Assessments
- International classification of types of Protected Areas.

1.1.2. Purpose

The primary purpose of this project is to perform environmental management scoping services to identify the biologically sensitive features of the marine and terrestrial environment, their spatial distribution and the location of rare, threatened and endangered

species in the Portland Bight & Ridge area and Goat Islands, and to provide preliminary information on the bio-physical and socio-cultural settings, in general. This is intended, among other things, to inform the preparation of a Draft Terms of Reference (ToR) for conducting an EIA.

1.2. Approach & Methodology

A team of experienced and highly qualified professionals were engaged in preparing this Environmental Management Scoping Study. The approach and methodology involved a combination of desktop research, literature reviews, remote sensing techniques supported by limited terrestrial and marine field investigations covering all aspects of the project. This included the following:

- Determine the geographic boundaries of the PBPA and the status of activities and uses within the area.
- Conduct archival research on the historical uses of the area.
- Identify applicable international and national environmental policies, legislation, regulations and standards for the area and those which may be relevant to the establishment of a Transshipment Port and Logistics Hub in the area.
- Identify the biologically sensitive features of the marine & terrestrial environment.
- Determine the location of rare, threatened and endangered species and their spatial distribution in the Portland Bight & Ridge area and the Goat Islands.
- Identify the main population centers within the area.
- Identify the boundaries of fish sanctuaries.
- Identify the fishing villages in the PBPA from Hellshire to Rocky Point
- Identify the number of registered fishers in the area
- Propose major tasks that will be involved in a Draft Terms of reference in conducting an Environmental Impact Assessment (EIA) for the proposed Transshipment Port as a component of the Logistics Hub
- Interact with the Port Authority of Jamaica (PAJ) in preparing a preliminary project scoping report, which takes into account several of the items referred to above.

This scoping project is not an Environmental Impact Assessment (EIA) nor an Environmental Impact Statement (EIS).

In preparing this report CD&A did not see any plans nor designs for the Transshipment Port and Logistics Hub under discussion.

1.3. Findings

Location

- The Portland Bight Protected Area (PBPA) is located at latitude 17°53'00" and longitude 77°08'00". It spans the parishes of St. Catherine and Clarendon and has a total area of 1,876 km² (724 sq. miles). Within the PBPA there are nine (9) cays and nine (9) islands (See Figure 5).
- The major natural resources within the Portland Bight Protected Area are: the tall open dry limestone forests of the Portland Ridge, Brazillito Mountains and Hellshire Hills, the mangrove and herbaceous wetlands of the northern, eastern and western shorelines of the PBPA, the fields and disturbed broadleaf forest areas of the northern sections of the PBPA, caves, seagrass beds, fish sanctuaries, coral reefs and riverine and estuarine areas.
- The main features and area coverage of the Goat Islands are dry limestone forest (589.6 acres), mangrove wetlands (529.3 acres), coastal vegetation assemblage on sand (82.5 acres), brackish water bodies (28.7 acres), seagrass beds (342.7 acres) and reef slope (25.7 acres) (See Figure 17).
- Portland Bight is mainly comprised unconsolidated sands, sandy clays, carbonaceous sandy clays and clays of Holocene age (last 12,000 years).
- The Portland Bight Protected Area experiences a tropical maritime climate with a bi-modal distribution of rainfall, which matches the national pattern. The predominant wind direction is from East to West. The PBPA falls within the Rio Minho Watershed. A total of fourteen (14) streams drain into the Portland Bight.

Legal Status

- The Portland Bight & Ridge was declared a Protected Area on April 22, 1999 under Section 5 of the Natural Resources Conservation (1991) Act
- The area was originally proposed as an Eco-Development Area (CD&A 1992) and is recognized as a Multiple Use National Park because in addition to its natural heritage resources it hosts a number of major industrial, commercial, residential and agricultural activities, inclusive of the Tarentum Industrial Zone. In addition, there are several areas which have been subjected to anthropogenic (human) intrusion over the last five (5) centuries.
- The PBPA does not fit any of the International Union for the Conservation of Nature (IUCN) categories, namely: ***Category Ia: Strict nature reserve***, ***Category Ib: Wilderness area***, ***Category II: National park***, ***Category III: Natural monument or feature***, ***Category IV: Habitat/species management area***, ***Category V: Protected landscape/seascape***, ***Category VI: Protected area with sustainable use of natural resources*** (See Section 4.0)
- In 2004 The Nature Conservancy (TNC) proposed the PBPA multiple use national park as a Sustainable Development Area¹ (Yugorsky and Sutton 2004)

Historical Uses

- A historical review of the Portland Bight & Ridge area and the Goat Islands shows:
 - Pre-Columbian (pre 1494)
 - Tainos occupied the Goat Islands before the Spanish Occupation. Taino middens, skeletal remains and relics have been found on the Goat Islands
 - Spanish occupation (1494-1655)
 - The Portland Bight was referred to as '*Bahía de la Vaca*', or "Cow Bay" by Christopher Columbus in his second voyage of 1493-1494.

¹ Areas designated to operate as an integrated whole over a broad area, including human settlements, industry and plantations, to promote conservation and minimize environmentally degrading practices while promoting economic development

- English occupation (1655-1962)
 - During World War II, a naval station was established on Little Goat Island by the US Navy. 2.8 million cubic yards of dredged spoils were excavated for creating a jetty for sea planes. The Goat Islands represented a part of the “land for destroyers exchange” between the United States of America and Great Britain. Barracks were constructed to house some 100 army personnel. Water was barged, stored, treated and distributed on Little Goat Island. 75,000 gallons of fuel was stored in eleven (11) underground storage tanks (USTs).
- Post-Independence (1962)
 - A number of developments have been done within the PBPA including the establishment of the Tarentum Industrial Zone.
 - Recent Environmental Permits granted in the area for significant increase in shipping and materials handling include:
 - ✓ Permit granted by NEPA to Jamalco in 2004 for increasing its material handling capacity and shipping schedule (doubling its capacity from 1.4 to 2.8 million tonnes of alumina per year)
 - ✓ Permit granted by NEPA to Rinker/CEMEX in 2009 for the development of a port to handle PANAMAX size vessels. Ship draft to be in excess of 14 meters.

Regulatory Framework

- A total of 68 international and national policies, legislation, regulations and standards which may be applicable in the establishment of a trans-shipment port in a Protected Area have been identified and classified. These categories include, for example:
 - ✓ International Agreements to protect Bio-diversity and Eco-Systems
 - ✓ International Agreements Protecting World Cultural and National Heritage
 - ✓ International Agreements to Protect against Marine Pollution
 - ✓ International Agreements to Protect Habitats

- ✓ International Agreements to delegate Sea Usage
 - ✓ Policies Relevant to Protected Areas and Trans-Shipment Ports
 - ✓ National Legislation for the Protection of the Environment (Bio-diversity)
 - ✓ National Legislation for the Protection of the Environment (Physical)
 - ✓ National Legislation governing the Local Fisheries
 - ✓ National Legislation governing Land Use
 - ✓ National Legislation governing Taxation
 - ✓ National Legislation governing Use of the Seas
 - ✓ National Legislation governing Port Operations
 - ✓ National Legislation relevant to and governing the Labour Force
 - ✓ Other National Legislation relevant to and governing Port Operation
 - ✓ Standards Relevant to Protected Areas and Trans-Shipment Ports
- A historical timeline on the regulatory framework has been prepared (See Figure 14).

Biology

- Jamaica ranks fifth of the Earth's islands with 4504 indigenous species of plants and animals of which 1642 are endemic.
- Within the ecosystems, identified as tall open dry limestone forests of the Portland Ridge, Brazillito Mountains and Hellshire Hills, mangrove and herbaceous wetlands of the northern, eastern and western shorelines of the PBPA, the fields and disturbed broadleaf forest areas of the northern sections of the PBPA, caves, seagrass beds, fish sanctuaries, coral reefs, riverine and estuarine ecosystems are:
 - twenty-one (21) species of rare, threatened, and endangered species of animals. Of these, ten (10) inhabit Portland Ridge and the Hellshire Hills. The Iguana is found only in Hellshire. The other eleven (11) species are also found in other areas in Jamaica. Fifteen (15) species of plants endemic to Jamaica are also found in the PBPA.

Fisheries

- There are three (3) declared fish sanctuaries in the PBPA (2010): These are: **I)** Three Bays, **II)** Galleon Harbour, and **III)** Salt Harbour. The Galleon Harbour sanctuary includes the Goat Islands. The fisheries in the PBPA are generally in a degraded condition, consequent on being overfished and subjected to dynamiting over the years.
- The main fishing villages in or within proximity to the PBPA coastline are Hellshire, Old Harbour Bay, and Rocky Point.
- There are 18,294 fishers who are registered with the Fisheries Division of the Ministry of Agriculture and Fisheries. Of this 2585 (14% of total registered fisher folks) operate from the coastline of the PBPA (Hellshire, St. Catherine to Rocky Point, Clarendon). The majority of these do not make their catch within the PBPA but offshore Jamaica's coastline, among principally the Pedro Cays.
- Adding the indirect employment, the fishing industry excluding aquaculture hires some 40,000 persons (full-time and part-time). While most of the fishers are on the south-coast of the island there are 148 landing sites almost covering the entire coast line.
- It was found that a majority of fishers within the PBPA had additional occupations and income-earning activities, in addition to their primary activity of fishing in, around and outside of Portland Bight (Jamaica's southern shelf). Some were policemen, farmers, coal burners, jockeys, disco operators, net makers, fish pot makers, carpenters, masons, boat repairers, restaurant operators and wage workers at the Kingston airport and the JPS power plant at Old Harbour Bay.
- Majority of the fishers do not fish in the PBPA because the fisheries are degraded from overfishing, dynamiting and the hydrogen sulphide enriched deep soft sediment in the Galleon Harbour, which may create anoxic conditions in the water column. Molluscs queen conch (*strombus gigas*) accounts for 2.1% of the total fish and the spiny lobster accounts for 7.1%. The flat oyster found on the prop roots of the red mangrove is significant.

- The total population within the PBPA was 67,506 persons, of which 33,798 were females and 33,708 were males.

1.4. Conclusions

Our conclusions are as follows:

- Declared in 1999 as a Multiple Use National Park the Portland Bight Protected Area (PBPA), which includes the Goat Islands, among 16 other cays and islands, is a mixture of major natural heritage resources and industrial, agricultural, commercial and residential developments.
- The area also includes an industrial zone at Tarentum.
- The PBPA does not fall into any of the IUCN categories of protected areas, being an area of mixed development consisting of major natural heritage resources and major industrial, agricultural, commercial and residential activities which have been in existence for several decades.
- The PBPA hosts the largest mangrove system in Jamaica and is a declared RAMSAR site.
- The PBPA presents itself as a Sustainable Development Area for which it was originally proposed (eco-development area by CD&A in 1992) and which was later supported by The Nature Conservancy (TNC), which proposed it as a Sustainable Development area in 2004. For these reasons, the two (2) extremes of natural resource conservation and economic development exist in the area. This illustrates that effective natural resource conservation and economic development are not necessarily mutually exclusive.
- Twenty-one (21) rare, threatened and endangered species of plants and animals are located in the PBPA. Except for the iguana, which is found in the Hellshire Hills only, five species of blind shrimps located in caves in Portland Ridge, the Portland Ridge tree frog, two species of thunder snakes, the blue tailed galliwasp and the fig eating bat which is found in the Hellshire Hills, these species are also found in other locations in Jamaica.

- There are three (3) fish sanctuaries in the PBPA which were established in 2010 under the Fishing Sanctuary Act of 2009.
- Of 18,294 registered fishers in Jamaica, 2,500 (14% of registered fishers) operate from landing sites in Hellshire, Old Harbour Bay and Rocky Point, spanning parts of the coastline of the parishes of St. Catherine and Clarendon.
- There are about 500 active fishers (2.7% of registered fishers) in the area who use artisanal boats. The majority of these fish outside of the PBPA. Fishing provides mainly supplemental income to other activities in which they are engaged such as farmers, policemen, coal burners, jockeys, disco operators, net makers, fish pot makers, carpenters, masons, boat repairers, restaurant operators and wage workers at the Kingston airport and the JPS power plant at Old Harbour Bay. A few of the fishers are also employed as wardens in the fish sanctuary.
- Some 40,000 persons directly or indirectly find employment through Jamaica's fishing industry.
- The fisheries in the PBPA are in a degraded condition as a result of over fishing and dynamiting over the years.
- The substrate of the Galleon Harbour primarily consists of relatively deep hydrogen sulphide enriched, soft sediment mainly of terrestrial origin.
- The Goat Islands are still inhabited by wild goats.
- It does not appear that there are iguanas on the Goat Islands.
- The Goat Islands have experienced anthropogenic intrusion (human activity) from Pre Columbian times. During World War II, Little Goat Island was developed as a United States of America Naval Station under the 'destroyers for land exchange' between Great Britain and the United States of America. 75,000 gallons of fuel were stored in 11 Underground Storage Tanks (USTs). There was a power plant on the site. Water was barged to the site and treated and stored. 2.8 million cubic yards of dredged spoils was extracted in creating a jetty for sea planes and naval access to the site. It would appear that the dredged spoils, at least in part, was stored adjacent to and between the Goat Islands and might have influenced its current bio-physical condition.

- There is significant scope for improvement in the management of the PBPA. This reportedly results mainly from insufficient funding.
- There are 68 pieces of international and national legislation, which may be taken into account in developing a transshipment port and associated logistics hub in a protected area.
- The project is conceived in the following socio-economic context:
 - ✓ Jamaica is engaged in a four year extended fund programme with the International Monetary Fund (IMF).
 - ✓ Jamaica has a Special Drawing Rights (SDR) with the IMF that now stands at 225%.
 - ✓ Jamaica's debt is JM\$1.8 trillion.
 - ✓ Jamaica has the highest debt risk burden in the world (Johnston 2013).
 - ✓ The total annual budget of the country is over JM\$6 billion, with more than 50% being used for debt servicing.
- The major sectors that generate income for the Jamaican economy in order of ranking are:
 - ✓ The Diaspora in the form of remittances
 - ✓ Tourism
 - ✓ Bauxite
 - ✓ Export agriculture
- Jamaica also has a high unemployment rate. The official unemployment rate jumped in April 2013 to 16.3 percent which is an increase from 14.5 percent in January and 14.4 percent a year earlier (IMF 2013).

1.5. Recommendations

Our recommendations are as follows:

1. Consequent on the ecological, social and economic importance of the Portland Bight Protected Area, it is strongly recommended that any project to establish a Transshipment Port and Logistics Hub in the PBPA, be subjected to a detailed

Environmental Impact Assessment (EIA). In this regard, we have prepared a Draft Terms of Reference (See Appendix I). However, in this Executive Summary we highlight the following among the various tasks, which must be carried out:

- Detailed description of the project (Electro-mechanical, structural and civil engineering designs for the pre-construction, construction and operation phase). Projected ship traffic analysis.
 - Alternatives analyses
 - Voluntary and mandatory ongoing public participation and consultations, inclusive of contact socio-economic surveys
 - Estimates of natural resource valuation
 - Cost Benefit Analyses at the macro and micro economic levels, inclusive of estimates of the Economic Rate of Return (ERR) for the proposed project
 - Description of the bio-physical and socio-cultural environment
 - Detailed oceanographic assessments
 - Drainage assessment
 - Analysis of the regulatory framework
 - Identification of potential impacts
 - Impact Mitigation
 - Risk assessment to inform, among other things impact identification and impact mitigation
 - Detailed environmental management & monitoring plan
 - Preparation of an Emergency Response Plan
2. Because there are risks associated with any project and several unknowns in developing a transshipment port in the PBPA, a risk assessment must be carried out as part of the detailed Environmental Impact Assessment.
 3. Develop a plan for the institutional strengthening of the Protected Areas Trust. This should be aimed at enabling the improved, efficient and effective management of the

natural resources of the proposed and declared protected areas in the Portland Bight Protected Area and Jamaica, in general.

4. The substrate of the Galleon Harbour is enriched with hydrogen sulphide and exists as a deep soft sediment. This appears to result from the influent of high sediment and organic loading from industrial installations and the drainage regime of both the natural and built environment. This may lead to the development of anoxic conditions through degradation of complex organic compounds (polycyclic aromatic compounds, humenes, fulvenes, humic and fulvic acids, humates and fulvates) by microorganisms. It is not known if the wave action and currents in the area are sufficient to facilitate turbulence and mixing to minimize the possible existence of anoxic conditions. It must be noted that the Portland Bight area hosts the driest conditions (highest evapo-transpiration rate and lowest rainfall) in Jamaica, at Portland Cottage at which a solar salt production facility was established.

From the marine survey conducted along the coast of the Goat Islands, it is evident that there are distinct differences between the terrestrial and marine influences of the northern and southern sides of the Goat Islands, respectively.

According to Aiken, et al, the following must be noted: *“The Galleon Harbour area was the most diverse of all the areas sampled (Aiken 1998; Aiken, Hay, and Montemuro 2003), suggesting that the area was a major nursery and critical habitat for fishable species of all types.”*

It is therefore recommended that the scientific criteria used for selecting any area as a fish sanctuary should be based on detailed physico-chemical and biological information (as well as the biophysical and socio-cultural information of the area, in general) obtained by systematic investigation over a scientifically acceptable period of time.

It is highly probable that there are other areas in Portland Bight which are more suitable for the establishment of fish sanctuaries than the Galleon Harbour.

2.0. Background & Introduction

Further to discussions concerning the environmental management scoping analysis of the Portland Bight and Ridge Protected Area (PBPA), a project was undertaken as a preliminary activity to rapidly identify principal bio-physical and socio-cultural characteristics and the general environmental setting of the Portland Bight and Ridge Protected area inclusive of the Goat Islands.

2.1. Purpose

The primary purpose of this project is to perform environmental management scoping services to identify the biologically sensitive features of the marine and terrestrial environment, their spatial distribution and the location of rare, threatened and endangered species in the Portland Bight & Ridge area and Goat Islands, and to provide preliminary information on the bio-physical and socio-cultural settings. This is intended, among other things, to inform the preparation of a Draft Terms of Reference (ToR) for an EIA.

2.2. Approach & Methodology

A team of experienced and highly qualified professionals were engaged in preparing this Environmental Management Scoping Study. The approach and methodology involved a combination of desktop research, literature reviews, remote sensing techniques supported by limited terrestrial and marine field investigations covering all aspects of the project. This included the following:

- Determine the geographic boundaries of the PBPA and the status of activities and uses within the area.
- Conduct archival research on the historical uses of the area.
- Identify applicable international and national environmental policies, legislation, regulations and standards for the area
- Identify the biologically sensitive features of the marine & terrestrial environment.
- Determine the location of rare, threatened and endangered species and their spatial distribution in the Portland Bight & Ridge area and the Goat Islands.

- Identify the main population centers within the area.
- Identify the boundaries of fish sanctuaries.
- Identify the fishing villages in the PBPA from Hellshire to Rocky Point
- Identify the number of registered fishermen in the area
- Propose major tasks that will be involved in a Draft Terms of reference in conducting an Environmental Impact Assessment (EIA) for the proposed Trans-shipment Port as a component of the Logistics Hub
- Interact with the Port Authority of Jamaica (PAJ) in preparing a preliminary project scoping report, which takes into account several of the items referred to above.

This desktop research is also supported by the use of:

- Remote sensing techniques such as satellite imagery.
 - ✓ Satellite images available from Google Earth images were used for initial photo-interpretation and spatial representation of substrate, life form and oceanographic features within the study area. Relevant images were inputted into a Geographical Information System (GIS) and referenced to JAD 2001, a known map projection/coordinate system.
 - ✓ Such referencing provided measurements and general mapping to be done to support air photo interpretations for the study. Referencing also provided positioning coordinates that facilitated field navigation to the location of features that could not be interpreted on the satellite images.
- Low altitude aerial photography of parts of the PBPA extracted from CD&A's archives.
- Google Earth images of the study area were examined using photogrammetric techniques to interpret the spatial extent of natural resources and processes occurring within the study area. The interpretation process was further facilitated with the use of Geographical Information Systems (GIS) software.

- Data layers from Mona Geoinformatics were used as an initial data reference representative of the general Portland Bight Protected Area (PBPA)
- Limited ground truthing in the terrestrial and marine environment
 - ✓ Land traverses on the Little and Great Goat islands (where ease of traversing facilitated this. (*No machete-cutting of trails was done*)).
 - i. Emphasis was placed on the characterization of vegetation assemblages in accordance with the Forestry Department's Land Use/Cover Hierarchical Classification. Having made basic classification distinctions through the use of satellite imagery interpretation techniques, visual traverses were then used through the areas defined, with observations being made for any indicator plant species that would characterize or confirm the type of plant assemblage being observed.
 - ii. While conducting the vegetation character traverses, observations were made for any ground, arboreal or avifauna that might be present within the assemblage.
 - ✓ Boat traverses of the Galleon Harbour and Goat islands water bodies and waterline
 - ✓ SCUBA/snorkeling supported traverses of the marine environment surrounding the Goat Island area
 - ✓ **Benthic Organisms/Substrate Analysis:** Two methods were used for the determination of the benthic organisms and the nature of the substrates within the study area.

Method 1

- iii. The first method used was the sampling of seafloor surface substrates with the deployment of a Van Veen grab sampler. The grab sampler was deployed at intervals during boat traverses of

the area and the nature of the sediments and any life forms present was recorded.

Water depths were taken with a hand-held depth sounder at the same time that the sediment samples were being taken.

Method 2

- iv. The second method was the use of underwater video information collected along tape measure-defined transects distributed over locations within the study area.

These transects were specifically deployed in areas identified during satellite imagery analysis as requiring ground truthing. Video information was collected with the use of SCUBA gear and a Sony Mini-DV camera mounted within an Amphibico underwater housing.

In the case of both the grab sampling and video transect work, observations were related to positions within the study area so that a spatial representation of those observations could be carried out.

- Video and still photography have been employed to identify major marine and terrestrial resources, followed by analysis and interpretation.
- All data sets collected in the field were positioned using a Garmin Foretrex 101 Global Positioning System, with positions being obtained in latitude and longitude. The latitude and longitude positions were then converted to easting and northing coordinates compatible with the JAD 2001 map reference system used in the GIS and overlaid onto geo-referenced Google Earth images and layers produced (See Figure 1 to Figure 4). For the Goat Islands these were as follows:

- i. Topography

- ii. Spatial distribution of terrestrial geological features
- iii. Spatial distribution of terrestrial vegetation/benthic life forms

For the study area indicated in red on the Google earth images, these were

- i. Spatial distribution of Land uses in the study area
- ii. Spatial distribution of benthic substrates/life forms in the study area
- iii. Depths within the study area
- iv. Interpretations on basic oceanography in the study area.

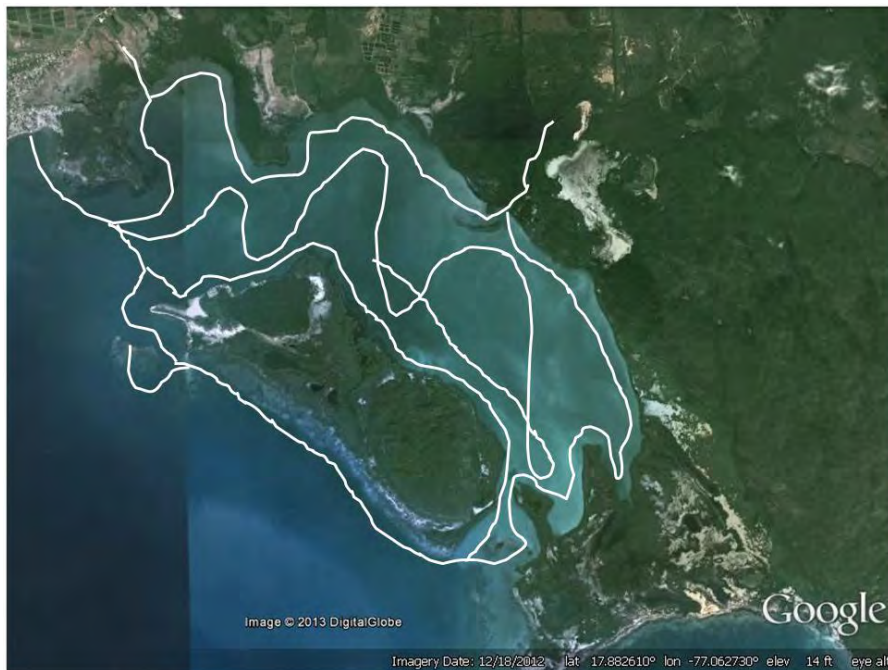


Figure 1: Traverses Taken by Boat over the Marine Sections of the Study Area (white lines).



Figure 2: Traverses Taken by Foot over the Little Goat Island Section of the Study Area (red lines).

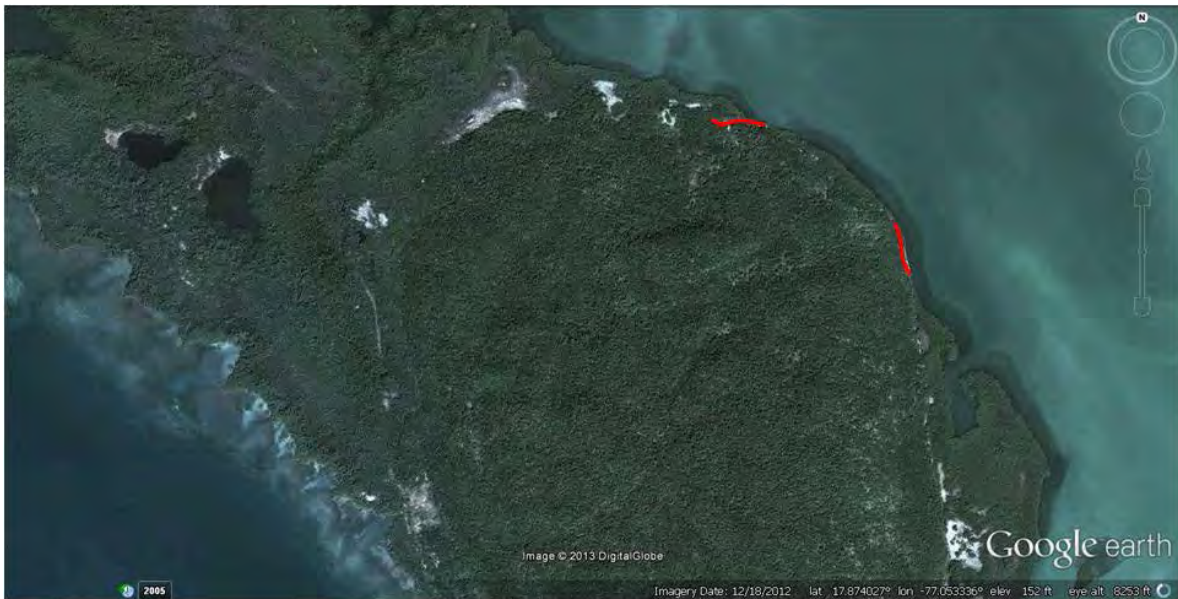


Figure 3: Traverses Taken by Foot over the Great Goat Island Section of the Study Area (red lines).



Figure 4: Traverses Taken by Foot over the Great Goat Island Section of the Study Area (red lines).

3.0. Location

The Portland Bight Protected Area (PBPA) is located on Jamaica's south coast at latitude 17°53'00" and longitude 77°08'00". It spans the parishes of St. Catherine and Clarendon and has a total area of 1,876 km² (724 sq. miles), which consists of integrated terrestrial and marine natural resources (see Figure 5 below). The 520 sq. km (200 sq. mile) terrestrial area represents 4.7% of Jamaica's land mass, and the 1,356 sq. km (524 sq. mile) of marine space represents 47.6% of Jamaica's shallow coastal shelf.

There are several industrial, agricultural, commercial and residential developments in the area. Some of these developments and activities, such as Port Esquivel and the shipping of sugar from Salt River have been in operation for more than a century.

The PBPA contains 210 sq. km (81 sq. mile) of dry limestone forest, 82 sq. km (32 sq. mile) of wetlands. Major seagrass beds and coral reefs exist in the area. The PBPA is a habitat for birds, iguanas, crocodiles, manatees, marine turtles, fish and human beings. There are a number of small islands and cays within the PBPA. Those identified are as follows:

- ✓ Little Goat Island
- ✓ Great Goat Island
- ✓ Pigeon Island
- ✓ Short Island
- ✓ Long Island
- ✓ Salt Island
- ✓ Dolphin Head Island
- ✓ Little Pelican Island
- ✓ Big Pelican Island
- ✓ Careening Cay
- ✓ Rocky Cay
- ✓ Man O' War Cays
- ✓ Bare Bush Cay
- ✓ Big Half Moon Cay
- ✓ Little Half Moon Cay
- ✓ Big Portland Cay
- ✓ Little Portland Cay
- ✓ Tern Cay

See Figure 5 below.

Notes on the physical, social and economic geography of the PBPA are mentioned below.



Figure 5: Location of Portland Bight Protected Area

4.0. Legal Status of Portland Bight Protected Area

The Portland Bight & Ridge was declared a protected area on April 22, 1999 under Section 5 of the Natural Resources Conservation Authority (1991) Act (See Figures 3-4 below). The area is recognized as a Multiple Use National Park because in addition to major natural heritage resources it hosts a number of major industrial, commercial, residential and agricultural activities, inclusive of the Tarentum Industrial Zone.

The protected area status of PBPA does not fit any of the categories of protected areas as defined by the International Union for the Conservation of Nature (IUCN). The IUCN defines a protected area as:

‘a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values.’ (Dudley et al. 2008)

There are several types of protected areas, as classified by the IUCN. These categories of protected areas are listed below:

- Category Ia: Strict nature reserve
- Category Ib: Wilderness area
- Category II: National park
- Category III: Natural Monument or Feature
- Category IV: Habitat/species management area
- Category V: Protected Landscape/Seascape
- Category VI: Protected area with sustainable use of natural resources

Table 1: Profiles on IUCN Categories of Protected Areas (Dudley et al. 2008)

Category	Description
Category Ia: Strict nature reserve	Category Ia are strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring.
Category Ib: Wilderness area	Category Ib protected areas are usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.
Category II: National park	Category II protected areas are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities
Category III: Natural monument or feature	Category III protected areas are set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value.
Category IV: Habitat/species management area	Category IV protected areas aim to protect particular species or habitats and management reflects this priority. Many category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category.
Category V: Protected landscape/seascape	A protected area where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.

Category	Description
Category VI: Protected area with sustainable use of natural resources	Category VI protected areas conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area

Source: Guidelines for Applying Protected Area Management Categories

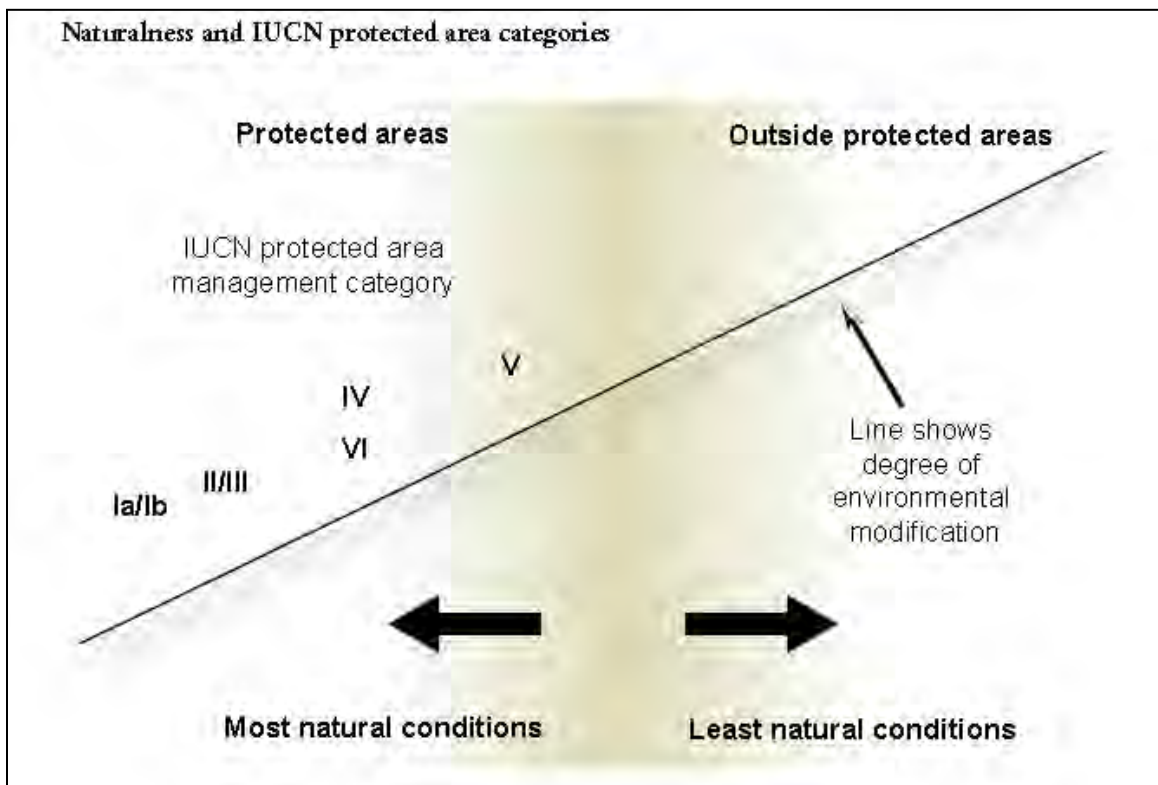


Figure 6: Relationship between Naturalness and IUCN Protected Area Categories (Dudley et al. 2008)

The Portland Bight Protected Area does not fall into any of the IUCN categories of protected areas. This was recognized prior to and at the time of its declaration, primarily because while it has major significant natural heritage and cultural resources, it also has major industrial, commercial, residential and agricultural activities in the area which have been in operation for several decades (See Figure 9 and Tables 2-3 below). In preparing ‘A Plan for

a System of Natural Protected Areas for Jamaica' in 1992 (CD&A 1992), one hundred and fourteen (114) sites were investigated. These were screened down to seventeen (17) sites and studied in detail. The 17 sites included:

1. Blue & John Crow Mountains
2. Portland Bight & Ridge
3. Hellshire Hills
4. Palisadoes and Cays
5. Pedro Bank & Cays
6. Morant Cays
7. Black River Lower Morass, St. Elizabeth
8. Negril Morass, Westmoreland
9. Canoe Valley, Manchester
10. Harris Savannah
11. Cockpit Country
12. Dolphin Head Mountains
13. Worthy Park Estate
14. St. Thomas Great Morass
15. Mason River
16. Douglas Castle
17. San San

Thirty four (34) reports were generated relating to Policy and Legislative Framework, Ecology, Wetlands, Marine and Terrestrial, Development Economics, Socio-economics, Land Tenure, Cultural Heritage Resources and Physical Planning.

It was recommended that the area be classified as an 'Eco-Development Area'. In 2004, The Nature Conservancy (TNC) proposed that the PBPA be classified as a '**Sustainable Development Area**' (Yugorsky and Sutton 2004).

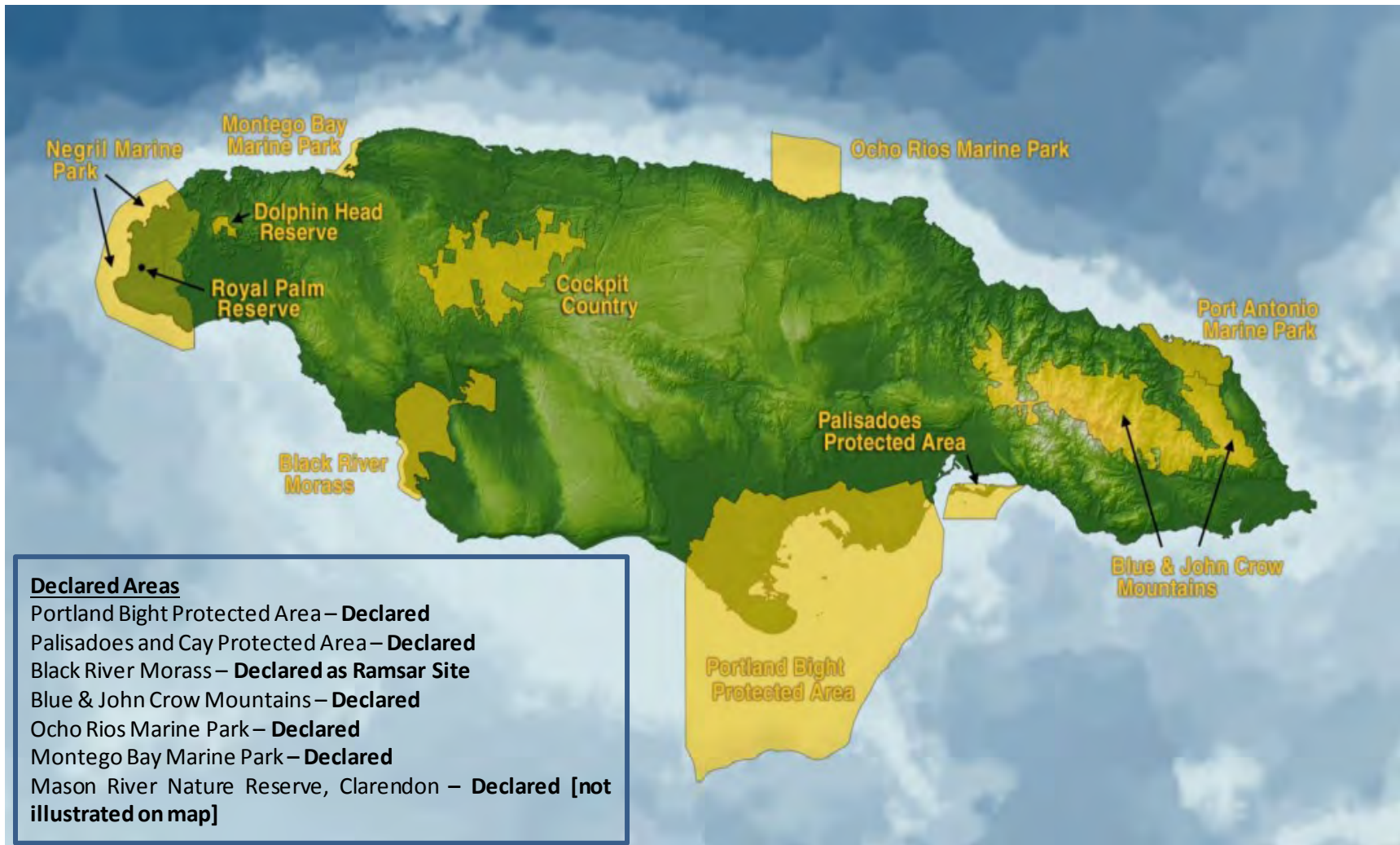


Figure 7: Location of Proposed and Declared Protected Areas located (Adapted from (“High Definition Map of Jamaica Protected Areas” 2013))



Figure 8: Map of the Portland Bight & Ridge Protected Areas (Adpated from (“JPAT > Interactive Virtual Tour > Portland Bight Protected Area” 2013))

Original Proposed Area Map prepared by Conrad Douglas & Associates Limited, A Plan for a System of Natural Protected Areas for Jamaica, 1992

4.1.1. Management of the PBPA

The Caribbean Coastal Area Management Foundation (C-CAM) was established in 1997 to promote coastal conservation in Jamaica and the Caribbean and has been delegated management responsibility for the PBPA in 2003. C-CAM has prepared a management plan for the PBPA and is contractually responsible for implementing it. This includes securing funds for financing its activities.

Table 2: Major Ecosystems within the PBPA

Major Ecosystems within the Portland Bight Protected Area	
Terrestrial	Marine
Tall Open Dry Limestone Forests of the Portland Ridge, Brazillette Mountains and Hellshire Hills	Seagrass beds
Fields and Disturbed Broadleaf Forest areas of the northern sections of the PBPA	Fish sanctuaries
Caves	Coral reefs
Mangrove and herbaceous Wetlands of the northern, eastern and western shorelines of the PBPA	
Riverine and estuarine ecosystems	

Table 3: Major Industrial, Agricultural, Commercial and Residential Activities within the Portland Bight Protected Area

Major Activities within the Portland Bight Protected Area			
Industrial	Agricultural	Commercial	Residential
Old Harbour Power Plant	Fish Farms	Old Harbour Bay Fishing Village	Moore Pen
The Doctor Bird Power Barge I (acquired 1995) (74.16 MW)	Chicken Farms	Salt River Springs	New Harbour Village Phase I & II
Doctor Bird Power Barge II (acquired 2006) (50.2MW)	Monymusk Sugar Factory	Monymusk Gun, Rod & Tillers Club	Longville Park
Jamaica Broilers Ethanol Plant	Small Scale Coal Kilns	Rocky Point Fishing Beach	Salt River Community
Winalco's Port Esquivel	Brampton Farm	Series of Small Shops	Hellshire Community
Tarentum Industrial Zone		Pharmaceutical Company	Lionel Town
Chemical Lime Company of Jamaica Limestone Quarry			Mitchell Town
Jamalco's Rocky Point Port			Amity Hall
Best Dressed Feed Mills			Lloyds Pen
Proposed RINKER/Cemex Port & Transportation Corridor **			Bushy Park
JAMALCO Alumina Plant			Braits Hill
Bauxite Residue Storage Area			Hayes
			Race Course

Major Activities within the Portland Bight Protected Area			
Industrial	Agricultural	Commercial	Residential
			Longwood
			Portland Cottage
			Water Lane
			Rocky Point
			New Bowens
			Dawkins Pen

***RINKER/Cemex obtained a permit from NEPA in 2009 to establish a deep water port to ship approximately 12 million tonnes per year of limestone using PANAMAX sized vessels.*

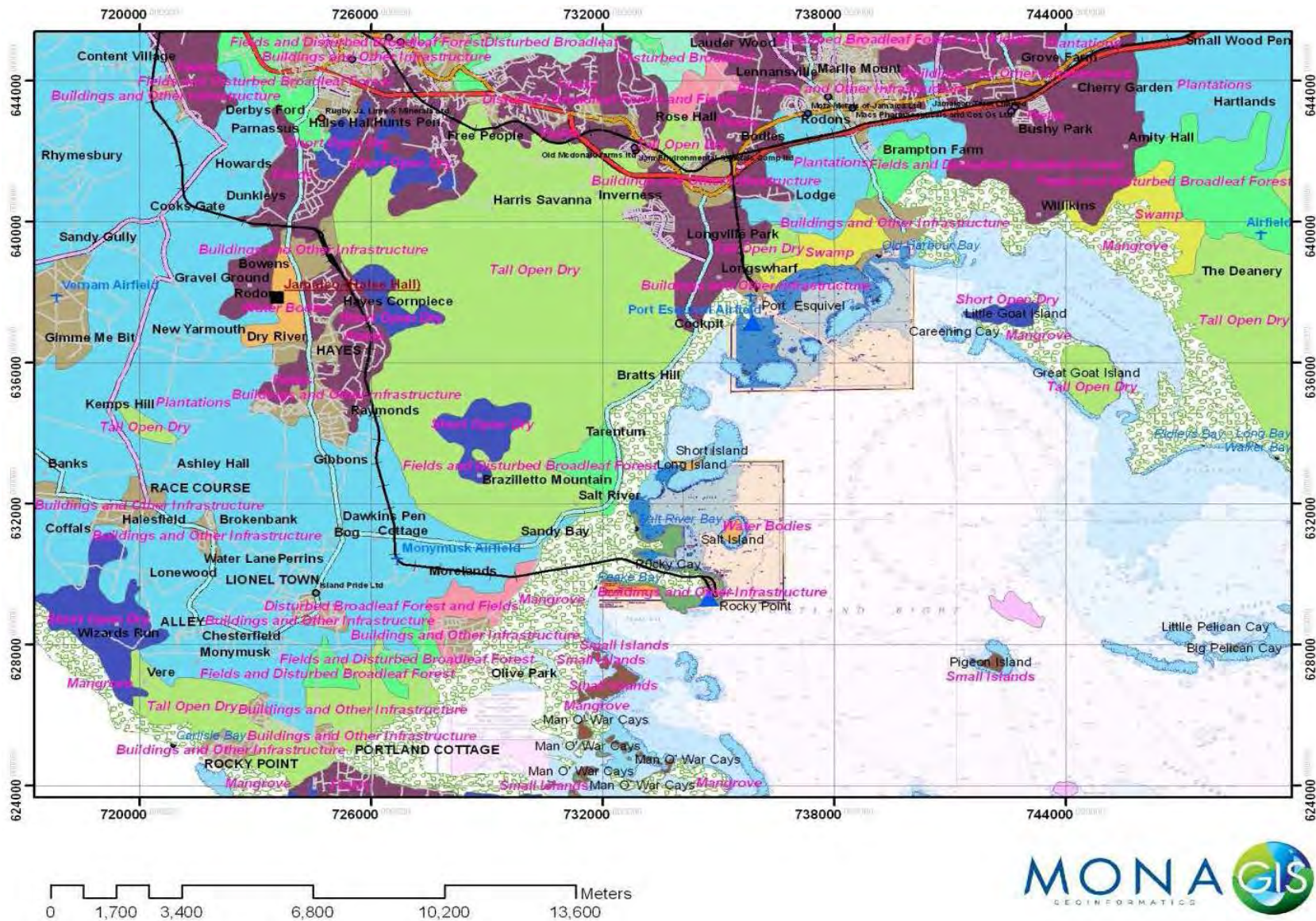


Figure 9: Land Use Profile on the PBPA (Mona Geoinformatics 2013)



5.0. Historical Review

A historical review of the Portland Bight & Ridge area and the Goat Islands has been done and a historical timeline prepared (See Figure 14 below). A chronology of the area shows the following:

✓ Pre-Columbian (Pre 1494)

- Prior to the Spanish occupation, the area was occupied by the Taínos who lived in villages near to the Portland Bight and on the Goat Islands.
- At least three sites have been noted on the Great Goat Island: two midden sites which may actually be the same occurrence and a cave site.
 - *Midden site No. 1* is reported in Duerden (1897); this is shown on a map of the island. No other information is given.
 - *Midden site No. 2* was reported by C.B. Lewis in the late 1940's on south west side of this coral island some 150ft up the slope. The agricultural assemblage included many pot shreds and large number of griddle fragments. The Duerden find was erroneously placed on Little Goat Island by Phillip Sherlock (1939).
 - A deep cave was discovered in the 1890's by Leo Verley and is reported by Duerden (1987). The contents included a large oval-shaped vessel with anthropomorphic decorated lugs which contained a flattened skull of an adolescent and two fragments of long bones. Although there are other caves in the island, a careful investigation by C.B. Lewis in the 1940's revealed no other utilized by the Taínos (CD&A 1992).
- On Little Goat Island, about one quarter mile from the north coast and slightly north of the highest point on the island, there is a ruin of a large house and outbuilding with walls standing as high as 15ft above sea level. Some 50ft to the east of the main structure is a natural vault or cellar which had been fitted with steps and a gate. In the absence of any further data, a date of c, 1790 is not unreasonable, as this is not mentioned on any of the five

18th century source maps for this area (latest 1784) but its general aspect is similar to many of the other structures in the area which can be adequately dated to the last quarter of the 18th century (CD&A 1992).

✓ **Spanish Occupation (1494-1655)**

- It has been recorded that Christopher Columbus in his second voyage of 1493-1494 stopped in Portland Bight, which he named '*Bahía de la Vaca*', or "Cow Bay". He called it '*Bahía de la Vaca*' because of the number of "sea-cows" (manatees) that he saw in the waters in the area (Black 1988).
- The Spanish established the settlement of 'Puerto de Esquivella' which was later renamed Old Harbour by the British.

✓ **English Occupation (1655-1962)**

- Among the haunts of Sir Henry Morgan was nearby Careening Cay on which he maintained his ships
- In 1936, the West Indies Sugar Company (WISCO) owned and operated a sugar warehouse at Salt River. Except for the barging of sugar and its ultimate shipping from the Salt River area, the area was basically pristine prior to the beginning of World War II in 1939.
- In 1941, under an agreement with Great Britain to exchange destroyers for land, the United States of America established a Naval Station on Little Goat Island. An aerial photograph of this is shown below (Figure 10) as well as an article from the Gleaner (Figure 13) from that time, as cited by Reid (2009). It should be noted that 2.8M cu yards of dredge spoils were extracted in pursuing this development and also that 75,000 gallons of fuel oil was stored in underground fuel tanks (USTs). Water was barged to Little Goat Island where it was treated and stored. There was naval and sea plane traffic from the island during World War II.
- Port Esquivel which later came under ownership by ALCAN began exporting bauxite in 1952. Oil, sulphuric acid and caustics soda among other goods were imported at Port Esquivel and alumina shipped. The port now also handles grain for animal feed production and ships ethanol.

- It is noteworthy that the Old Harbour Bay Fishing Village and the Rocky Point Fishing Village were in existence prior to 1962.



Figure 10: Little Goat Island with US Naval Installation: 1943 (Reid 2009)



Figure 11: Goat Island with US Naval Installation: 1943
 Source: *The Story of Portmore - An Illustration of Jamaica's Sunshine City*, Kennedy Reid

A declassified 1943 US military aerial photograph of Naval Air Station Goat Island, Jamaica at a thousand feet, looking east. The rare image shows American facilities for two squadrons of seaplanes. A total of 2.8 million cubic yards of dredging was conducted to remove shoals from the seaplane runways and to deepen the anchorages and channel approaches to the piers. The location ended up with two timber piers, a concrete seaplane ramp, a parking area and various auxiliary buildings.

There were facilities for 75 men and 25 officers, two administration buildings, a 10-bed dispensary, a power plant, a shop, utility buildings and a warehouse. Fresh water was brought in by barge and pumped from the dock to storage tanks for treatment and distribution. Gasoline storage totaling 75,000 gallons was provided in 11 underground steel tanks.

The base was commissioned in 1942 and decommissioned in 1949.

Courtesy US National Archives

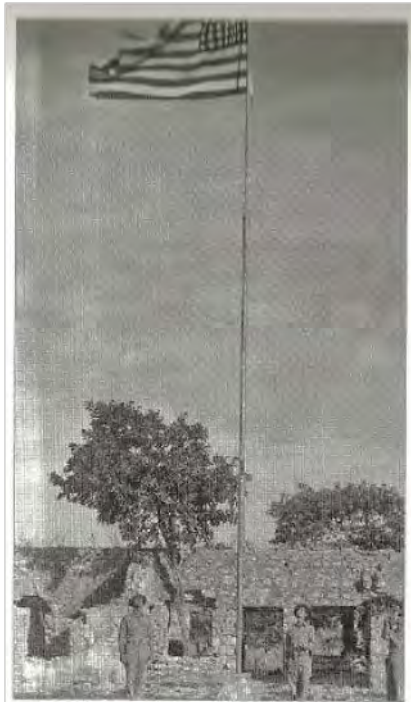


Figure 12: Little and Great Goat Islands: 2012

It would appear that over the period 1949 (decommissioning of US Naval Air Station) to the present, artificial and natural processes have resulted in the rehabilitation and natural colonization of the area around the perimeter of Great and Little Goat Islands and created the shallow mangrove (marsh land) between both islands.

It would also appear that the whitish areas shown in Photograph A is where the dredged spoils might have been stored

Conrad Douglas & Associates Limited (CD&A) Comments



US Marines raise Old Glory on Jamaican soil at Little Goat Island in 1942 during World War II.

Courtesy US National Archives



On 5 April 1941, the formal flag-raising at the base was a *Gleaner* headline.

© The Gleaner Company Ltd.



Figure 13: The American flag is raised in 1941 on Little Goat Island, situated at Old Harbour Bay, the United States naval base acquired from Great Britain. Source: *The Jamaican Gleaner*

✓ **Post Independence (1962)**

- Shipment of bauxite from JAMALCO's Rocky Point Port began in 1963 followed by the shipping of alumina in 1972
- In 1968, 1970, 1972 and 1973 Jamaica Public Service (JPS) commissioned generating units at the Old Harbour Bay station. These were Old Harbour Units I (30MW), II (60MW), III (65MW) and IV (68.5MW), respectively. Old Harbour I has been decommissioned.
- The Tarentum Industrial Zone was established to host light and heavy industries. The following developments are found in the Tarentum Industrial zone:
 - Wallenford Coffee Processing Plant
 - Chemical Lime Quarry
- Jamaica Energy Partner (JEP) currently operates two power barges, within Old Harbour Bay:
 - The Doctor Bird Power Barge I (commissioned 1995 - 74.16 MW), and
 - The Doctor Bird Power Barge II (commissioned 2004 - 50.2MW)The power barges are each self-contained floating facilities with eight and three medium speed diesel engines and provide electricity that is sold to Jamaica Public Service Limited Company (JPSCO).

Recent Environmental Permits Granted in the Area for significant increase in shipping and materials handling.

Permit Granted to Jamalco for Increasing its Material Handling Capacity and Shipping Schedule

In 2004 a permit was granted to Jamalco by NEPA to expand its alumina plant and port. This represented a doubling of alumina production capacity from 1.4 to 2.8 million tonnes per year. The handling of raw materials such as oil and caustic soda and product alumina at the port would also be doubled.

Permit Granted for Development of a Port to Handle PANAMAX Size Vessels

In 2009 a permit was granted to Rinker/CEMEX by NEPA for the establishment of a Port and Transportation Corridor at Salt River, Clarendon in proximity to Jamalco's Rocky Point Port. The port was permitted to host PANAMAX size vessels with a capacity of 60,000 tonnes each. A ship channel and turning basin, with depths of more than 14 m, were included in the permit.

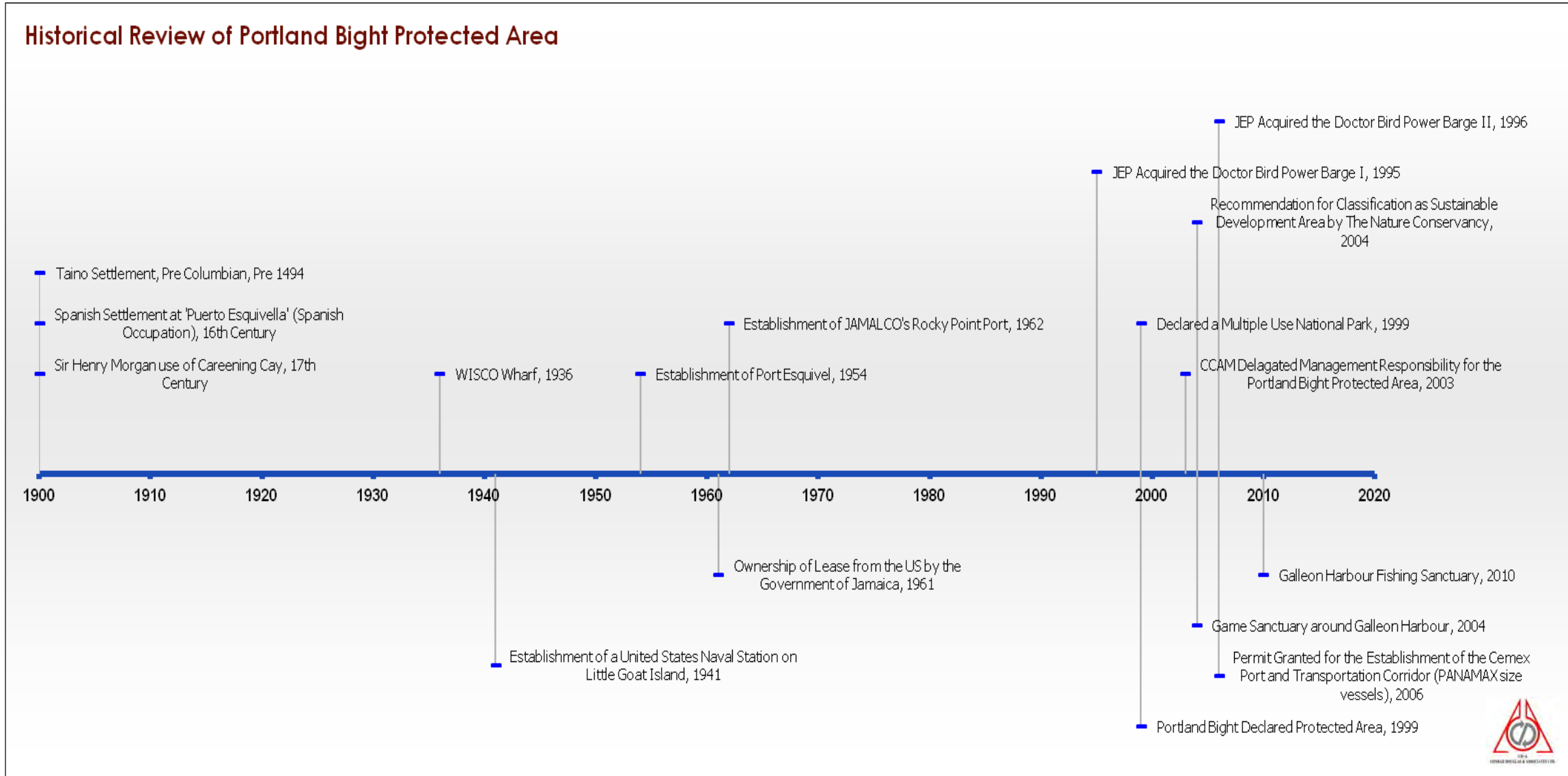


Figure 14: Historical Timeline of Portland Bight, Ridge, Cays and Goat Islands

6.0. Regulatory Framework

6.1. International and National Policies, Legislation, Regulations and Standards which may be applicable to the Development of a Trans-shipment Port and Protected Areas

The international and national policies, legislation, regulations and standards which may be applicable to establishment of trans-shipment port in a protected area have been identified and classified.

The purpose is to guide the engineering design team and to ensure that regulatory compliance is maintained for all phases of the project (pre-construction, construction and operations). The categories of laws are listed below. Table 4 to Table 7 below provide brief summaries of these laws.

International Agreement to protect Bio-diversity and Eco-Systems

- Convention on Biological Diversity (Rio de Janeiro, 1992)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora-CITES (Washington, 1973) NRCA
- Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere (Washington, 1940) NRCA
- Convention on the Conservation of Migratory Species of Wild Animals, Bonn 1979

International Agreement Protecting World Cultural and National Heritage

- Convention concerning the Protection of the World Cultural and Natural Heritage (Paris, 1982) JNHT/JalCOMOS

International Agreement to Protect against Marine Pollution

- Convention of Ballast Waste Management
- Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena, 1982)
- International Convention for the Prevention of Pollution from Ship-MARPOL (1973/78)

- Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter (London 1972)

International Agreement to Protect Habitats

- Convention on Wetlands (Ramsar 1979) NRCA
- United Nations Framework Convention on Climate Change

International Agreement to delegate Sea Usage

- United Nations Convention on the Laws of Seas-UNCLOS
- Convention of Ballast Waste Management
- Convention on Fishing and Conservation of the Living Resources of the High Seas

National Legislation for the Protection of the Environment (Bio-diversity)

- Natural Resources Conservation Authority Act (1991) NRCA
- Wildlife Protection Act (1945) NRCA
- Endangered Species Act, 2000 NRCA
- Beach Control Act (1956)-NRCA
- Forest Rule (1945)
- Forestry Act, 1937

National Legislation for the Protection of the Environment (Physical)

- Watersheds Protection Act (1963) NRCA
- Air Quality Regulations, 2006
- Country Fire Act (1942)
- Clean Air Act

National Legislation governing the Local Fisheries

- Fishing Industry Act, 1975
- Fishing Industry Regulation, 1976
- The Fishing Industry (Special Fishery Conservation Area), 2012

National Legislation governing Land Use

- Land Valuation Act, 1957
- Idle Lands Act (LUC)
- Land Acquisition Act, 1947
- The Customs Act, 1941
- General Consumption Act, 1991
- Harbour Fee Act, 1927

National Legislation governing Taxation

- Income Tax Act, 1955
- Land Taxation (Relief) Act, 1959
- Property Act Tax, 1903
- Stamp Duty Act, 1937
- Transfer Tax Act, 1971

National Legislation governing Use of the Seas

- Harbour Act (1874)
- Maritime Area Act, 1996
- Shipping Act, 1999

National Legislation governing Port Operations

- The Cargo Preference Act, 1979
- The Export Industry (Encouragement) Act, 1956
- The Free Zone Act, 1985

National Legislation relevant to and governing the Labour Force

- Labour Relations and Industrial Disputes Act, 1975
- Foreign Nationals and Commonwealth Citizens (Employment) Act, 1964
- Public Health Act (ECD)

Other National Legislation relevant to and governing Port Operation

- Jamaica National Heritage Trust Act (1985) JNHT
- Local Improvement Act (1914) Parish Councils
- Morant and Pedro Cays Acts (1907) FD
- Tourist Board Act (1955) JTB
- Town and Country Planning Act (1957) TCPD
- St. Catherine Development Order
- Clarendon Development Order
- Disaster Preparedness & Emergency Management Act, 1993
- National Solid Waste Management Authority Act, 2001

Standards Relevant to Protected Areas and Trans-shipment Ports

- Air Quality Standard
- Trade Effluent Standard
- Noise Standard
- Water Quality Standard (Freshwater)

- Water Quality Standard (Marine)
- Emission (Pollution) Standard
- Sedimentation Standard

Policies Relevant to Protected Areas and Trans-Shipments Ports

- Cays Management Policy
- Beach Policy
- National Policy and Strategy on Environmental Management Systems
- Coastal Resources and Wetlands Policy (a combination of the Mangrove and Coastal Wetlands, Sea grass and Coral Reef draft policies)
- National Policy & Guidelines on Over- Water Structure

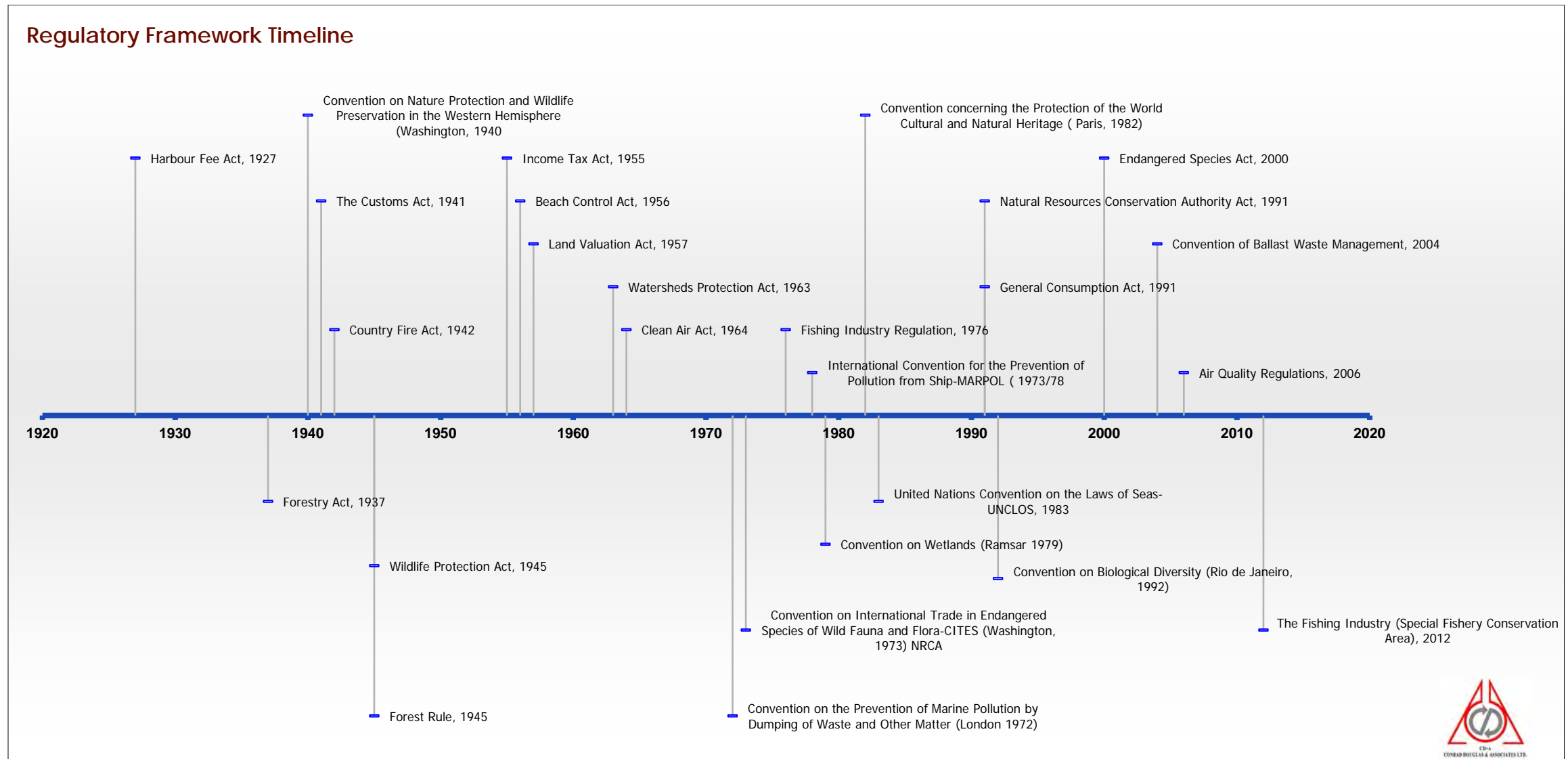


Figure 15: Regulatory Framework Timeline

Table 4: Summary of International Agreements Relevant to Protected Areas and Trans-Shipments Ports

Agreement	Date of entry into force of the Convention	Date of entry into force by Jamaica:	Summary of Agreement
International Agreement to Protect Bio-diversity and Eco-Systems			
Convention on Biological Diversity (Rio de Janeiro, 1992)	June 5, 1992	June 1, 1995	This convention controls conservation of biological diversity, sustainable use of its components; and fair and equitable sharing of benefits arising from genetic resources
Convention on International Trade in Endangered Species of Wild Fauna and Flora-CITES (Washington, 1973) NRCA	July 1, 1975	July 22, 1997	Control of collection, import and export of wild plants and animals
Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere (Washington, 1940) NRCA	January 05, 1942	Unknown	Establishment and management of national parks and other protected areas, protection of species
Convention on the Conservation of Migratory Species of Wild Animals, Bonn 1979	1979	Signatory	Recognizing that wild migratory animals in their innumerable forms are irreplaceable and must be conserved
International Agreement Protecting World Cultural and National Heritage			
Convention concerning the Protection of the World Cultural and Natural Heritage (Paris, 1982) JNHT/JaICOMOS	November 1972	June 14, 1983	Identification and protection of cultural and natural heritage of outstanding universal value

Agreement	Date of entry into force of the Convention	Date of entry into force by Jamaica:	Summary of Agreement
International Agreement to Protect against Marine Pollution			
Convention of Ballast Waste Management	February 2004	Unknown	To prevent, minimize and ultimately eliminate the transfer of harmful aquatic organisms and pathogens through the control and management of ships' ballast water and sediments
Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena, 1982)	March 24, 1983	May 01, 1987	Includes a draft protocol for Special Protected Areas, the purpose of which is to encourage conservation of coastal areas
International Convention for the Prevention of Pollution from Ship-MARPOL (1973/78)	August 17, 1973	June 13, 1991	Preserve the marine environment through the complete elimination of pollution by oil and other harmful substances and the minimization of accidental discharge of such substances
Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter (London 1972)	August 30, 1975	March 22, 1991	The convention is to protect the environment from human activities. It is to promote the effective control of all sources marine pollution and to take practicable steps to prevent pollution of the sea by dumping waste and other matter.
International Agreement to Protect Habitats			
Convention on Wetlands (Ramsar 1979) NRCA	August 1979	February 07,1998	Protection of Wetlands of international importance especially as waterfowl habitat
United Nations Framework Convention on Climate Change	1992	April 5, 1995	The international response to climate change

Agreement	Date of entry into force of the Convention	Date of entry into force by Jamaica:	Summary of Agreement
International Agreement to Delegate Sea Usage			
United Nations Convention on the Laws of Seas-UNCLOS	1982	March 21, 1983	Legal order for the seas and oceans which will facilitate international communication and will promote the peaceful uses of the seas and oceans- conservation of living resources
Convention on Fishing and Conservation of the Living Resources of the High Seas	April 29, 1958	March 20, 1966.	Considering the development of modern technology for the exploitation of the living resources of the sea floor, increasing man's ability to meet the need of the world's expanding population for food, has exposed some of these resources to the danger of being over-exploited
Convention of Ballast Waste Management	February 2004	Unknown	To prevent, minimize and ultimately eliminate the transfer of harmful aquatic organisms and pathogens through the control and management of ships' ballast water and sediments

Table 5: National Legislation Relevant to Protected Areas and Trans-shipment Ports

National Legislations Relevant to Protected Areas and Trans-shipment Ports		
Legislation	Summary of Legislation	Governing Organizations of the Legislation
National Legislation for the Protection the Environment (Bio-diversity)		
Natural Resources Conservation Authority Act (1991) NRCA	Declaration of National Parks, marine parks protected areas; control of lands in protected areas, control of pollution	Natural Environmental and Planning Agency (NEPA)
Wildlife Protection Act (1945) NRCA	Declaration of game sanctuaries and reserves, game wardens control of fishing in rivers, protection of specified rare or important species	Natural Environmental and Planning Agency
Endangered Species Act, 2000 NRCA	Provided for the prosecution, conservation and management of endangered species of wild fauna and flora and for the regulation of trade in such species and for connected matters	Natural Environmental and Planning Agency
Beach Control Act (1956)-NRCA	Control of use of the foreshore and floor of the sea, public bathing beaches, marine protected areas, prohibition of mining, recreational activities and removal of coral	Natural Environmental and Planning Agency
Forest Rule (1945)	Control of extraction of timber and other produce from Forest Reserves; hiking or camping in Forest Reserves; declaration of private lands as Forest Reserves; control of land use in protected areas	Natural Environmental and Planning Agency Ministry of Water, Land, Environment and Climate Change (Forestry Department)
Forestry Act, 1937	This Act provides for the management and the declaration of Forest Reserves on Crown Lands and regulates activities in Forest Reserves. This Act will be reviewed to determine if the upgrade-activities (particularly mining) will impact on Forest Reserves and to what extent.	Ministry of Water, Land, Environment and Climate Change (Forestry Department)

National Legislations Relevant to Protected Areas and Trans-shipment Ports		
Legislation	Summary of Legislation	Governing Organizations of the Legislation
National Legislation for the Protection the Environment (Physical)		
Watersheds Protection Act (1963) NRCA	Protection of watersheds including detailed regulations for land use	Natural Environmental and Planning Agency
Air Quality Regulations, 2006	The quality of the airshed within which an industrial entity that is discharging emissions (gases or particulate matter)	Natural Environmental and Planning Agency
Clean Air Act, 1964	This act entity such as the stockpiles, conveyors and ship loading, which are industrial operations. These facilities/operations have the potential to discharge particulate matter to the atmosphere.	Natural Environmental and Planning Agency
Country Fire Act (1942)	Various provision concerning burning crops, trash and extinguishing fires	Natural Environmental and Planning Agency
National Legislation governing the Local Fisheries		
Fishing Industry Act, 1975	Licensing and fishing regulation with territorial and archipelagic seas	Ministry of Agriculture (Fisheries Division)
Fishing Industry Regulation, 1976	An act to provide for the regulation of the fishing industry	Ministry of Agriculture (Fisheries Division)
The Fishing Industry (Special Fishery Conservation Area), 2012	This act is proposed to protect the fishing sanctuary list across the island.	Ministry of Agriculture (Fisheries Division)
National Legislation governing Land Use		
Land Valuation Act, 1957	For determining the valuation of land for taxation, rating and other purposes and for matters connected therewith or incidental thereto	Commissioner of Land Valuations
Idle Lands Act (LUC)	Declaration of land which is not being used as "Idle Lands" subject to various measures by government	Commissioner of Lands Ministry of Water, Land, Environment and Climate Change

National Legislations Relevant to Protected Areas and Trans-Shipments Ports		
Legislation	Summary of Legislation	Governing Organizations of the Legislation
Land Acquisition Act, 1947	Make provision for the acquisition, and for the temporary occupation, of land required for public purposes	Commissioner of Lands Ministry of Water, Land, Environment and Climate Change
National Legislation governing Taxation		
The Customs Act, 1941	Governs the transaction of goods imported or exported, in or out of the island whether it is transported by air or sea	Commissioner of Custom and Excise
General Consumption Act, 1991	For the imposition of a general consumption tax and matters connected therewith or incidental thereto	Commissioner of Taxpayer Appeal
Harbour Fee Act, 1927	To re-impose harbour fees and light dues on vessels entering any harbour in the island	Port Authority
Income Tax Act, 1955	The imposition of an Income Tax on the people of the island	Commissioner of Inland Revenue Taxpayer Audit Tax (Revenue) Administration
Land Taxation (Relief) Act, 1959	The imposition of a tax fee on land	Commissioner of Inland Revenue Land Taxation Relief Board Commissioner of Land Valuations

National Legislations Relevant to Protected Areas and Trans-Shipment Ports		
Legislation	Summary of Legislation	Governing Organizations of the Legislation
Property Act Tax, 1903	An act to make provision for the tax payable under the Property Tax Act	Commissioner of Inland Revenue Land Taxation Relief Board Commissioner of Land Valuations
Stamp Duty Act, 1937	Governs the sale or transfer of property, land, importation of vehicles, estate duty	Ministry of Finance Commissioner of Tax payer
Transfer Tax Act, 1971	Impose tax upon transfers of interests in land and securities and to provide for matters connected therewith or incidental thereto	Ministry of Finance Commissioner of Tax payer Land Taxation Relief Board
National Legislation governing Use of the Seas		
Habour Act (1874)	Control of disposal of waste, ballast, mud or sand from vessels in harbours	Port Authority
Maritime Area Act, 1996	Declaring Jamaica to be an archipelagic State and to make provision with respect to certain Maritime Areas of Jamaica and to provide for matters incidental thereto or connected therewith	Maritime Authority

National Legislations Relevant to Protected Areas and Trans-Shipment Ports		
Legislation	Summary of Legislation	Governing Organizations of the Legislation
Shipping Act, 1999	To make better provision in respect of the regulation of merchant shipping generally; and more particularly in respect of the registration of ships, the employment and certification of seafarers, the safety of shipping; to significantly consolidate the law relating thereto, and to make provision for matters connected therewith	Ministry of Transport, Works and Housing (Maritime Authority) CARICOM
National Legislation governing Port Operations		
The Cargo Preference Act, 1979	An Act to make provision for the reservation of certain cargoes for carriage by ships owned by the Government and for matters incidental thereto or connected therewith	Maritime Authority Commissioner of Custom and Excise
The Export Industry (Encouragement) Act, 1956	The grant of concessions in relation to income tax, tonnage tax and customs duties in aid of industries producing exclusively for export and for other matters incidental thereto or connected therewith	Commissioner of Custom and Excise
The Free Zone Act, 1985	An act to repeal the Kingston Export Free Zone Act and to provide for the establishment and operation of export free zones in designated areas, and for matters connected therewith or incidental thereto	Port Authority Commissioner of Custom and Excise
National Legislation relevant to and governing the Labour Force		
Labour Relations and Industrial Disputes Act, 1975	Provide the regulation of relations between employers and workers, to establish an industrial disputes tribunal for the settlement of industrial disputes, to provide for boards of inquiry to inquire into industrial disputes and matters connected with labour relations or economic conditions, and for purposes incidental to or consequential on the foregoing	Ministry of Justice Ministry of Labour and Social Security
Foreign Nationals and Commonwealth Citizens (Employment) Act, 1964	Relating to the employment of persons who are not citizens of Jamaica, and matters incidental thereto or connected therewith	Ministry of Labour and Social Security

National Legislations Relevant to Protected Areas and Trans-Shipments Ports		
Legislation	Summary of Legislation	Governing Organizations of the Legislation
Public Health Act (ECD)	Control and monitoring of pollution from point sources	Ministry of Health (Environmental Control Division)
Other National Legislation Relevant to and Governing of Port Operation		
Jamaica National Heritage Trust Act (1985) JNHT	Declaration and preservation of protected national heritage and monuments	Jamaica National Heritage Trust (JNHT)
Local Improvement Act (1914) Parish Councils	Planning permission for subdivisions and developments up to one mile inshore	Town Planning Department
Morant and Pedro Cays Acts (1907) FD	Control of access to and exploitation of the resources of the Morant and Pedro Cays	Natural Environmental and Planning Agency
Tourist Board Act (1955) JTB	Under Tourist Board (Water Sport) Regulations (1985) licensing of water sport operators boats and dive operators	Ministry of Tourism and Entertainment
Town and Country Planning Act (1957) TCPD	Control of development and land use (excluding agriculture) in specified areas through Development Orders, local planning authorities, development planning process and Tree Preservation Orders	Town Planning Department
Clarendon Parish Provision Development Order (1982)	This development order authorizes the Clarendon Parish Council to grant permission for land development and maintain a public registry of the land development application.	Town Planning Department
St. Catherine Parish Provision Development Order (1982)	This development order authorizes the St. Catherine Parish Council to grant permission for land development and maintain a public registry of the land development application.	Town Planning Department
Disaster Preparedness & Emergency Management Act, 1993	To advance disaster preparedness and emergency management measures in Jamaica by facilitating and coordinating the development and implementation of integrated disaster management systems	Office of Disaster Preparedness and Emergency Management (ODPEM)

National Legislations Relevant to Protected Areas and Trans-shipment Ports		
Legislation	Summary of Legislation	Governing Organizations of the Legislation
National Solid Waste Management Authority Act, 2001	The National Solid Waste Management Authority (NSWMA) has the responsibility to manage and regulate the solid waste sector	National Solid Waste Management Authority (NSWMA)
Factory Act, 1968	The factories act regulates factories and make conditions for their inspection	

Table 6: Standards that are relevant to Protected Area

Standards that are relevant to Protected Area	
Standard	Summary of Standard
Air Quality Standard	The regulation was gazetted on July 12, 2006. It speaks to the quality of the airshed with which an industrial entity is discharging emissions (gases or particulate matter).
Trade Effluent Standard	This standard has existed in draft format since 1996. These standards regulate the quality of effluent discharged from any entity into public drains/sewers and all surface and water bodies such as pond, sea or lakes.
Noise Standard	It has been proposed by NEPA based on the World Bank standards. The guideline for day time perimeter noise is 75 decibels and 70 decibels for night time noise
Water Quality Standard (Freshwater)	Water Quality Standards are the foundation of the water quality-based pollution control program mandated
Water Quality Standard (Marine)	The aim of this standard is to protect and enhance water quality while maintaining economic and social development for the marine habitat.

Standards that are relevant to Protected Area	
Standard	Summary of Standard
Emission (Pollution) Standard	Emission standards are requirements that set specific limits to the amount of pollutants that can be released into the environment.
Sedimentation Standard	Suspended and bedded sediments (SABS) are defined as particulate organic and inorganic matter that suspend in or are carried by the water, and/or accumulate in a loose, unconsolidated form on the bottom of natural water bodies.

Table 7: Policies Relevant to Protected Areas and Trans-Shipments Ports

Policies Relevant to Protected Areas and Trans-Shipments Ports		
Policies	Policies Level	Summary of Policies
Cays Management Policy	Stage 1	To develop a well-defined multi-agency, regulatory framework for the effective management of the Cays in recognition of the number of activities which threaten the sustainability of the ecology and economy of the Cays which are of significant ecological, economic and geo-political importance to Jamaica
Beach Policy	Stage 4	To provide guidelines for the use of the foreshore, beach and floor of the sea. Addresses issues of public access, coastal erosion, cays and fishing beaches
National Policy and Strategy on Environmental Management Systems	Stage 5	To establish the framework within which an organization (private or public) can improve their performance by addressing the impacts of their products, processes, and services on the environment
Coastal Resources and Wetlands Policy (a combination of the Mangrove and Coastal Wetlands, Sea grass and Coral Reef draft policies)	Stage 2	To establish guidelines for the protection and conservation of coral reefs, sea grass, mangroves and coastal wetlands
National Policy & Guidelines on Over- Water Structure	Stage 4	To provide guidelines for construction of structures over-water

Key

Cabinet Office advised of intention to create policy	1
Initial Concept Paper drafted	2
Plan of Action prepared and submitted to Cabinet Office	3
Policy Document being prepared	4
Public Consultation in progress	5
Policy submitted for approval by Cabinet	6
Policy approved by Parliament	7

7.0. Description of the Physical Environment

7.1. Topography

The Great Goat Island rises from sea level to a maximum elevation in excess of 80 m (See Plate 2 and Figure 16), while Little Goat Island has a maximum elevation in excess of 20 m (See Plate 1 and Figure 16). Deep caves have also been identified on the Goat Islands.



Plate 1: Geomorphology of the Little Goat Island -viewed from Galleon Harbour to the north.



Plate 2: Geomorphology of the Great Goat Island - viewed from Galleon Harbour to the north.



Figure 16: Topography of the Goat Islands (height in Meters, contour interval =20m).

The topography between the Little and Great Islands, and their perimeters, seems to have been influenced by the deposition of dredged spoils during the development of Little Goat Island for the establishment of a Naval Station during World War II.

7.2. Geological Profile

Portland Bight is mainly composed of unconsolidated sands, sandy clays, carbonaceous sandy clays and clays of Holocene age (last 12 000 years). The present beach sediments consist mainly of non-carbonate grains (Fernandez 1983).

The coastal plains consist of quaternary alluviums of generally moderate permeability. The alluvial plain results largely from the buildup of essentially non-limestone deposits derived by rivers from the largely volcanic rocks of the island's interior, and consists of coarse gravel, sand and clay (Fernandez 1983). These are underlain by lithified rocks of the White Limestone Group. The area consists of some 2200 m of Eocene-Miocene limestone resting on volcanic rocks (Fernandez 1983).

The Portland Bight Protected Area (PBPA) dry limestone forests are carbonate rocks in the most southerly part of Jamaica. In the Portland Ridge and Hellshire there are extensive caves that house a diversity of avifauna and bat species most of which are endemic to Jamaica. The existence of these caves derives from the carbonaceous nature of the predominantly limestone geology.

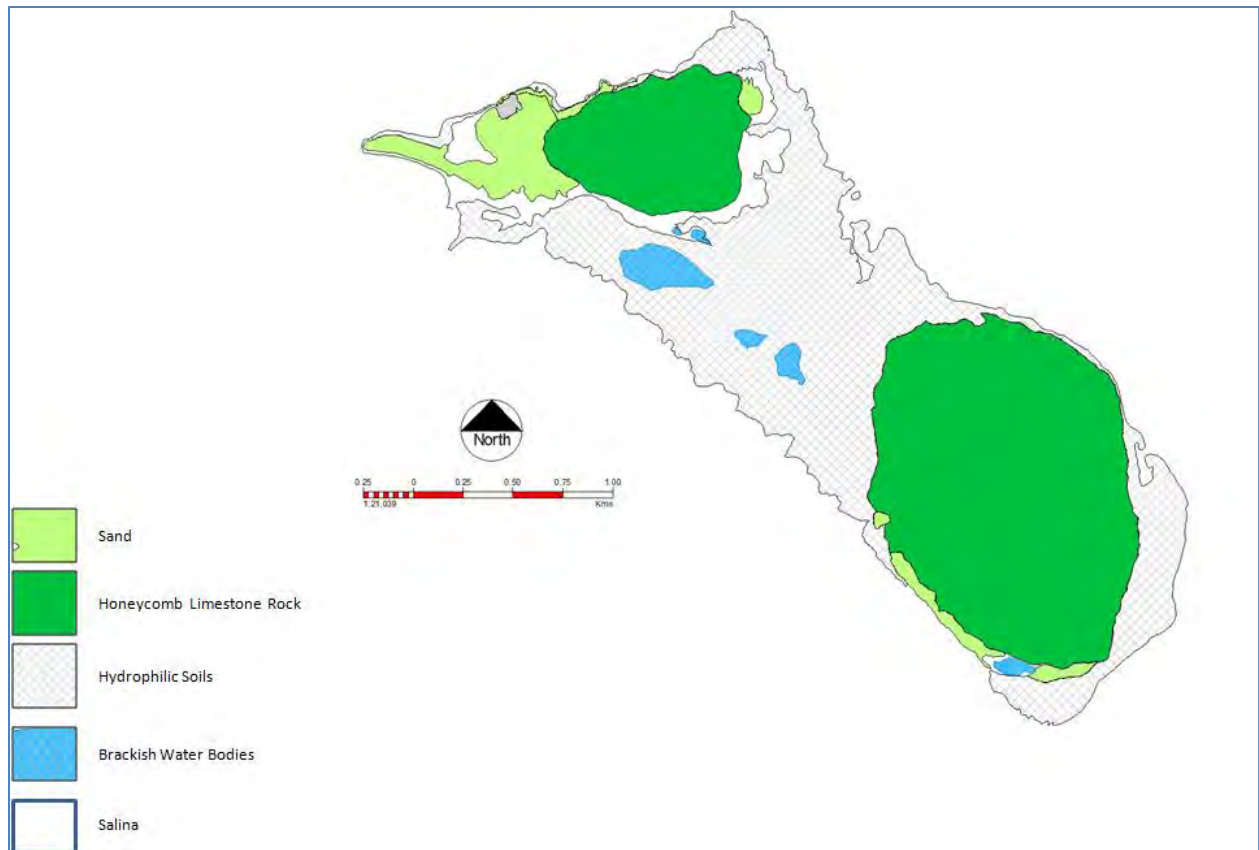


Figure 17: Summarized Geology of the Goat Islands

The main features and area coverage of the Goat Islands are tall open dry limestone forest (589.6 acres), mangrove wetlands (529.3 acres), coastal vegetation assemblage on sand (82.5 acres), brackish water bodies (28.7 acres), 5 beds (342.7 acres), reef slope (25.7 acres) (See Figure 18 below).

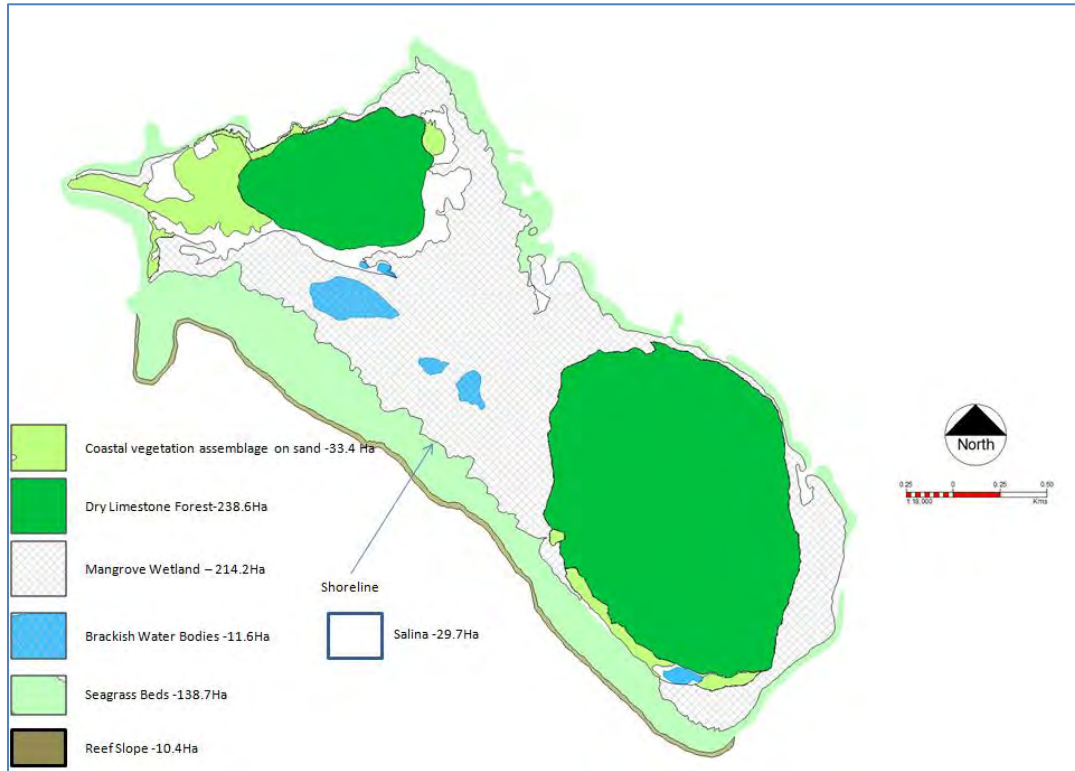


Figure 18: Terrestrial and Marine Life form Assemblages and Approximate Areas of Goat Islands

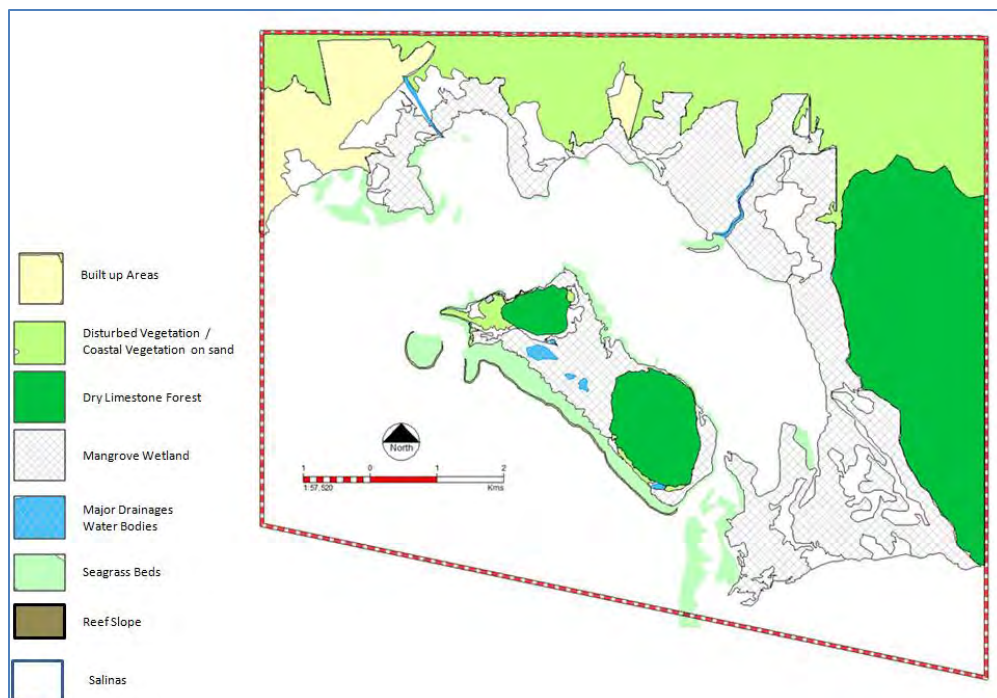


Figure 19: Terrestrial and Marine Life form Assemblages for the General Study Area

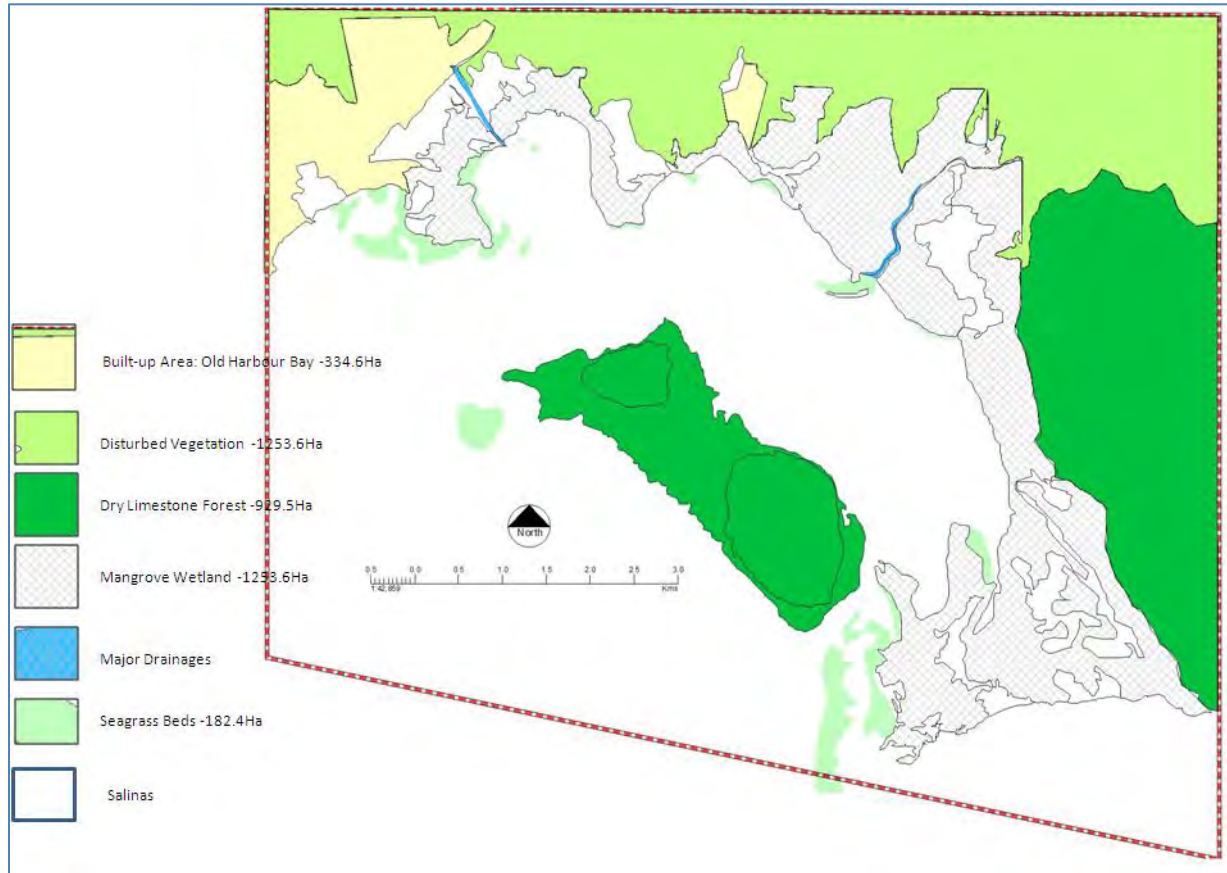


Figure 20: Land use Areas (Excluding Goat Island) for the General Study Area

7.3. Hydrological Profile

The Portland Bight & Ridge falls within the Rio Minho Watershed. The principal aquifers, surrounding the Portland Bight are due to the white limestone group and the overlying alluvial deposits. The extent and quality of the limestone aquifer is more important than the alluvium aquifer (Fernandez 1983). The alluvium deposits function primarily as clayey aquicludes. However, the upper 20 to 30 meters of coastal alluviums often have sufficiently thick layers of sand and gravel to function as aquifers (Underground Water Authority, 1990). The plains limestone is covered by alluvium and marine sediments that have a high clay content that restricts flow into the limestone (Fernandez 1983).

The following list of streams that drains into the Portland Bight Area were identified (See Figure 21 below):

- ✓ Black River
- ✓ Salt Island Creek
- ✓ Rio Minho
- ✓ Breadnut Gully
- ✓ Calabash Gully
- ✓ Salt River
- ✓ Stony Gully
- ✓ Shutes Gully
- ✓ Webbers Gully
- ✓ Sandy Gully
- ✓ Mammee Gully
- ✓ Mytons Gully
- ✓ Bowers Gully
- ✓ Bushy Park Aqueduct

7.4. Oceanography

Only day-time current measurements were obtained during the survey and these were conducted within the Galleon Harbour area. At the time that the drogue survey was done, prevailing winds were from the southeast at approximately 15 knots. Additionally, tidal information extrapolated from data published for Port Royal in Kingston² (see Figure 22) suggested that the area would have been experiencing flood tide conditions.

Figure 23 outlines current speeds and directions for drogues set to a depth of 1.5 meters (5ft). This depth was chosen (approximately half the overall depth of the area) so as to incorporate both water body movements that might be influenced by tides and surface water movement influenced by winds.

Westerly current directions were tracked with approximately 0.1 meter per second current speeds being calculated. The directions illustrated in Figure 23 contrast with those illustrated in Figure 24, which show generally southerly-moving bodies of suspended sediments under the apparent influence of northerly winds.

Both Figure 23 and Figure 24 suggest that wind might play an important role in driving water movement in the shallow environment of the study area. The extent of the role could not be determined during the study period. However, if comparisons can be made with the water environment bound by the Kingston Harbour, then it is possible that:

1. Like Kingston³, the Galleon Harbour and environs would be influenced by 3 water driving forces, namely:
 - Prevailing winds
 - Tides

² <http://tides.mobilegeographics.com/locations/4999.html?y=2013&m=9&d=24>

³ Doreen Williams 1997 the Oceanography of Kingston Harbour, a Tropical Polluted Embayment. MPHIL Thesis CMS UWI.

- Density-related movements caused by fresh water/salt water interactions at the entrances of drainage systems into the sea.
2. Like Kingston, wind speed and direction present the greatest influence on the direction and rate of movement of water within the study area and, by extension, the Bight.

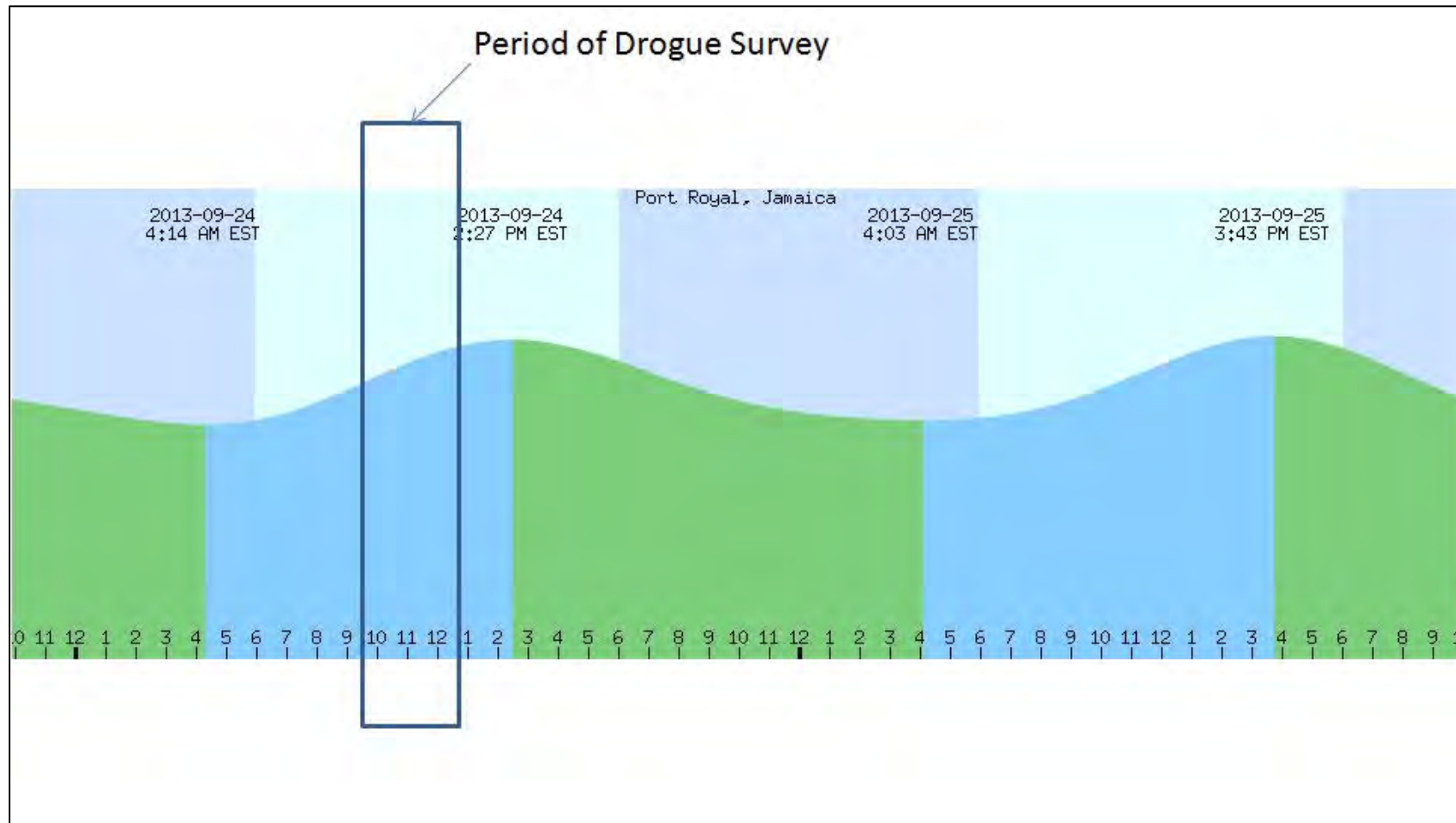


Figure 22: Extract from Tidal Predictions for Port Royal Jamaica (<http://tides.mobilegeographics.com>) for the Drogue study Period.

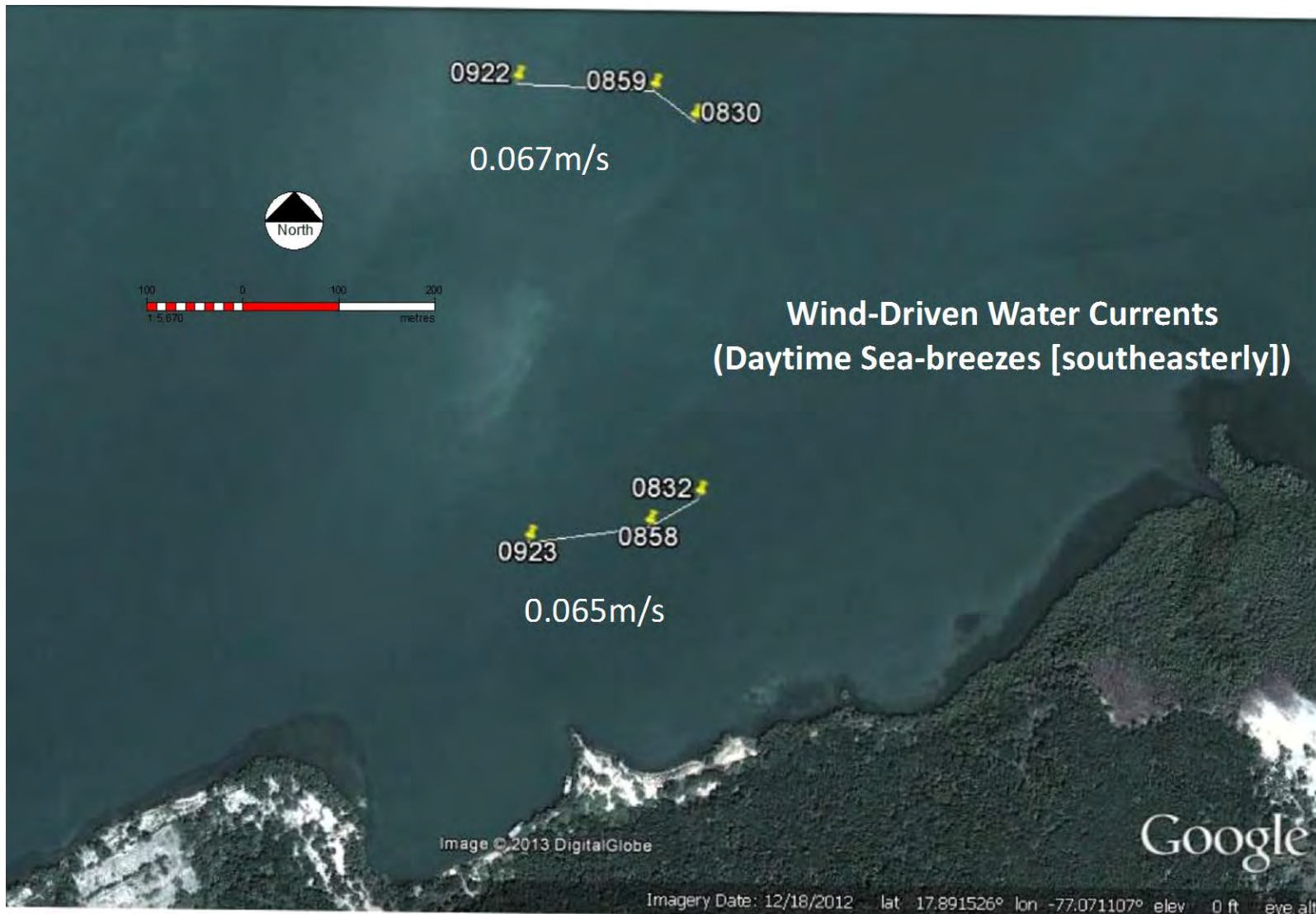


Figure 23: Drogue Measurement Results – Galleon Harbour (Date -September 24, 2013, time –between 0830-0930hrs).

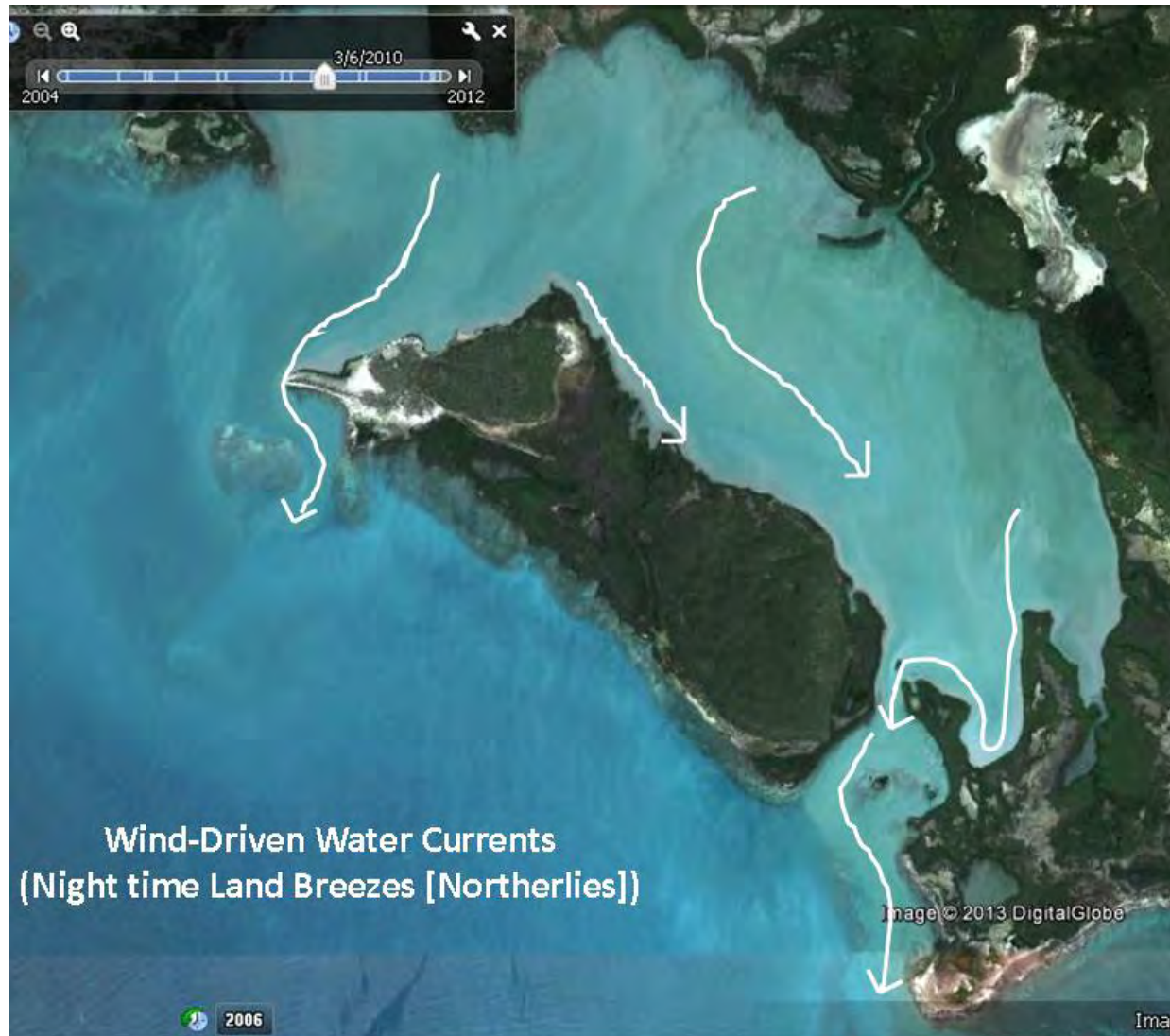


Figure 24: Prevailing Water Currents in the Vicinity of the Goat Islands (influenced by night time land breezes)

7.5. Bathymetry

In the vicinity of the Goat Islands, the greatest depth as been identified north-west of Little Goat Island at 21 ft. The Galleon Harbour is generally shallow with an average depth of about 9 to 11 ft (See figures 25 – 26 below).



Figure 25: Bathymetry of the Portland Bight & Ridge Protected Areas
 Source: *Jamaica Protected Areas Trust/Forest Conservation Fund*

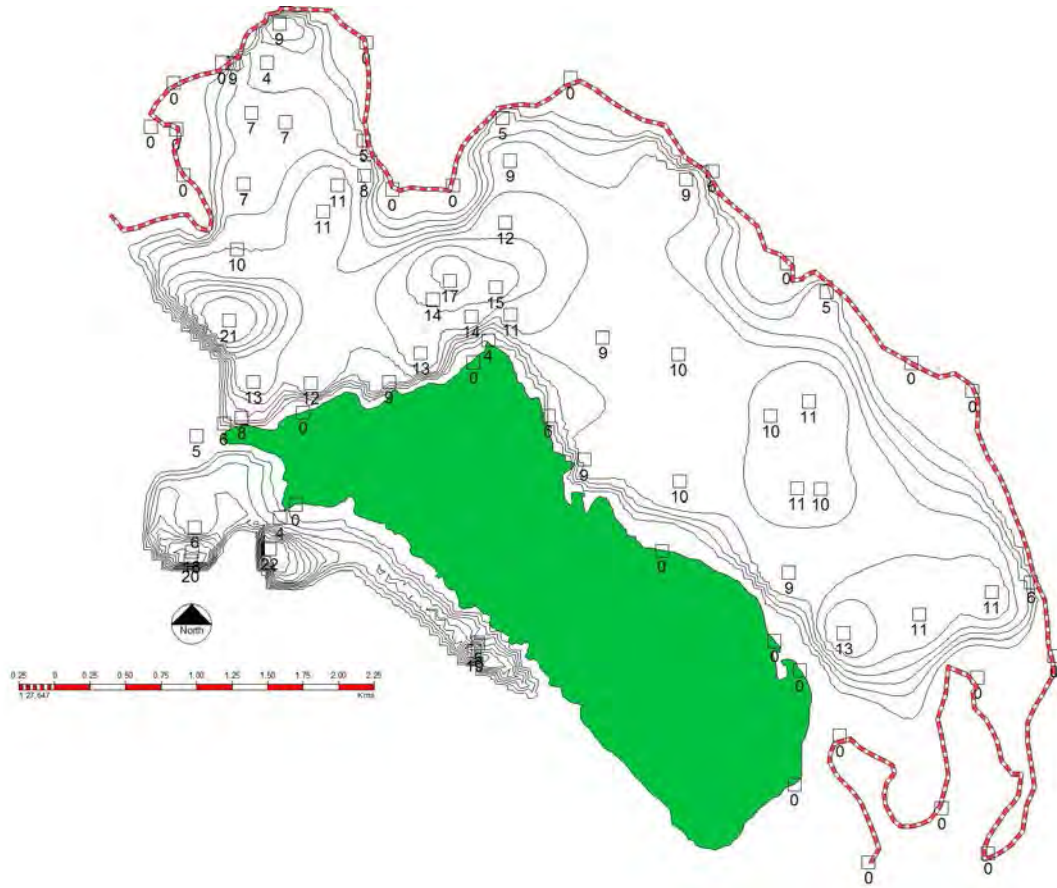


Figure 26: General Water Depths around the Goat Islands

7.6. Meteorology

Meteorological data for the area was sourced from the National Meteorological Service and supplemented with secondary information from in-house databases that were adapted from CD&A (1995), CD&A (2008) and CD&A (2013). These databases include information from close collection points such as the Monymusk Sugar Estate and Bodles Research Station.

7.6.1. Climate

Mean annual average rainfall for Jamaica is 2,032 mm (80 inches) per year. The historical pattern has light rains in May, a summer dry season marked by brief but torrential thunderstorms, a main rainy season from September to November and a marked dry season from November to April. However, both annual totals and daily rainfall patterns are highly variable. The stationary weather system over central Jamaica in June and July 2002 produced two-thirds of the parish's annual rainfall in 15 days.

Annual rainfall gradients decrease from north to south and west to east. The northern mountains have the highest volumes, often in the form of heavy fog. In the centre, Mandeville averages over 80 inches while amounts are lower in sheltered parts, such as Grove Place to the south.

The Portland Bight Protected Areas experiences a Tropical Maritime climate.

7.6.2. Rainfall

Rainfall is the most variable of the climatic parameters exhibiting a bimodal nature. The thirty (30) year (1951-1980) average monthly rainfall values, highlight the typical rainfall pattern for the region (Figure 27). The driest period runs from December to March and is associated with cold fronts migrating from North America. There are two distinct wet seasons, May to June and September to November occurring as regular yearly cycles.

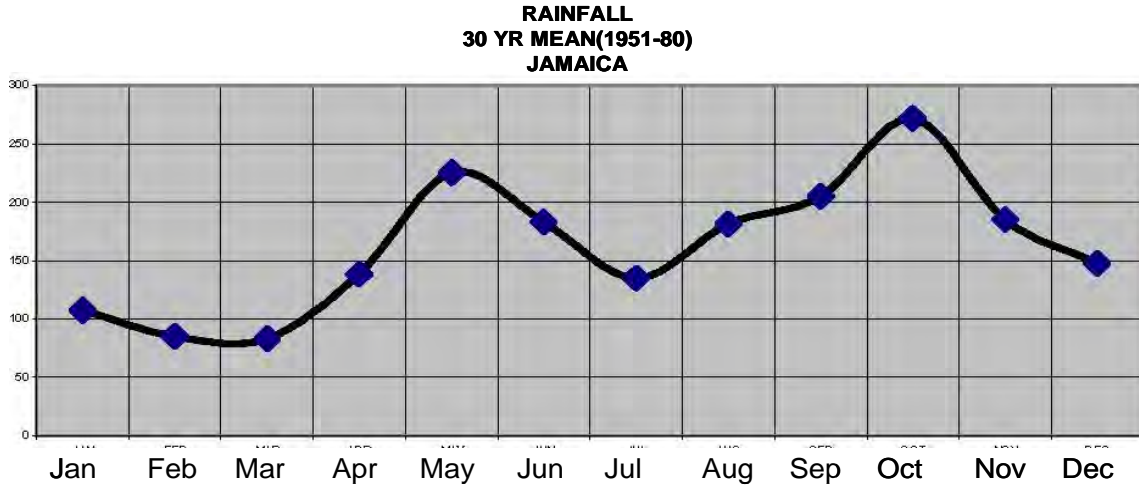


Figure 27: Jamaica 30 Year Rainfall Mean (1951-1980)

Of the weather parameters, rainfall is the most variable. Islandwide, during the period 1951 to 1980, annual rainfall ranged from a maximum of 2593 mm (102.09 in) in 1963 to a minimum of 1324 mm (52.13 in) in 1976, with an average of 1940 mm (76.38 in) annually. The hundred-year (1881-1990) mean annual rainfall is 1895 mm (74.61 in). Historically, the wettest year on record was 1933 with an annual rainfall of 2690 mm (116.54 in) whilst the driest year was 1920 with an annual rainfall of 1299 mm (51.14 in).

7.6.2.1. Clarendon Rainfall

Figure 28 below shows the mean long-term mean rainfall for the parish of Clarendon for 1951-1980.

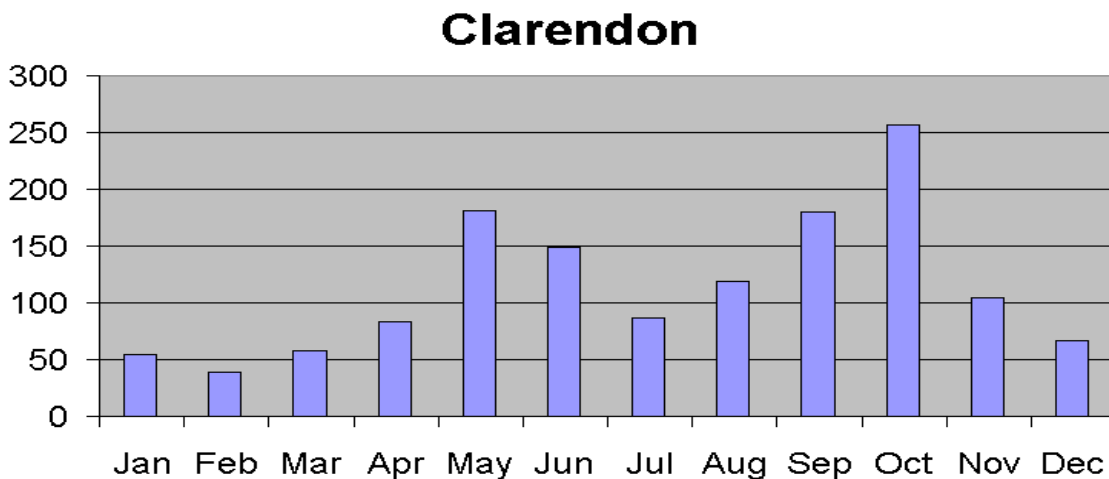


Figure 28: Clarendon Long-Term Mean Rainfall (mm) 1951-1980

Whether during the dry or rainy season, other rain-producing systems are influenced by the sea breeze and orographic effects which tend to produce short-duration showers, mainly during mid-afternoon.

The parish of Clarendon receives an annual average of 1378 mm of rainfall per year mainly during the rainy period, between the months of May and November. The driest period occurs from January through March, with less than 58 mm per month. Figure 29 below shows the average yearly rainfall for Monymusk while Figure 30 below shows annual rainfall for Salt River, the closest available rainfall monitoring sites.

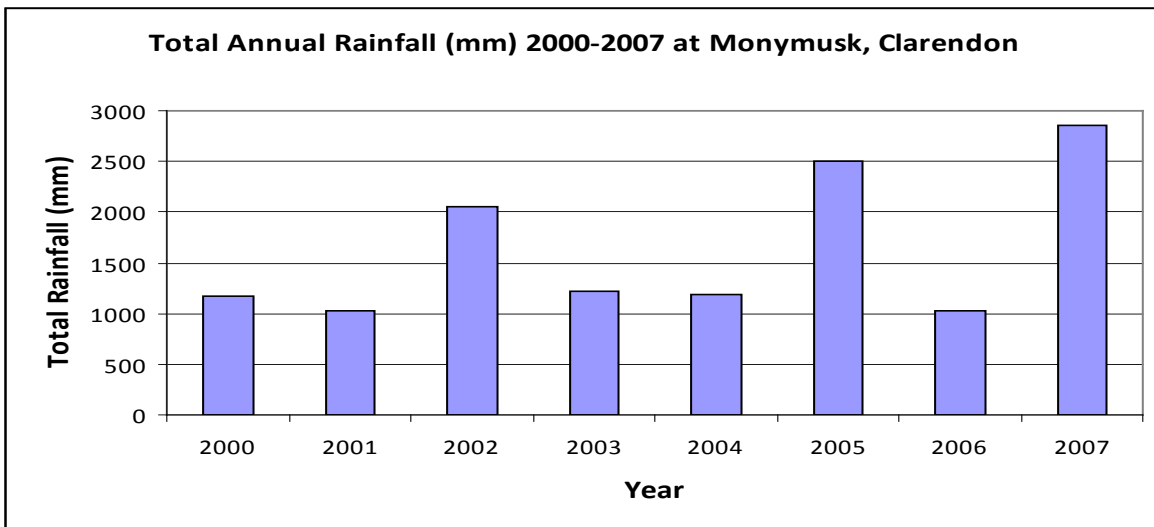


Figure 29: Annual Precipitation (mm) at Monymusk, Clarendon for the Period 2000-2007⁴

⁴ Jamaica Meteorological Service, Climatological Data

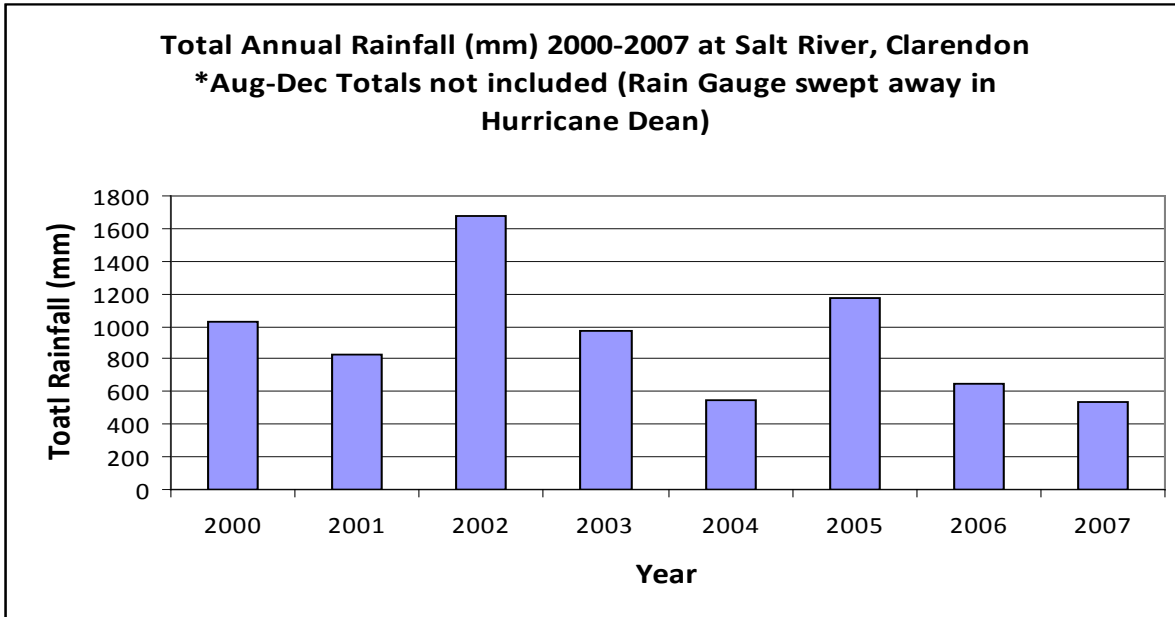


Figure 30: Annual Precipitation (mm) at Salt River, Clarendon for the Period 2000-2007

7.6.2.2. St. Catherine Rainfall

The parish of St. Catherine receives rainfall mainly during the rainy period, between the months of May and November. The driest period occurs from January through March, with less than 58 mm per month. Figure 31 below shows the average yearly rainfall collected from the Bodles Research Station, the closest available weather monitoring site.

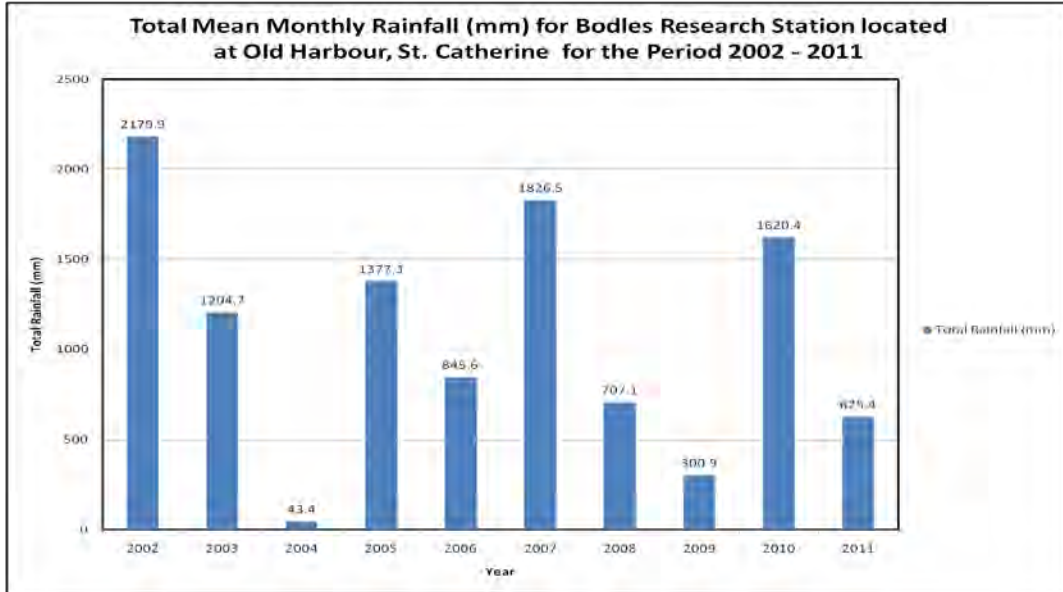


Figure 31: Total Mean Monthly Rainfall (mm) at Bodles Research Station located at Old Harbour, St. Catherine for the Period 2002-2011

7.6.3. Wind

The Portland Bight Protected Area experiences the traditional north easterly trade winds that affect the island. Hurricanes are a serious seasonal threat from June to November. Since 1886, 23 hurricanes have made landfall in Jamaica, while over 100 have passed within 240 km (150 miles) of the island. Tsunamis are also a possible major risk.

Figure 32 below presents the wind rose for the Norman Manley International Airport, Jamaica from 1976-2005. The wind rose illustrates predominant winds from the east through southeast. Fairly constant wind conditions are shown with winds exceeding 20 knots approximately 10% of the time, and 30 knot wind speeds are exceeded only 0.26%.

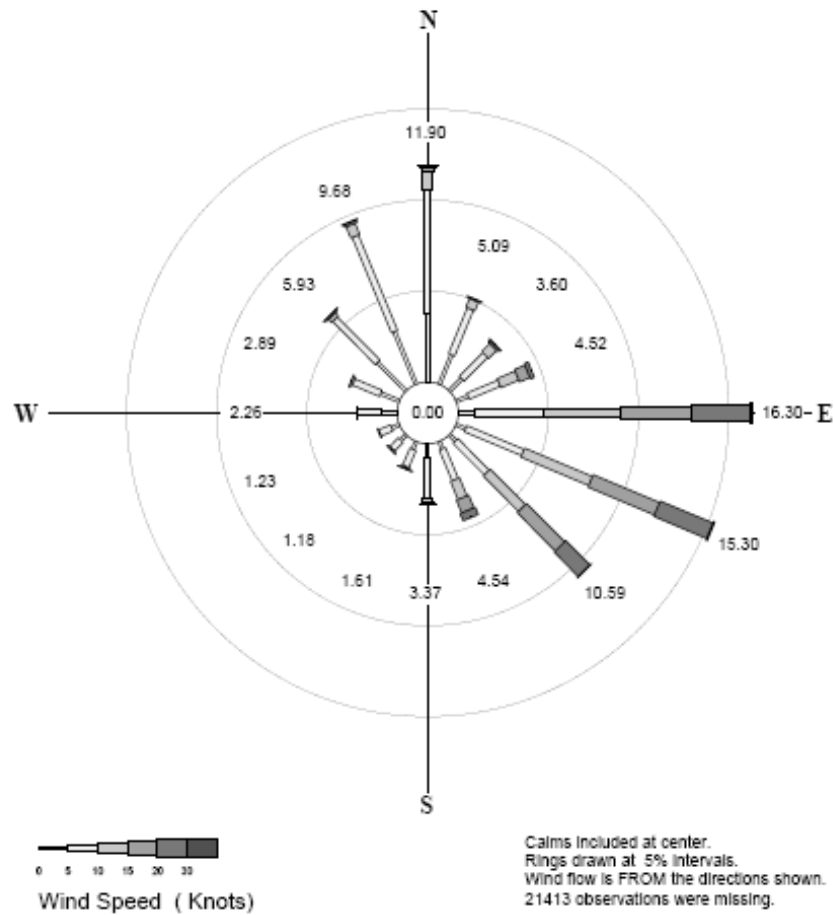


Figure 32: Wind Rose for Norman Manley International Airport, Jamaica (1976-2005)

In conducting a Climatic Baseline Study in the Portland Bight Protected Area, CD&A monitored various parameters over a period of (13) thirteen months using state-of-the-art equipment (CD&A 1995). This included SO_x, CO_x, relative humidity, temperature, wind speed and direction and solar radiation, among others.

7.7. Natural Hazard and Risk Assessment

7.7.1. Seismic Activity & Earthquakes

Figure 33 and Figure 34 show regional and local epicentres for earthquakes over the period 1998-2001. Table 8 lists the earthquakes known to have occurred in the parish of Clarendon between 2003 and 2007. The data show that local earthquake activity for the PBPA is low. However, large earthquakes can seriously affect an area even though the epicentres are at a distance.

An investigation of the historical records for seismic activity carried out as part of an earlier EIA for the JAMALCO's 2.8 Million Efficiency Upgrade (Hayes plant and RDAs) (CD&A 2004) has shown that the adverse effects of earthquakes have been experienced in the PBPA for the major 1692 and 1907 earthquakes.

The following quote from a newspaper clipping written by the local Rector illustrates: *"all brick and stone buildings were thrown down and water spewed out of the chasms opened in the ground by the earthquake so that even dry gullies ran water. The St. Peter's Anglican Church in Alley built in 1671 was destroyed beyond repair. However, the Halse Hall Great House, where alluvial thicknesses are comparatively low, survived the 1692 earthquake, as well as subsequent ones."*

For these reasons the risk from earthquakes needs to be assessed from activity over the region, rather than locally. Figure 35 and Figure 36 indicate the likely maximum effects of an earthquake (horizontal accelerations and ground motion) with a 10% probability of exceedence in any one 50-year period.

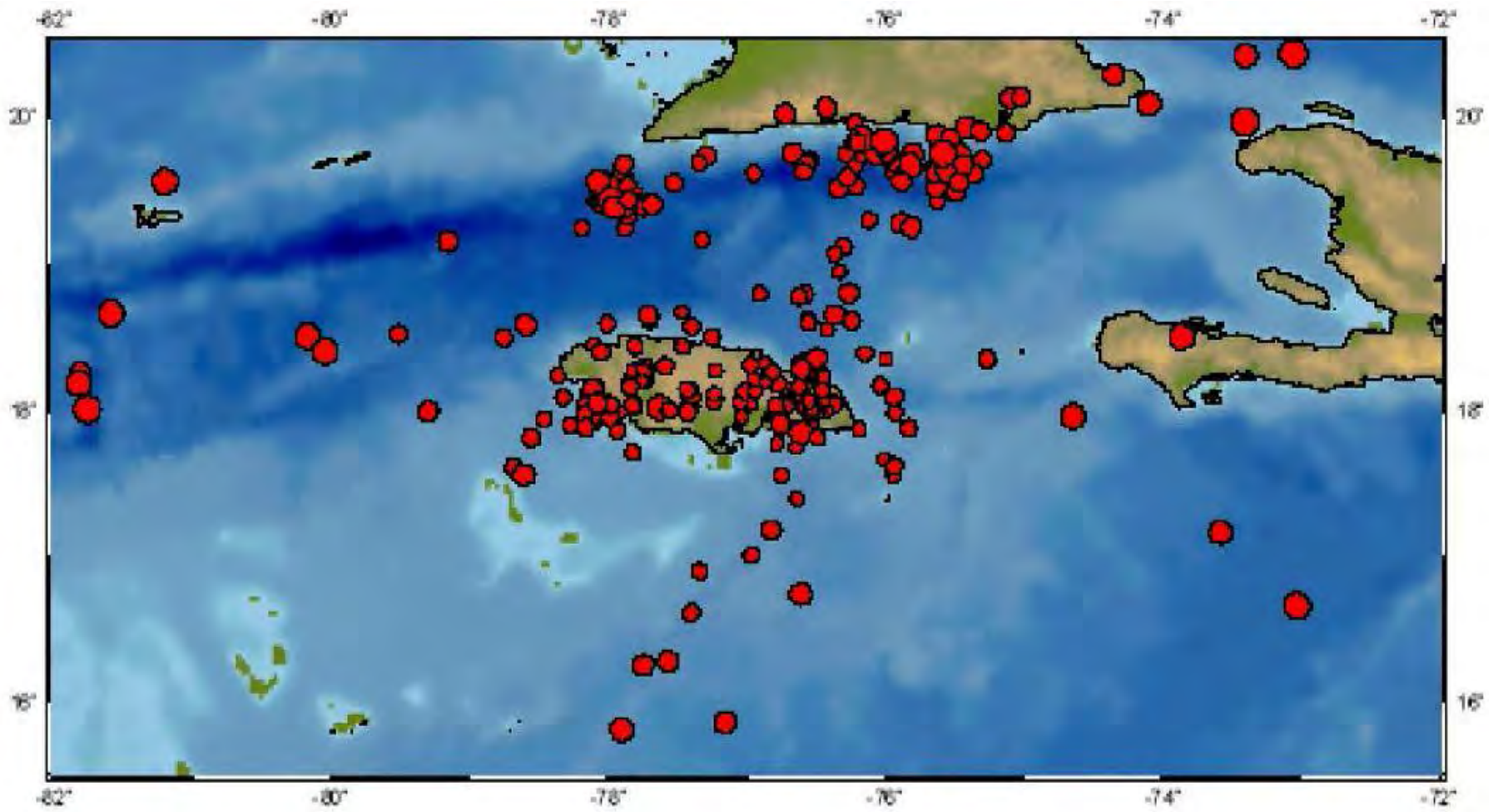


Figure 33: Epicentres of earthquakes occurring between 1998 and 2001 in the vicinity of Jamaica (Source: The Earthquake Unit, UWI).

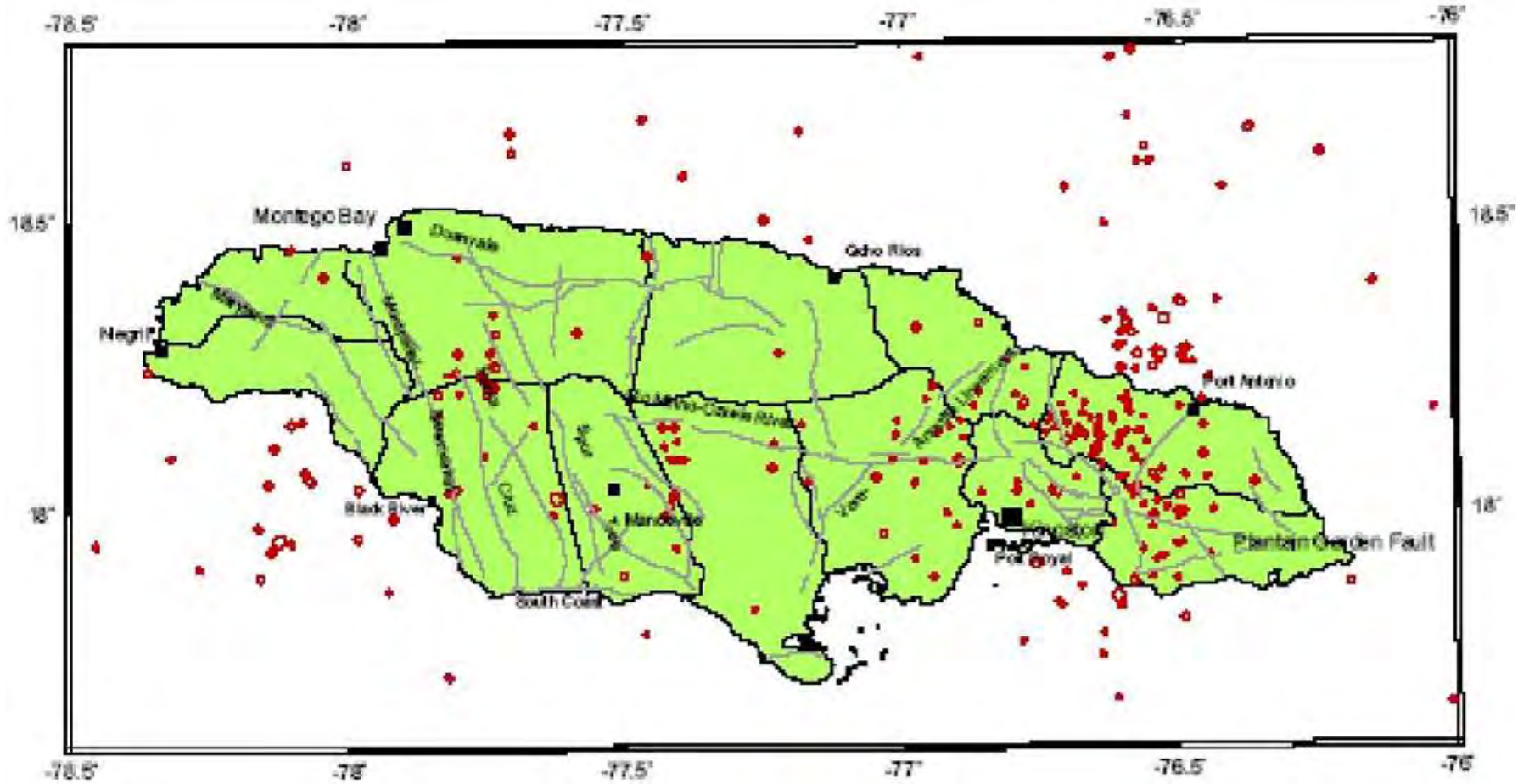


Figure 34: Epicentres of earthquakes occurring between 1998 and 2001 located in and around Jamaica. (Source: The Earthquake Unit, UWI).

Table 8: Earthquakes known to have occurred in the parish of Clarendon between 2003 and 2007

Year	Month	Day	Time (EST)	Mag., Mt	degrees N	degrees W	depth, km	Sub-area	Sub-area name	Epicentre location	Intensity, EMS
2005	January	11	5:27a.m.	3.2	17.89	-76.88	10	21	Kingston Offshore	Offshore Helshire Hills, St. Catherine	Reports from St. Andrew (Red Hills III) and St. Catherine (Cumberland II, Greater Portmore)
2005	March	18	2:06a.m.	3.6	17.82	-77.29	10	25	South Coast fault Zone	South-Central Clarendon	Reportedly felt in May Pen III, Clarendon
2005	June	13	10:58p.m.	5.1	18.22	-77.42	5	9	Dry Harbour Mountains	Near Aenon Town, Clarendon	Reportedly felt in Clarendon (Aenon Town VII, Top Alston VII), Manchester (Silent Hill VII), Trelawny (Wait-a-bit VII, Lemon Walk VII)
2005	June	13	6:21a.m.	3.3	18.25	-77.43	10	9	Dry Harbour Mountains	Near Aenon Town, Clarendon	Reportedly felt by two individuals in Aenon Town III, Clarendon
2004	May	2	4:55a.m.	3	18.03	76.95	10	15	Rio Minho-Crawle River Fault zone	Approx. 5km north of Spanish Town, St. Catherine	Few residents of havendale III, Meadowbrook III and Forest Hills III, Bull Bay III, St. Andrew
2004	August	10	12:19p.m.	4	18.17	77.22	10	15	Rio Minho-Crawle River Fault zone	Near Kellits, Clarendon	Reports from central and eastern parishes

 Source: Earthquake Unit – UWI Mona www.mona.uwi.edu/earthquake/

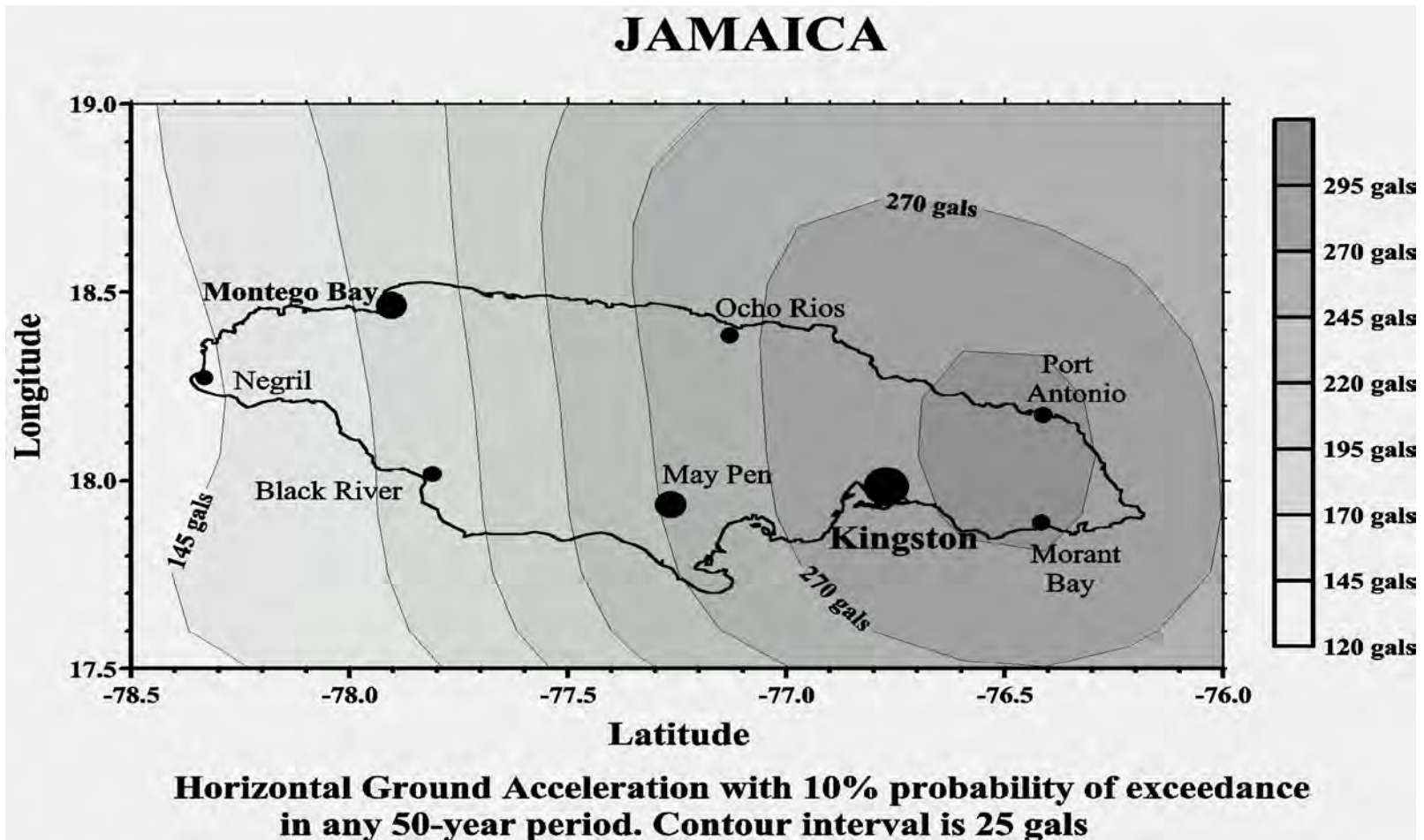


Figure 35: Horizontal ground acceleration with 10% probability of exceedance in any 50-year period. Contour interval is 25 gals (“Seismic Hazard Maps: Jamaica” 2001)

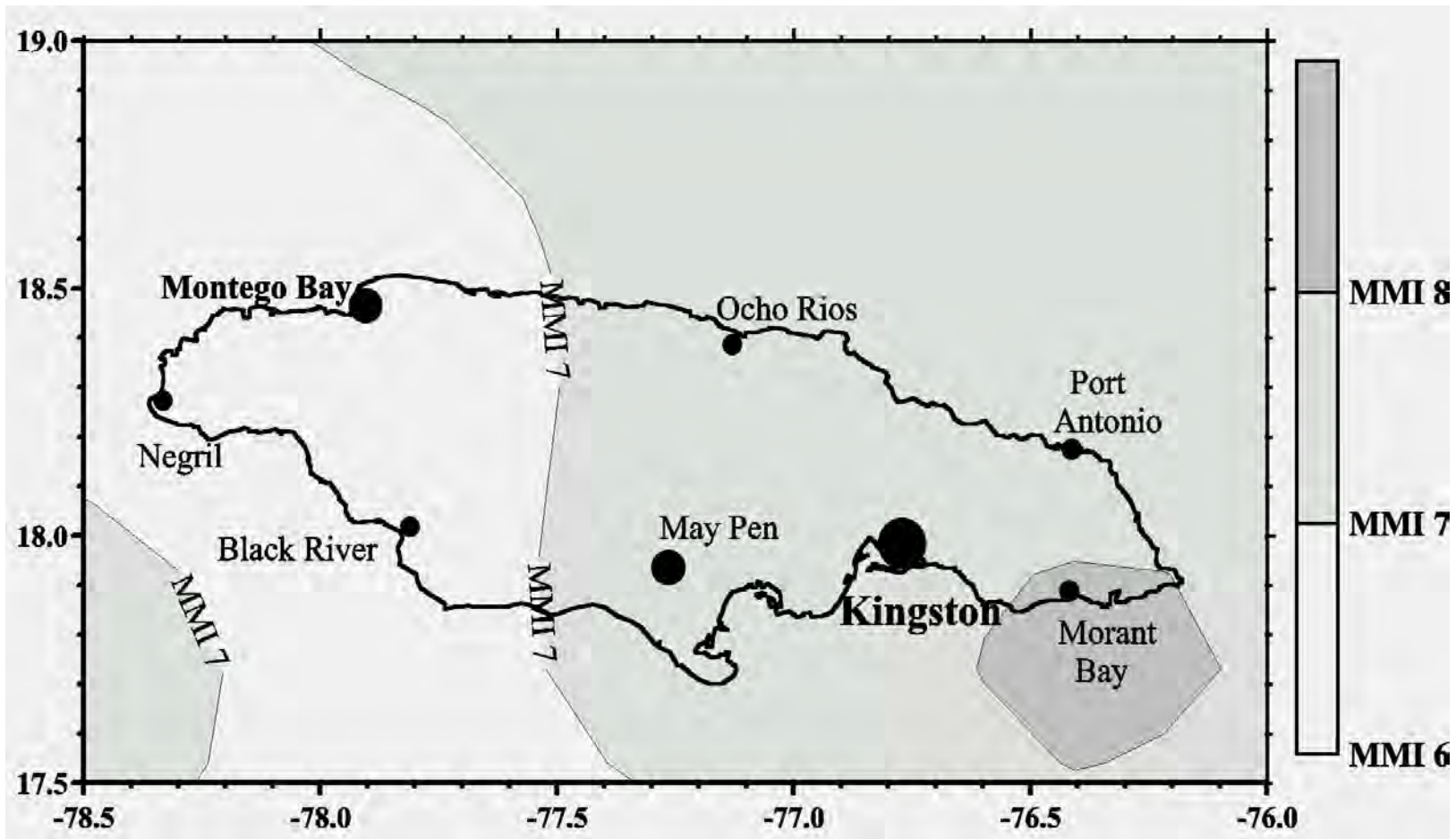


Figure 36: Expected maximum Mercalli Intensity with 10% probability of exceedance in any 50-year period (“Seismic Hazard Maps: Jamaica” 2001).

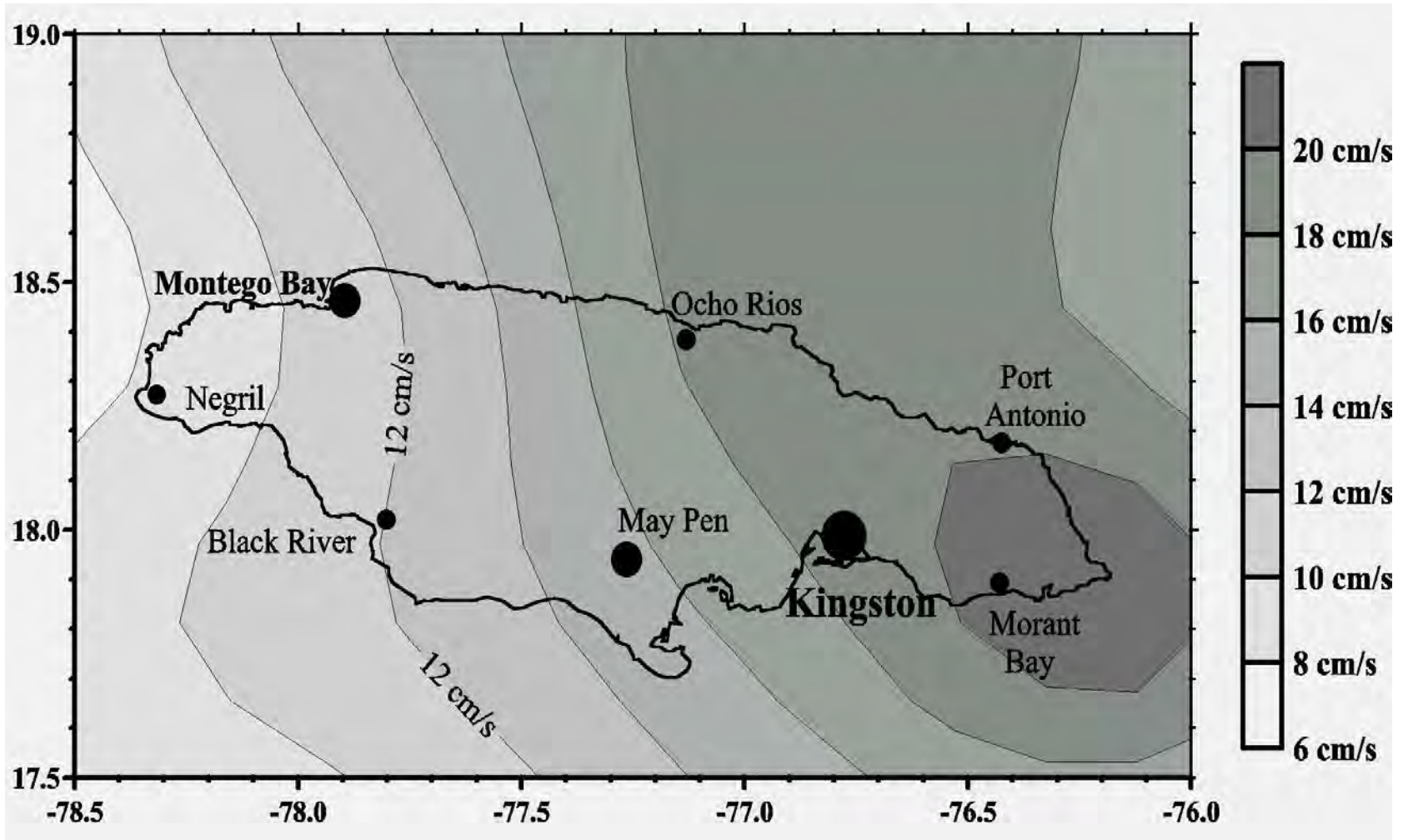


Figure 37: Horizontal ground velocity with 10% probability of exceedance in any 50-year period. Contour interval is 2 cm/sec ("Seismic Hazard Maps: Jamaica" 2001)

7.7.2. Hurricanes

Hurricanes are a serious seasonal threat from June to November; since 1886, 23 hurricanes have made landfall in Jamaica, while over 100 have passed within 240 km (150 miles) of the island.

Using Norman Manley International Airport in Kingston as a reference point location: 17.93N, 76.78W, all recorded tropical storm and hurricane activity over a period of 100 years are considered to estimate any trends related to the hurricane activity and the return period of such activities to the island. This can be done confidently as Jamaica is a small island and is likely to be affected wholly regardless of the point of approach of a tropical depression or storm system.

So far this year, no hurricanes have affected the island. However, the island was affected in 2012, 2010, 2008, 2007 and 2005 cycles by six storms, all considered major hurricanes (Category 3 and above) making landing on the island or passing on either side of the island. The last being category 1 Hurricane Sandy.

7.7.3. Flooding

Storm surges from hurricanes Ivan (September 2004) and Dean (August 2007) were recorded along most of the edge of Portland Bight, including the stretch of coast from Port Esquivel to Rocky Point Port and Portland Cottage. A flood hazard map is shown below.

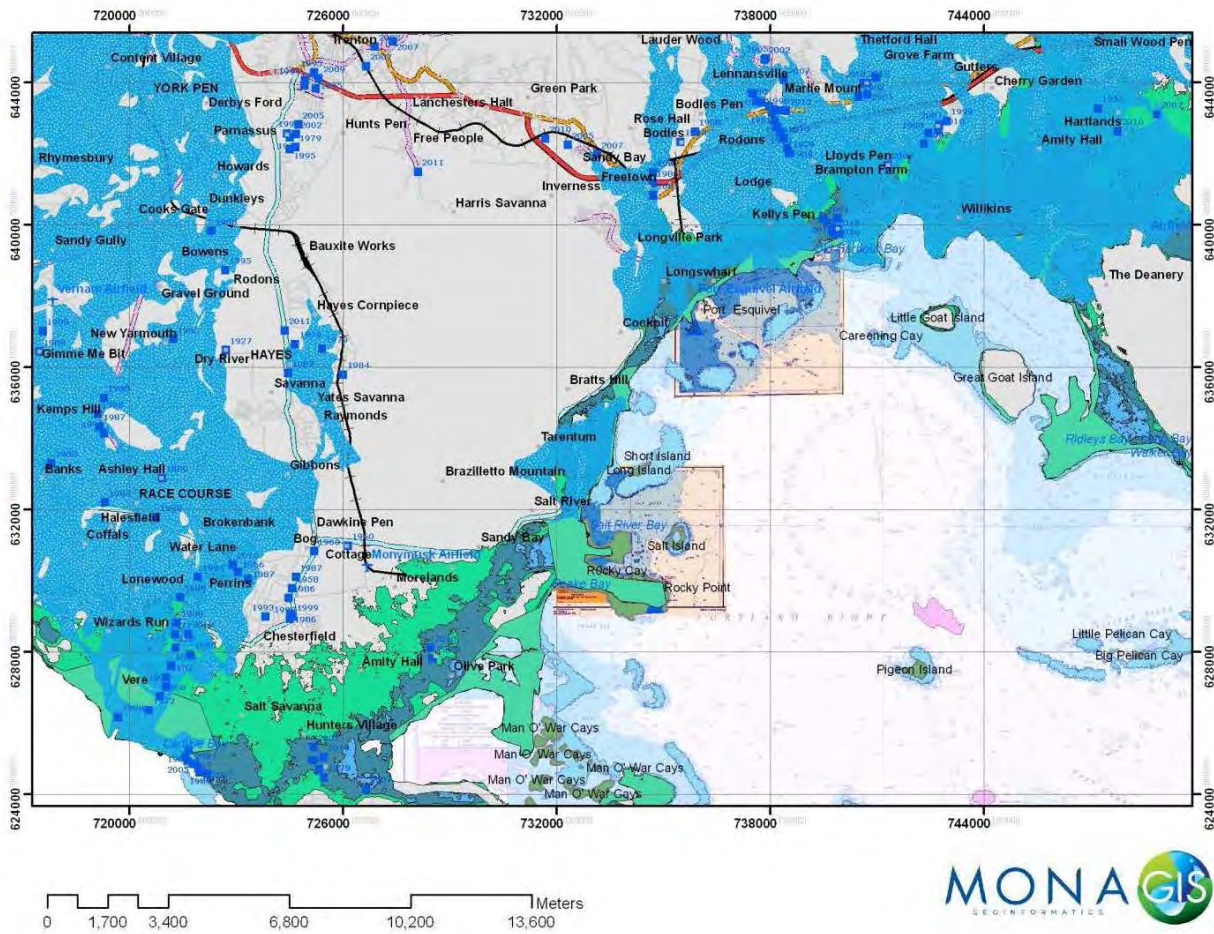


Figure 38: Flood Hazard Map of the PBPA

8.0. Description of the Biology

8.1. Introduction

Jamaica has a diverse physical environment, with a wide range of microclimates, soils, and physical features that support a great variety of forest types, including lower montane mist, dry limestone, wet limestone, mangrove, woodland, herbaceous swamp and marsh forests.

“Jamaica is ranked 5th worldwide among the earth’s islands in terms of endemism of plants species. There are more than 4500 species of plants and animals that are indigenous to Jamaica and of this 1642 are endemic species.”(Planning Institute of Jamaica and National Environment and Planning Agency). Table 9 below shows the number of indigenous and endemic organisms, along with the total percentages which are indigenous and endemic to Jamaica.

Table 9: Jamaica's Indigenous and Endemic Species (Planning Institute of Jamaica and National Environment and Planning Agency)

Category	Indigenous	Endemic	Percent of Total
Plants	3304	923	27.9%
Invertebrates	1000	625	62.5%
Fish (freshwater)	6	4	66.6%
Amphibians	22	22	100.0%
Reptiles	43	33	76.7%
Birds (shore and sea)	39	1	2.6%
Birds (land)	67	30	44.8%
Bats	21	2	9.5%
Mammals	2	2	100.0%
Total	4,504	1,642	36.5%

The ecologically sensitive areas in the Portland Bight Protected Area have been identified as:

- The tall open dry limestone forests of the Portland Ridge, Brazillette Mountains and Hellshire Hills areas
- Caves (*A total of 60 caves have been identified within the PBPA*)
- The mangrove and herbaceous wetlands of the northern, eastern and western shorelines of the PBPA
- The fields and disturbed broadleaf forest areas of the northern sections of the PBPA
- Seagrass beds
- Coral Reefs

A list of the rare, threatened and endangered species of plants and animals in the PBPA has been compiled for the following areas (See Table 10 to 12 below):

- Brazillette Mountains
- The Portland Ridge
- Hellshire Hills
- Rocky Point, Clarendon
- The marine environment

A spatial summary of the endemic species found within the PBPA is shown in Figure 39 below under their common names.



Figure 39: Known location of Rare, Threatened, and Endangered Species within the Portland Bight Protected Area

The Jamaican Iguana, which was previously thought to be extinct, is the species which is still under greatest threat for extinction. It was rediscovered in the Hellshire Hills. It has been reported that there are signs that the Jamaica Hutia or Coney which was thought to be extinct, may exist on the main land. Indications are that neither the iguana nor the Jamaica Hutia exist on the Goat Islands.

There are several vertebrates which are endemic to the Portland Ridge dry limestone forest. These include:

- the Portland Ridge tree frog (*Eleutherodactylus cavernicola*),
- two species of thunder snakes (*Trophidophis stullae*, *Trophidophis jamaicensis*), and
- the blue-tailed galliwasp (*Celestus duquesneyi*).
- The last skink population (*Mabuya mabouya*) is located in the Hellshire Hills.

Over 271 plant species have been identified in the Hellshire Hills. This includes 53 species which are endemic to Jamaica. (“Jamaica Gleaner Online” 2013)

The low lying coastal wetlands support mangrove and seagrass growth and are important as marine nurseries and as sources for the harvesting of shellfish among other things. Wetlands, commonly called morass, are among the most biologically productive of all Caribbean ecosystems.

The four species of mangroves that are dominant in Jamaica are the white mangrove, black mangrove, button mangrove and red mangrove. The mangrove forests within the PBPA provide many natural services in the ecosystem. These include:

- a basis of marine food chain,
- habitat,
- nursery,
- wave buffering.
- flood control,
- sediment filtration and water quality,
- carbon fixation and general air cleansing, and
- nutrient cycling

There are three dominant species of seagrass commonly found in Jamaican waters. These are

- *Thalassia sp* (the most dominant in Jamaica)
- *Syringodium, sp* and
- *Halodule, sp.*

Table 10: List of Rare, Threatened and Endangered Species of Plants Present within the Portland Bight Protected Area (adapted from CD&A (1992))

Family	Scientific Name	Common Name	Special Note
Anacardiaceae	<i>Comocladia velutina</i>	Velvet-leaved Maiden Plum	Endemic (Near Threatened)
Arecaceae	<i>Thrinax parviflora</i>	Broom Thatch	Endemic
	<i>Coccothrinax jamaicensis</i>	Jamaican silver thatch	Endemic
	<i>Agave sobolifera</i>	-	Endemic
Burseraceae	<i>Bursera lunanii</i>	Black Birch	Endemic (Near Threatened)
	<i>Hylocerus triangularis</i>	God Okra	Endemic
	<i>Calliandra pilosa</i>	-	Endemic; Threatened (Vulnerable)
Leguminosae	<i>Galactia pendula</i>	-	Endemic
Orchidaceae	<i>Broughtonia sanguinea</i>	Blood Red Broughtonia	Endemic
Piperaceae	<i>Peperomia amplexicaulis</i>	Jackie's Saddle	Endemic
	<i>Ziziphus sarcomphalus</i>	Bastard Lignum Vitae	Endemic
Rutaceae	<i>Esenbeckia pentaphylla</i>	Wild Orange	Endemic
Sapotaceae	<i>Bumelia rotundifolia</i>	-	Endemic
	<i>Brunfelsia membranacea</i>	-	Endemic
Total number of Plant Species found to be endemic to Jamaica within the PBPA			14
Total Number of Plant Species found to be Threatened and endangered within the PBPA			3

Table 11: List of Rare, Threatened and Endangered Species of Invertebrates Present within the Portland Bight Protected Area (adapted from CD&A (1992))

Family	Scientific Name	Common Name	Special Note
Hadziidae	<i>Metaniphargus jamaicae</i> **	Cave Dwelling Blind Shrimp	Endemic
	<i>Metaniphargus anchihalinus</i> **	Cave Dwelling Blind Shrimp	Endemic
	<i>Metaniphargus hyporheicu</i> **	Cave Dwelling Blind Shrimp	Endemic
Stygiomysidae	<i>Stygiomysis major</i> **	Cave Dwelling Blind Shrimp	Endemic
	<i>Antromysis peckorum</i> **	Cave Dwelling Blind Shrimp	Endemic
Total number of Invertebrate species endemic to Jamaica within the Portland Ridge			5

** Endemic to Portland Ridge

Table 12: List of Rare, Threatened and Endangered Species of Vertebrates present within the Portland Bight Protected Area (adapted from CD&A (1992))

Family	Scientific Name	Common Name	Special Note
Leptodactylidae	<i>Eleutherodactylus cavernicol</i> **	Portland Ridge tree frog	Endemic (Vulnerable Threatened)
Fringillidae	<i>Euphonia Jamaica</i>	Jamaican Euphonia	Endemic
Picidae	<i>Melanerpes radiolatus</i>	Jamaican Woodpecker	Endemic
Psittacidae	<i>Aratinga nana</i>	Olive-throated Parakeet	Endemic
Todidae	<i>Todus todus</i>	Jamaica Tody	Endemic
Trochilidae	<i>Anthracothorax mango</i>	Jamaican Mango Hummingbird	Endemic
	<i>Myiarchus barbirostris</i>	Sad Flycatcher	Endemic
Vireonidae	<i>Vireo modestus</i>	Jamaican Vireo	Endemic
Anguillidae	<i>Celestus duquesneyi</i> **	Blue tailed galliwasp	Endemic
Tropidophiidae	<i>Trophidophis stullae</i> **	Thunder snake	Endemic
	<i>Trophidophis jamaicensis</i> **	Dwarf snake	Endemic
Scincidae	<i>Mabuya mabouya</i>	Skink	Critically threatened
Boidae	<i>Epicrates subflavus</i>	Jamaican boa	Endemic (Vulnerable Threatened)
Cheloniidae	<i>Caretta caretta</i>	Loggerhead sea turtle	Endangered
	<i>Eretmochelys imbricata</i>	Hawksbill sea turtle	Critical threatened
Dermochelyidae	<i>Dermochelys coriacea</i>	Leather back sea turtle	Critical threatened
Crocodylidae	<i>Crocodylus acutus</i>	American crocodile	Threatened
Iguanidae	<i>Cyclura collei</i>	Jamaican Iguana	Endemic (Critically Endangered)
Polychrotidae	<i>Anolis grahami</i>	Grahams anole	Endemic
	<i>Anolis garmani</i>	Jamaican Giant anole	Endemic
Capromyidae	<i>Geocapromys brownii</i>	Jamaican coney	Endemic (Vulnerable threatened)
Phyllostomidae	<i>Ariteus flavescens</i> **	Jamaican fig-eating bat	Endemic
Trichechidae	<i>Trichechus manatus</i>	West Indian manatee	Vulnerable Threatened
Total number of vertebrates endemic to Jamaica			16
Total number of vertebrate found to be threatened and endangered			6

** Endemic to Portland Ridge

8.2. The Goat Islands Terrestrial and Marine Environment

8.2.1. Above-water Environment (Terrestrial)

Figure 40 illustrates the spatial character of floral life form assemblages observed on the Goat Islands. The more accessible low-land areas on Little Goat Island were characterized by a combination of the following:

- Short open dry forest vegetation (including Cashaw - *Prosopis juliflora* and Logwood - *Haematoxylum campechianum*),
- Salt adapted dry land coastal vegetation
- Mangroves (Predominantly Red Mangroves - *Rhizophora mangle*, but comprising all four Mangrove species represented in Jamaica).
- Salinas - much of which (at the time of the limited ground truthing) were inundated with brackish water and devoid of plant-forms.

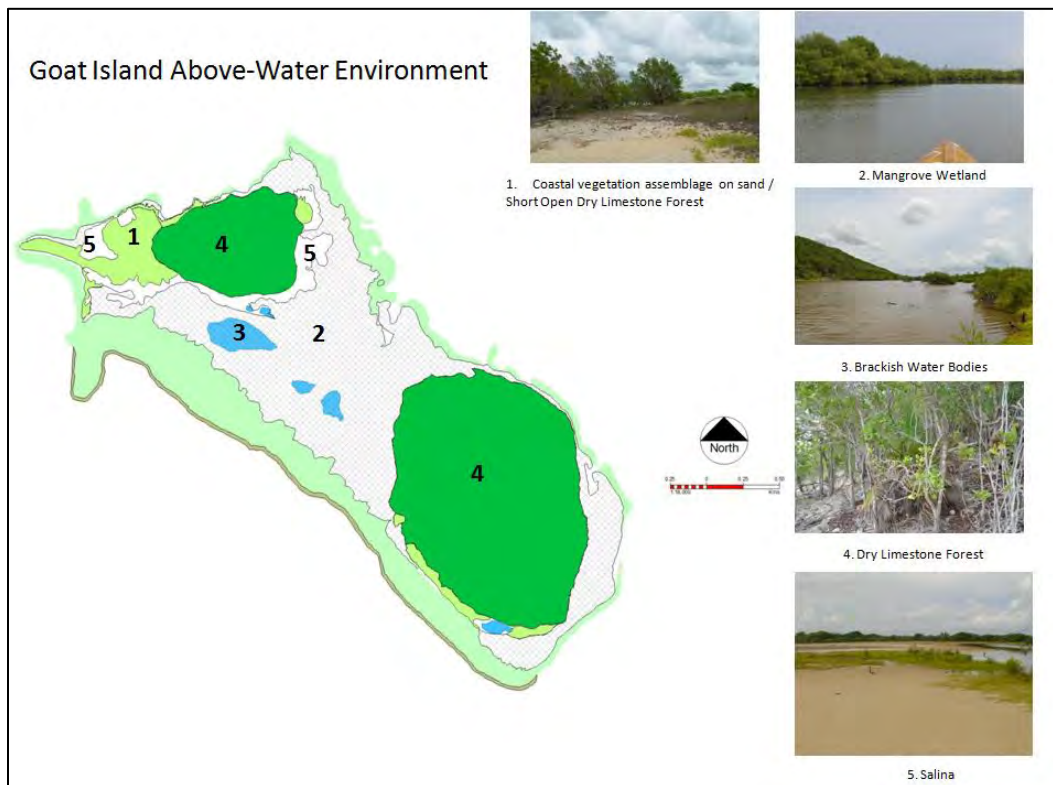


Figure 40: The Goat Islands Above-Water Environment

The higher elevations were dominated by Tall Open Dry Forest vegetation on limestone rocks which includes the endemic Broom Thatch Palm (*Thrinax parviflora*) and the Century Plant (*Agave sp*) (See Plate 4 and Plate 3 below).



Plate 4: Broom Thatch Palm observed on the Great Goat Island



Plate 3: Century Plants observed on the Great Goat Island

The floral assemblages of the Great Goat Island were dominated by tall open dry forests on elevated limestone areas and mangroves (again predominantly red mangroves) on low-lying areas. There was evidence of short open dry forest vegetation on flat lands towards the south and southwestern sections of the Great Goat Island (typified by the columnar cactus - *Stenocereus hystrix* (See Plate 5).



Plate 5: Cactus (believed to be Columnar Cactus) interspersed between Century Plants observed on the Great Goat Island

Faunal species observed on (or above) both islands were grouped as follows:

1. Avifauna (birds): These were not common on or around the islands at the time of the survey and were mainly coastal or water birds:
 - Cattle egret
 - Grey heron
 - White giant heron
 - Black-necked stilt (*Himantopus mexicanus*)
 - Yellow-faced grassquit
 - Turkey vulture (*Cathartes aura*) (gaggle in thermals over Great Goat Island)

Shotgun shells remains found on the Little Goat Island suggested that game hunting was occasionally done on the island – targeting game birds such as the bald pate and white wing. However, none were seen at the time of the limited ground truthing.

2. Land fauna – The most commonly observed fauna were small (<10cm diameter) gastropod and bivalve molluscs observed in and around the Salinas on the Little Goat Island. Goats were observed on the Great Goat Island, as well as the anole (*Anoles graham*).
3. Aerial components – mangrove mangrove tree crab (*Aratus pisonii*) and the arboreal gastropod (*Littorina angulifera*) (see Plate 7 and Plate 6 below).



Plate 7: The Arboreal Gastropod *Littorina angulifera*



Plate 6: The Mangrove Tree Crab *Aratus pisonii*

8.2.2. *Below-Water Environment*

Figure 41 illustrates the spatial character of benthic lifeforms assemblages observed around the Goat Islands, which included:

1. The prop root environment of adjoining red mangroves. These roots provide habitat support for several types of attached marine organisms, including:
 - The flat oyster (*Isognomon alatus*)
 - Various encrusting and tubular sponges
 - Tunicates
 - Tube worms, eg the magnificent feather duster (*Sabellastarte magnifica*).
 - The large ivory barnacle (*Balanus eburneus*)
2. Seagrasses, dominated by turtle grass (*Thalassia testudinum*) but also including manatee and shoal grasses (*Syringodium filiforme* and *Halodule wightii*) were observed near the seagrass/mangrove inter-phase on the leeward sides of both Goat Islands.
3. Scattered heads of massive corals, particularly the smooth startlet coral (*Siderastrea sideria*), brain coral (*Faviidae*) and mustard hill coral (*Porites asteroides*) were observed in the shallow seagrass bed areas on the windward side of the islands. For the most part, these corals were less than 10-15 cm in diameter.

However, much larger examples of the smooth startlet coral were observed south of the Great Goat Island (see Plate 8 below).



Plate 8: Large Smooth Startlet Coral (>1m diameter) Observed near to the Southern Shore of the Great Goat Island

4. A fore reef slope on the windward sides of both islands. The shallow portions of this slope might have been dominated historically by branching staghorn coral (see Plate 9) interspersed with scattered boulder coral heads. However, much of what might have been coral substrate is now heavily sedimented and being grown over by turtle grass.



Plate 9: Remnants of Branching Staghorn Coral on Reef Area South of the Little Goat Island

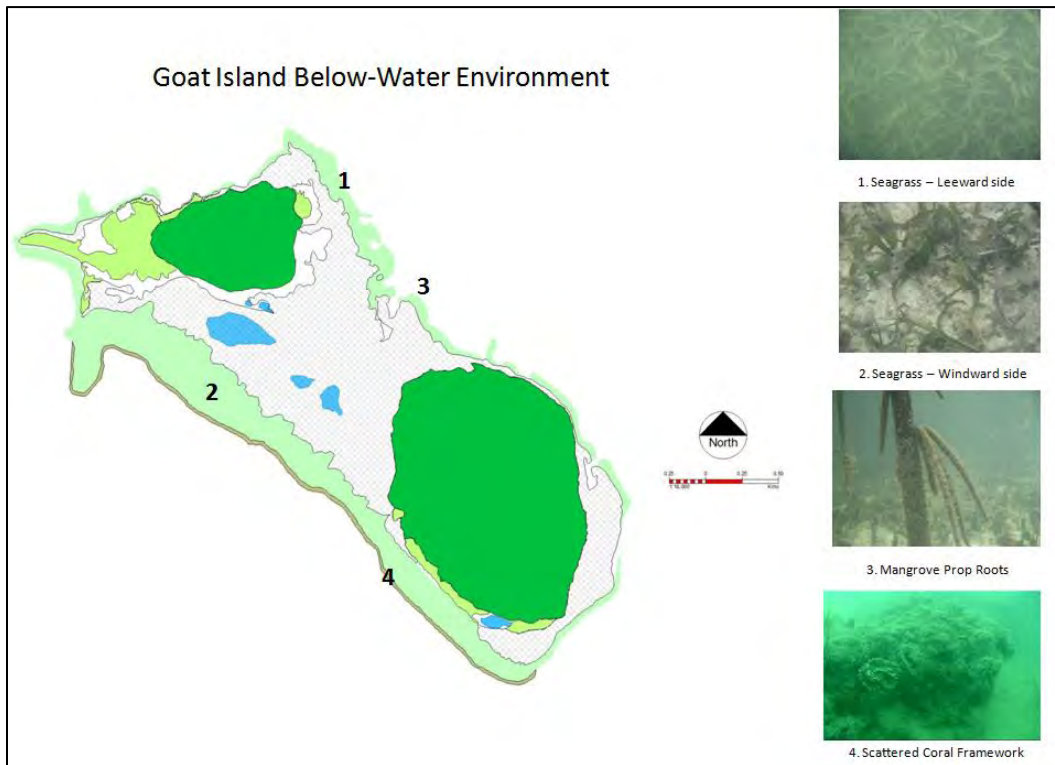


Figure 41: The Goat Islands below Water Environment

Video transects were conducted at 4 locations around the Goat Island area (see locations on Figure 42). The observations made are illustrated on Figures 41-44.

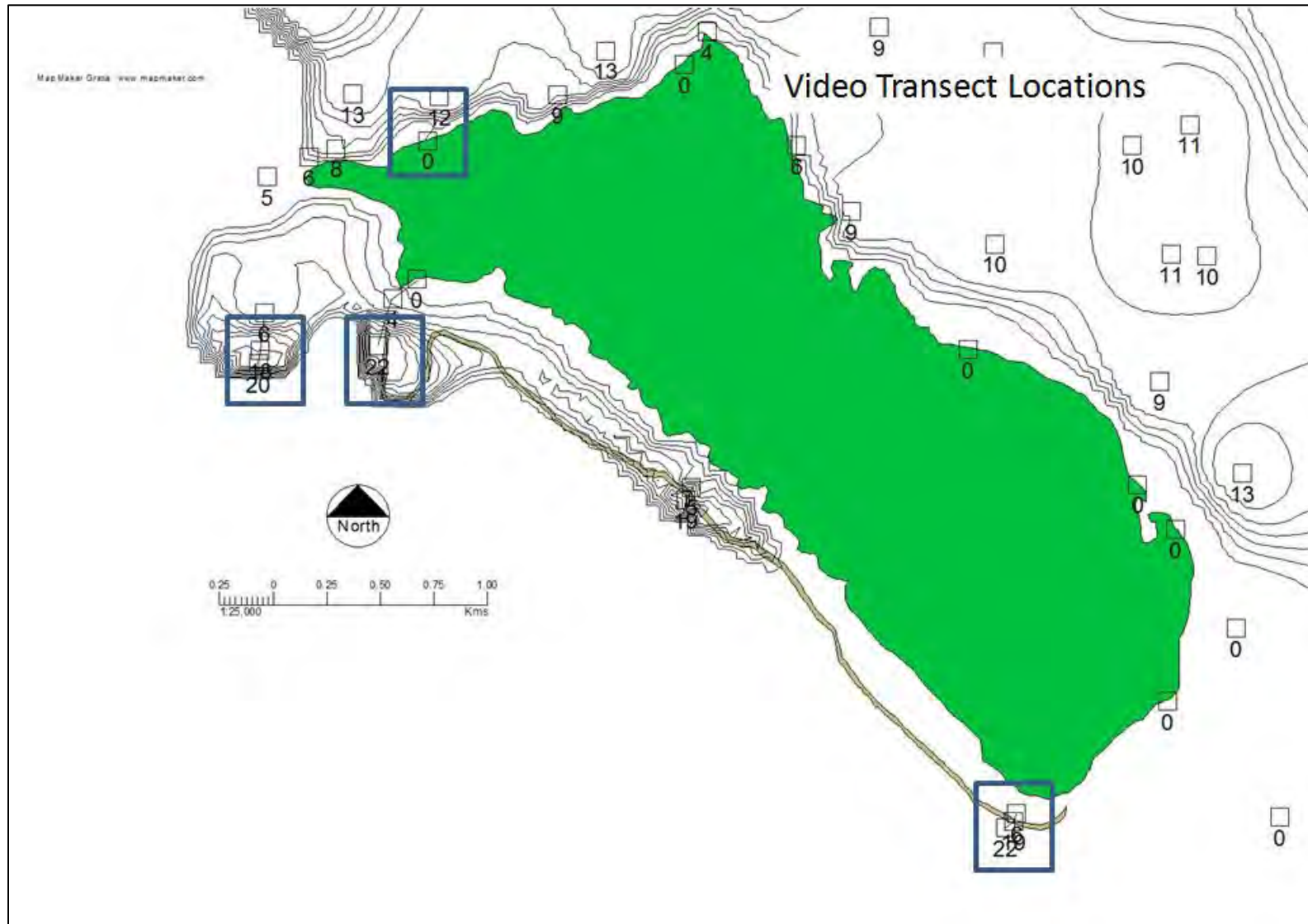


Figure 42: Video Transect Locations at the Goat Islands

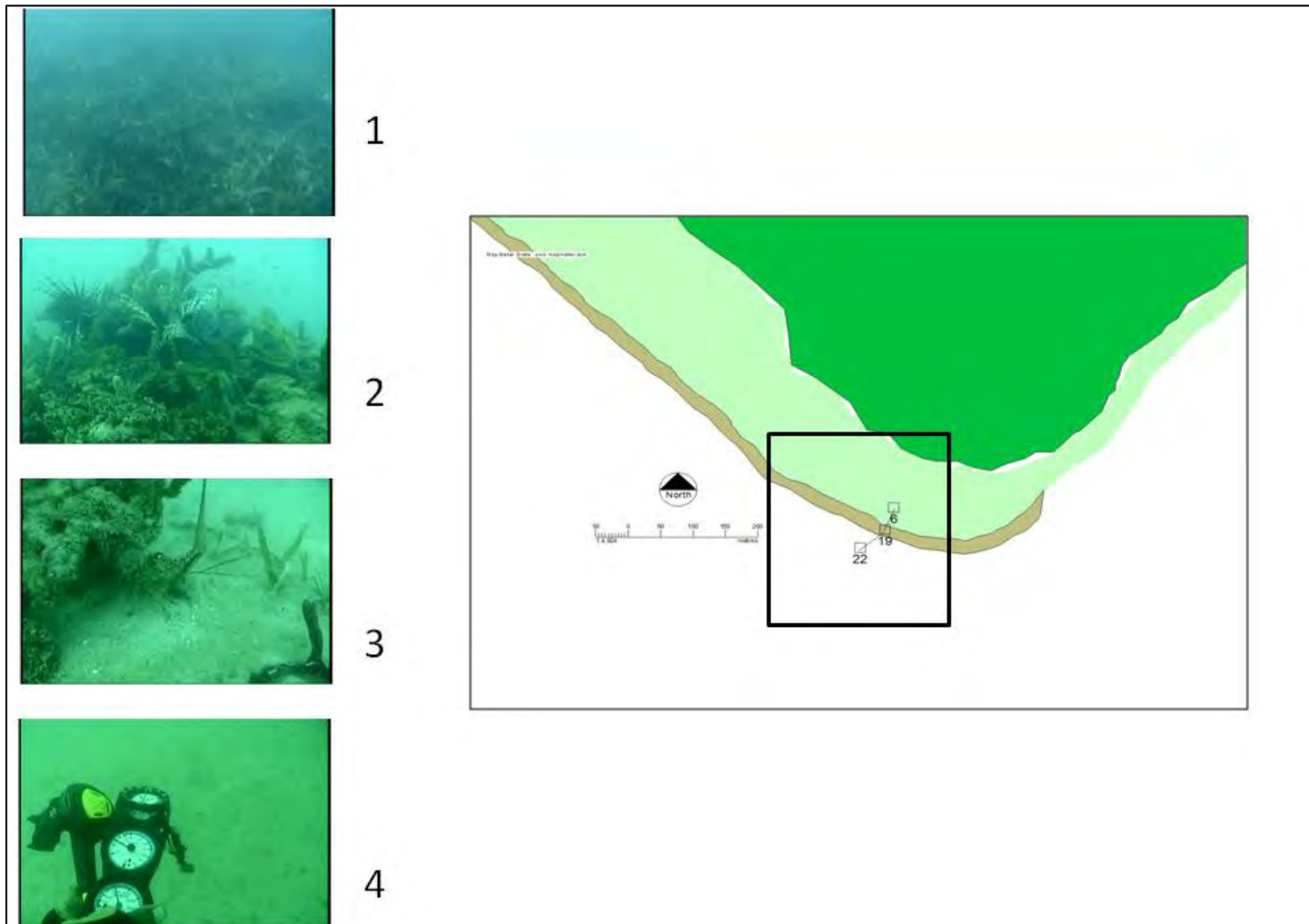


Figure 43: Observations at Transect 1 -The Goat Islands. The direction of movement was from shoreward to seaward. 1: Turtlegrass bed close to shore | 2-3: Reef slope | 4: Base of reef slope and sand/silt plain (depth indicated on gauge - 20ft)

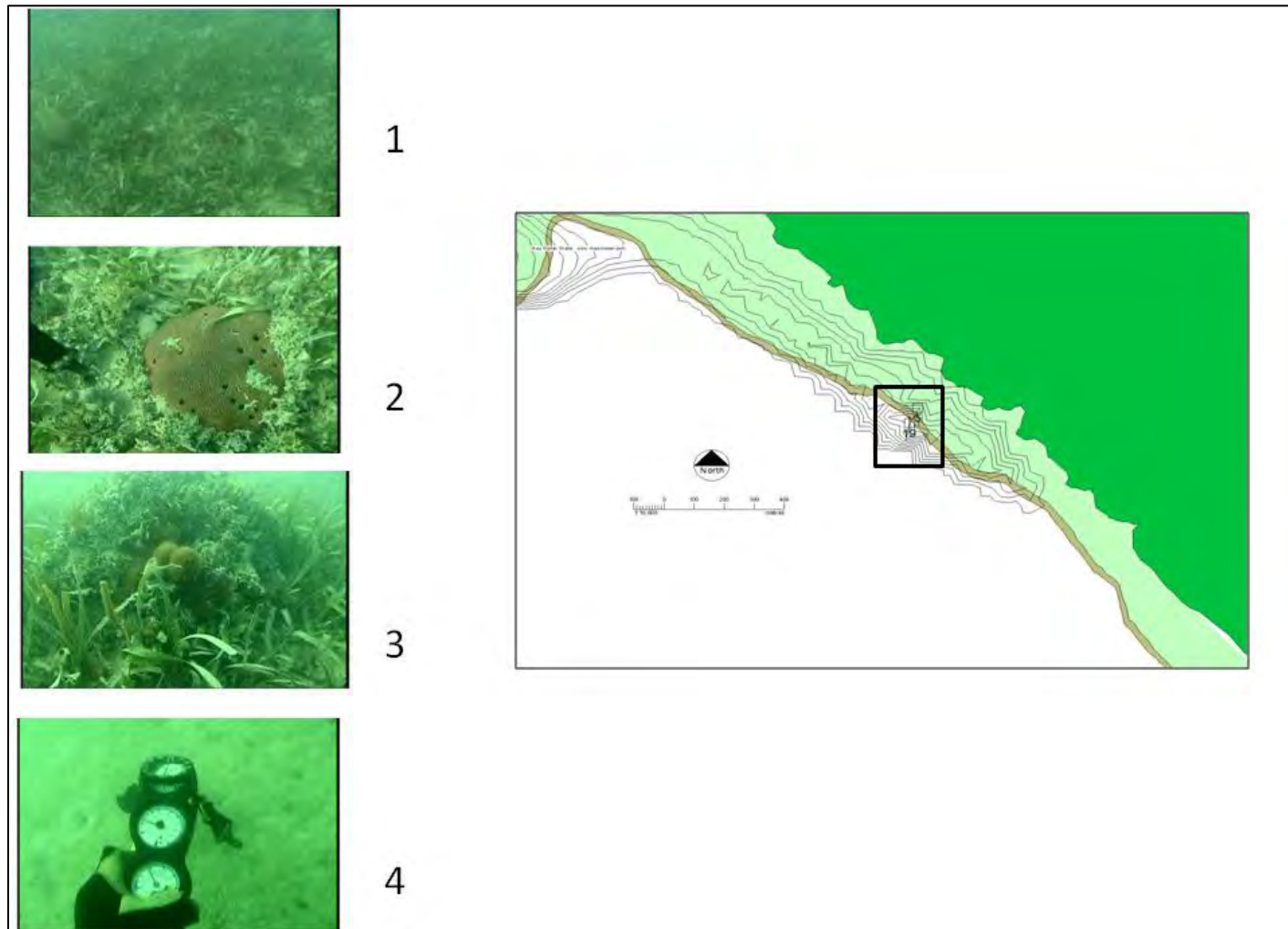


Figure 44: Observations at Transect 2 -The Goat Islands The direction of movement was from shoreward to seaward. 1: Turtlegrass bed close to shore | 2-3: Transition from seagrass to reef slope | 4: Base of reef slope and sand/silt plain (depth indicated on gauge - 20ft)

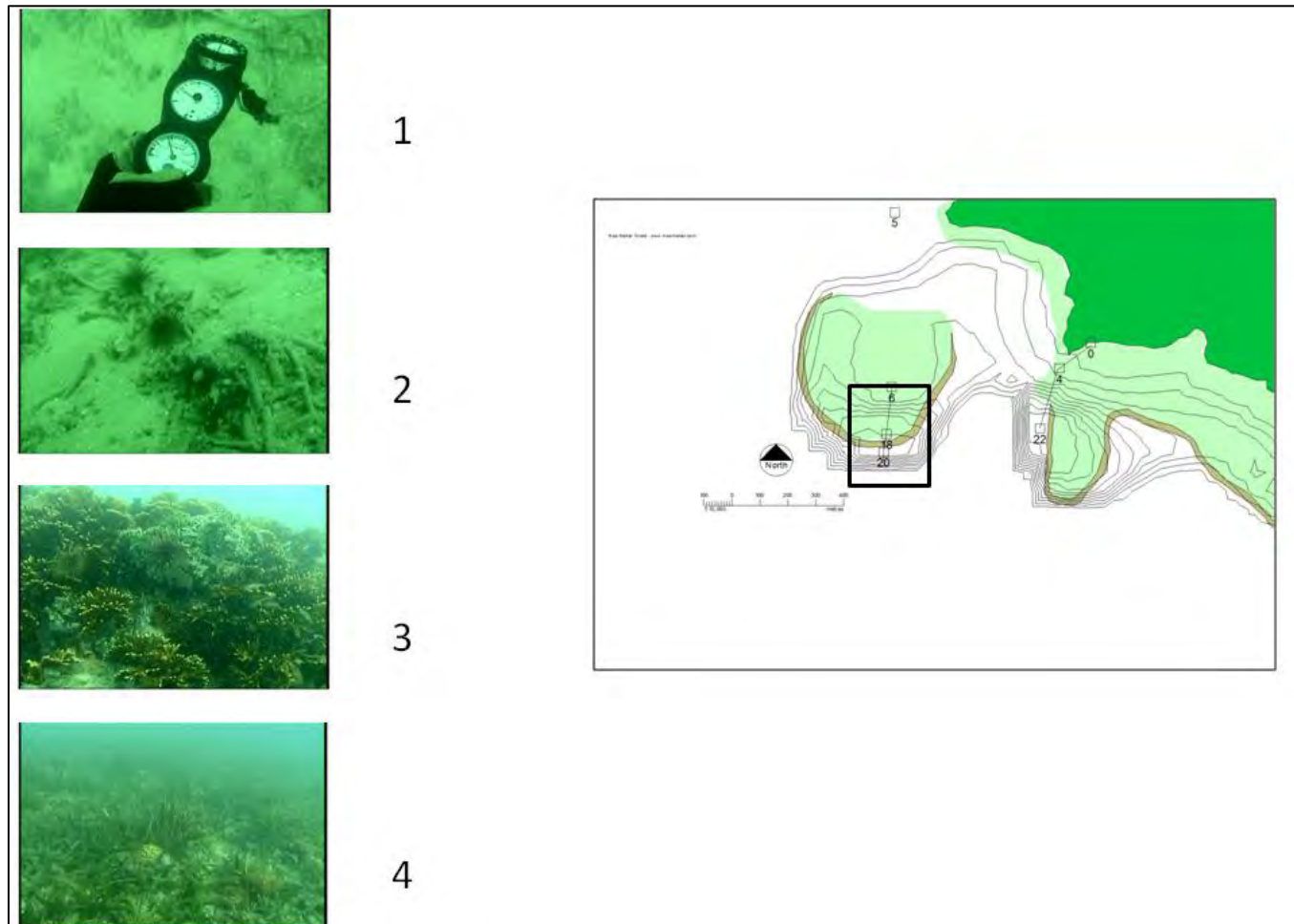


Figure 45: Observations at Transect 3 -The Goat Islands (Careening Island) The direction of movement was from seaward to shoreward. 1: Base of reef slope and sand/silt plain (depth indicated on gauge - 20ft) | 2: Remnants of Staghorn Coral (*Acropora cervicornis*) | 3: Fire Coral colony (*Millepora* sp) | 4: Turtlegrass bed in shallows

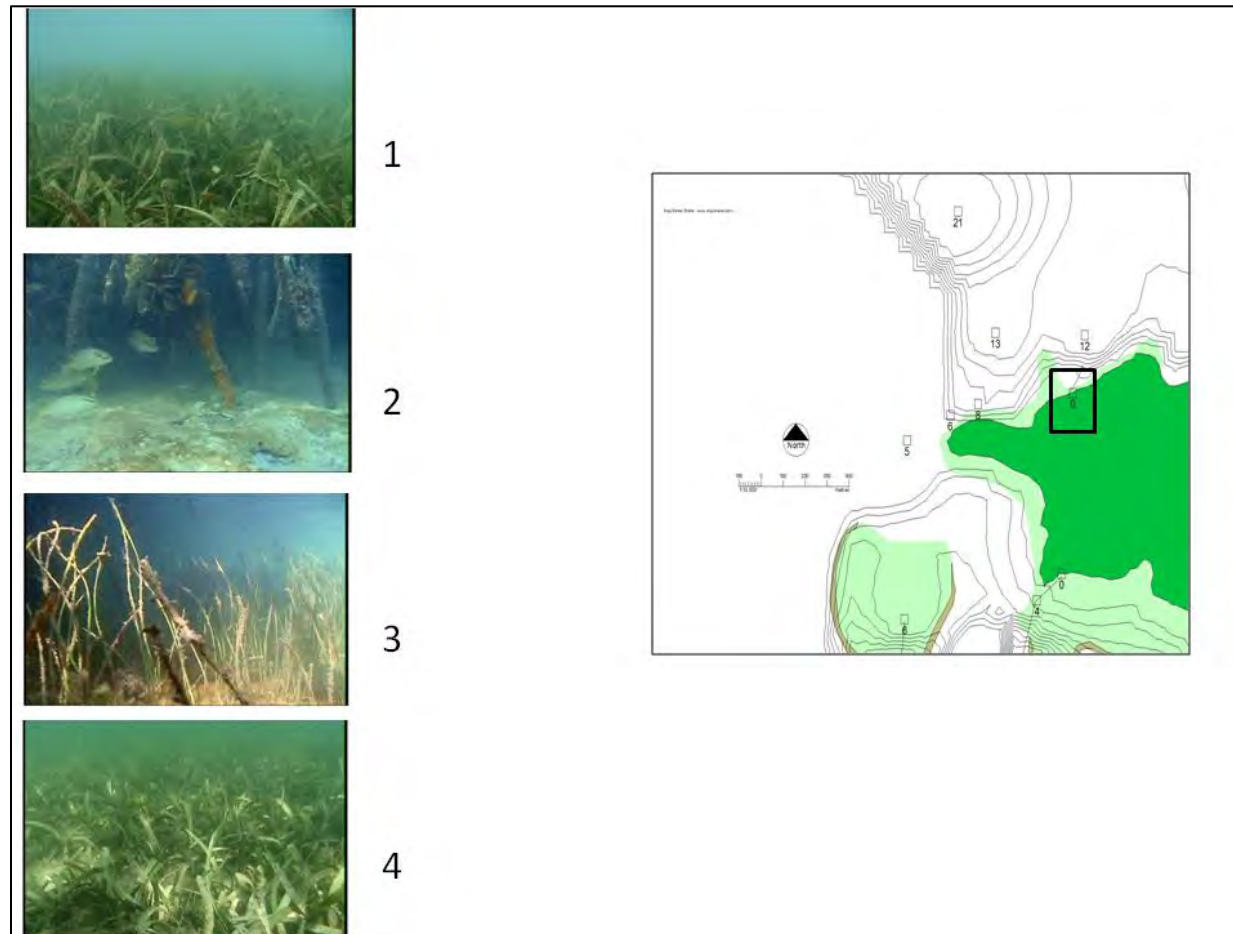


Figure 46: Observations at Transect 4 –The Goat Islands. The direction of movement was from seaward to the mangroves and back to seaward. 1: Turtle Grass bed (depth 1.3m) 2: Mangrove prop roots with Schoolmaster Snapper Juveniles (*Lutjanus apodus*) present | 3: Manatee grass (*syringodium filiforme*) close to Mangrove Prop Roots | 4: Turtle Grass.

8.3. Mainland Terrestrial and Marine Environment

8.3.1. Above-water Environment

Figure 47 -46 illustrates the spatial character of floral life form assemblages observed along the shorelines within the study area peripheral to the Goat Islands. The dominant assemblage type was Mangroves (Predominantly Red Mangroves - *Rhizophora mangle*). Some individuals, particularly those located along the banks of the Black River, grew to heights in excess of 10 meters, with aerial roots extending into the water from 5 meters height.

Faunal species observed were grouped as follows:

1. Avifauna – These were mainly coastal or water birds:
 - Cattle egret
 - Grey heron
 - White giant heron
 - Brown pelican
 - Magnificent frigate bird
2. Aerial components – mangroves mangrove tree crab (*Aratus pisonii*) and the arboreal gastropod (*Littorina angulifera*).



1. Entrance to channel leading to Brampton



2. Bridge at Brampton



3. Red Mangrove in Black Bar River

Mainland Above-Water Environment

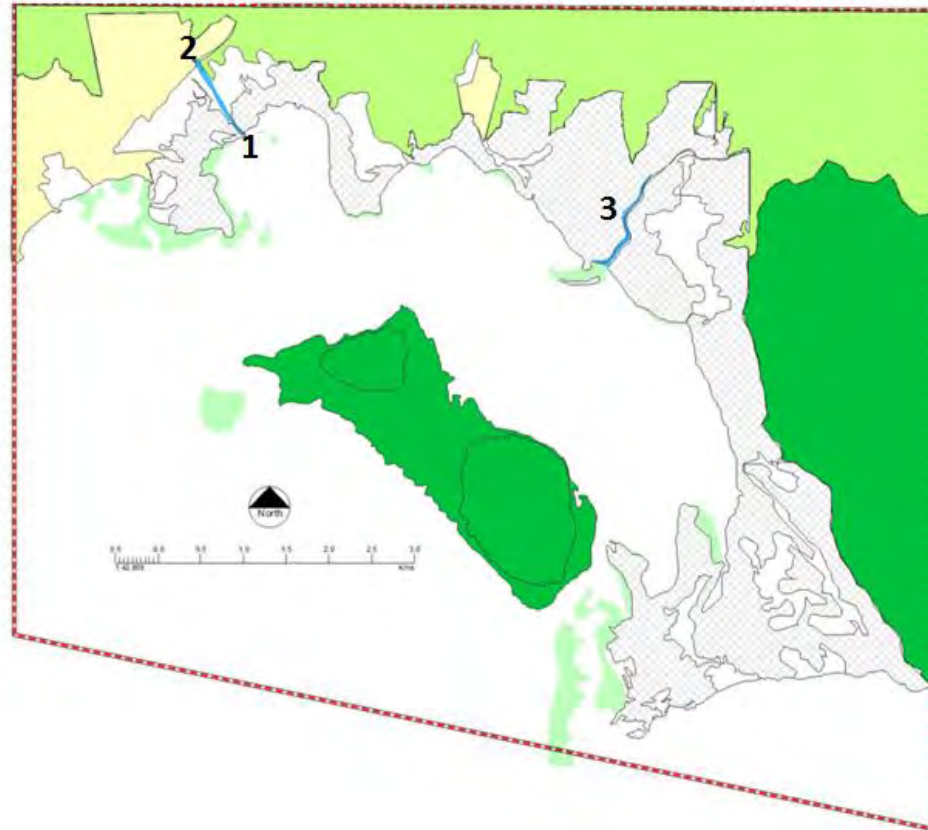


Figure 47: Description of Above-water Environment Surrounding the Goat Islands



1. Gregory Park Beach



2. Mouth of Black Bar River



3. View of Limestone Forest Area

Mainland Above-Water Environment

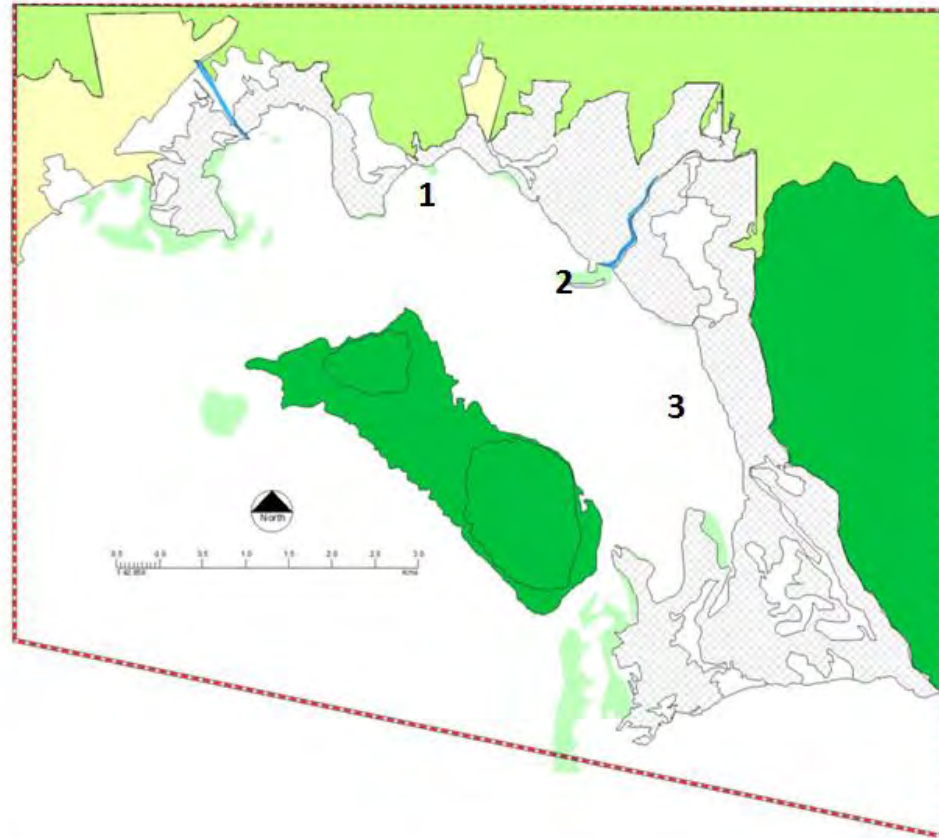


Figure 48: Description of Above-water Environment Surrounding the Goat Islands

8.3.2. *Mainland Below-water Environment*

Figure 49 illustrates the spatial character of benthic life forms assemblages observed along the mainland shoreline within the study area, which included:

1. The prop root environment of adjoining red mangroves, which had attached marine organism compositions similar to that observed on prop roots at the Goat Islands.
2. Seagrasses, dominated by turtle grass (*Thalassia testudinum*).

Mainland Below-Water Environment



1. Seagrass Beds east of Old Harbour Bay



2. Red Mangrove Prop roots at Mouth of Black Bar River



3. Seagrasses East of Great Goat Island

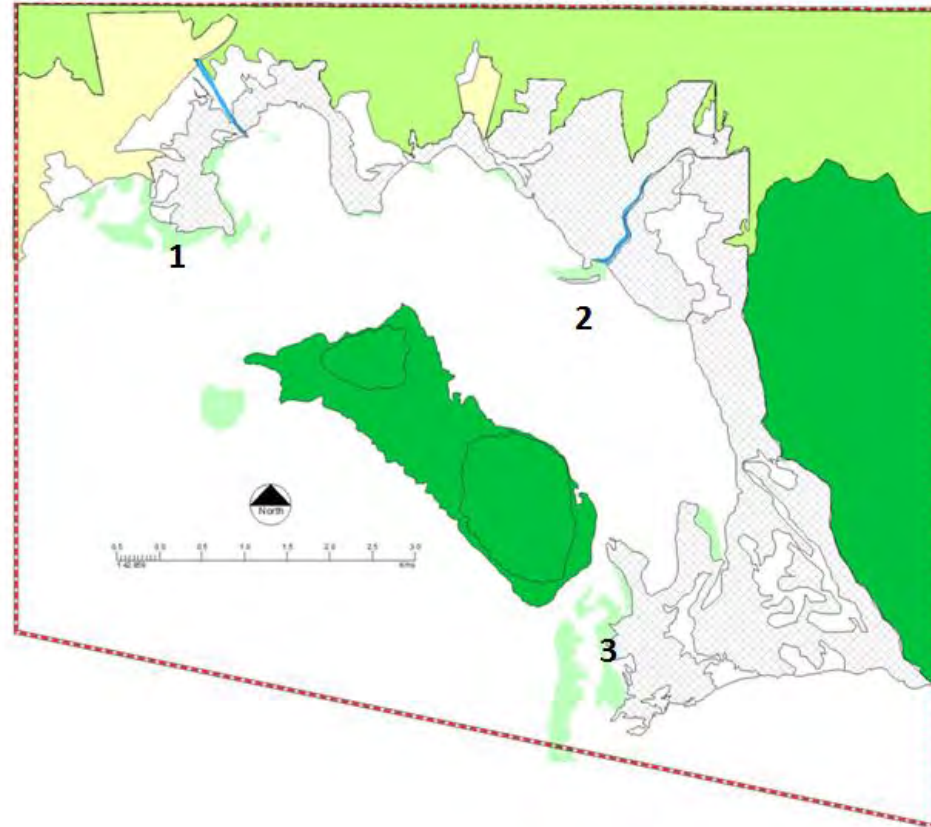


Figure 49: Description of Below-water Environment Surrounding the Goat Islands

9.0. Description of the Socio-cultural Environment

9.1. Social and Economic Context

The project is conceived in the following socio-economic context:

- Jamaica is engaged in a four year extended fund programme with the International Monetary Fund (IMF).
- Jamaica has an Special Drawing Rights (SDR) that now stands at 225%.
- Jamaica's debt is JM\$1.8 trillion.
- Jamaica has the highest debt risk burden in the world (Johnston 2013).
- The total annual budget of the country is over JM\$6 billion, with more than 50% being used for debt servicing.

The major sectors that generate income for the Jamaican economy in order of ranking are:

- The Diaspora in the form of remittances
- Tourism
- Bauxite
- Export agriculture

Jamaica also has a high unemployment rate. The official unemployment rate jumped in April 2013 to 16.3 percent which is an increase from 14.5 percent in January and 14.4 percent a year earlier (IMF 2013).

9.2. Population and Gender Distribution

The population and gender distribution for the PBPA was determined using data obtained from STATIN. The data included specific age cohorts for the 149 enumeration districts (EDs) and special areas which constitute (in part or in whole) the PBPA.

The total population within the PBPA was 67,506 persons, of which 33,798 were females and 33,708 were males. The percentage distribution of male and female is illustrated in Figure 50.

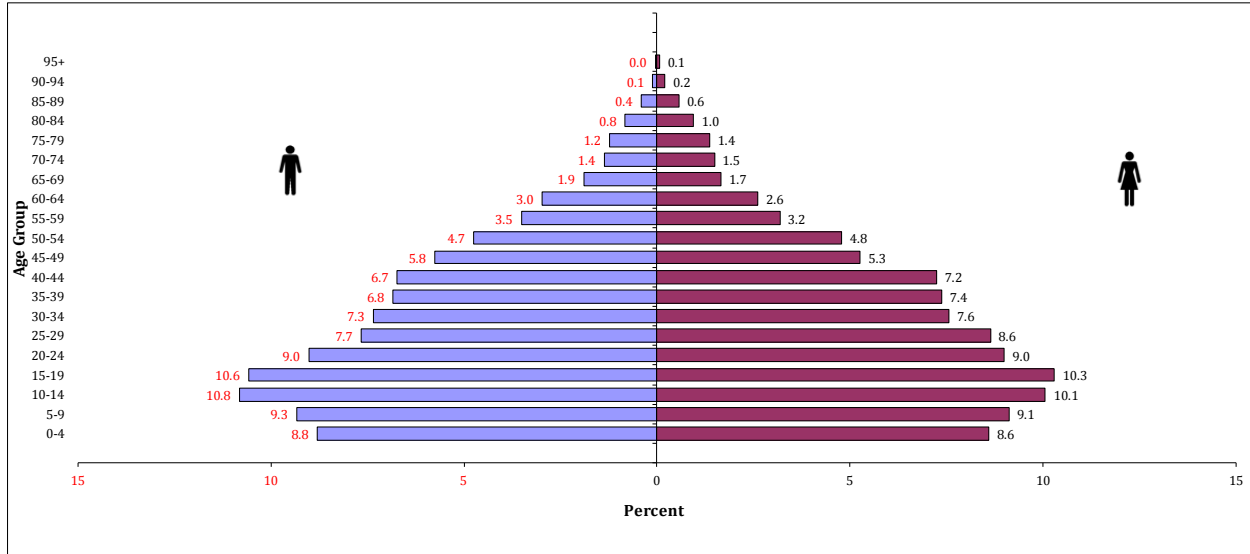


Figure 50: Population Pyramid showing the Gender Percentage Distribution within the Portland Bight Protected Area (St. Catherine and Clarendon)

The largest cohort distribution for males is the 10-14 age group, which represents 10.8 % of the recorded male population within the PBPA. The smallest cohort distribution for males was the 95+ age group, which represents less than 0.1% of the male population within the PBPA.

The largest cohort distribution for females is the 15-19 age group, which represents 10.3% of the recorded female population. The smallest cohort distribution for females was the 95+ age group which represents 0.1% of the female population.

The selected EDs found within an approximate 10 km sphere of influence of the Goat Islands are SE71, SW75 – SW92. The sphere of influence included, Galleon Harbour, Salt Harbour, and Old Harbour Fishing village. The percentage distribution of male and female for the 10 km sphere of influence of the Goat Islands is illustrated in Figure 51 below.

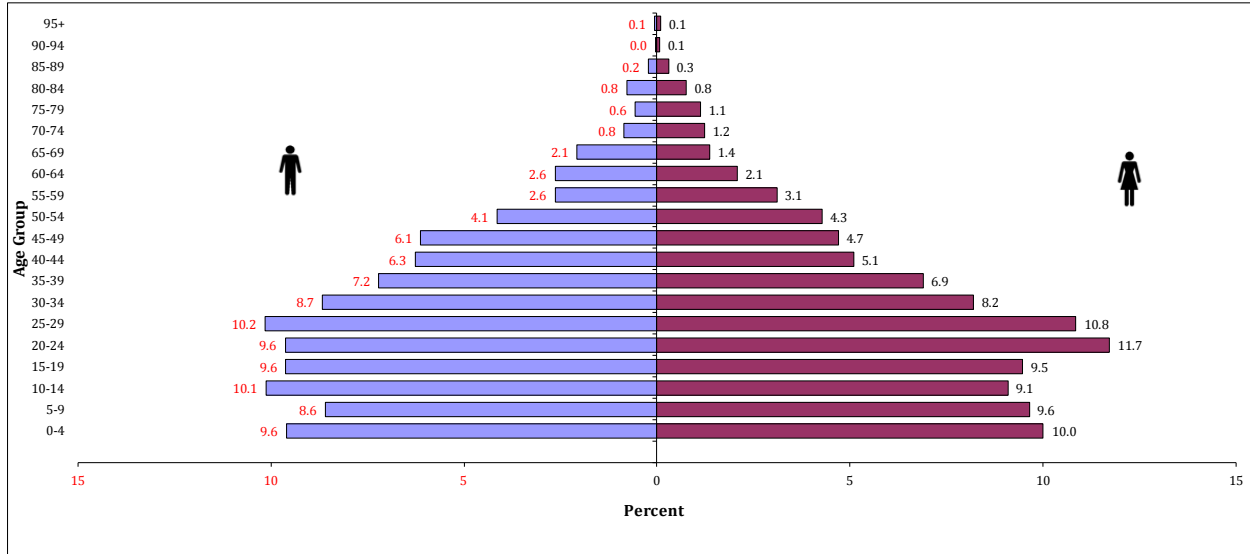


Figure 51: Population Pyramid showing the Gender Percentage Distribution within the Selected EDs and Special Areas within a 10 km Sphere of Influence

The largest cohort distribution for males is the 25-29 age group, which represents 10.2 % of the recorded male population within the 10 km sphere of influence. The smallest cohort distribution for males was the 90-94 age group, which represents less than 0.1% of the male population within sphere of influence.

The largest cohort distribution for females is the 20-24 age group, which represents 11.7% of the recorded female population within the 10 km sphere of influence. The smallest cohort distribution for females was the 90-94 and 95+ age groups which each represent 0.1% of the female population within the sphere of influence.

The ED with largest recorded population was South East 28 (SE 28). SE 28 has a population of 1923 persons, of which 986 are female and 937 are male

SE 28 represents 2.85 % of the recorded population of the PBPA.

The top 10 EDs with the largest recorded populations are shown in Table 13.

Table 13: Top 10 EDs with the Largest Populations

Rank	Parish	ED/Special Area	Female	Male	Total	Percentage of Population in PBPA
1	Clarendon	SOUTH EAST 28	986	937	1923	2.85
2	Clarendon	SOUTH EAST 89	587	577	1164	1.72
3	Clarendon	SOUTH EAST 116	513	545	1058	1.57
4	St. Catherine	SOUTH WEST 69	530	490	1020	1.51
5	St. Catherine	SOUTH 12	450	530	980	1.45
6	Clarendon	SOUTH EAST 86	494	481	975	1.44
7	Clarendon	SOUTH EAST 121	457	515	972	1.44
8	Clarendon	SOUTH EAST 107	453	448	901	1.33
9	St. Catherine	SOUTH 13	452	395	847	1.25
10	Clarendon	SOUTH EAST 48	431	394	825	1.22

None of the selected EDs within the 10 km sphere of influence rank within the top 10 EDs with the largest populations.

The Population Ranks of the selected EDs within the 10 km sphere of influence of the Goat Islands are shown in Table 14.

The selected EDs within the 10 km sphere of influence include areas such as: Old Harbour Bay, Salt River, Mitchelle Town, Hellshire, and Rocky Point. These selected EDs have a total recorded population of 10,356 persons of which 5,204 are female and 5,153 are male. The selected EDs represent 15.34% of the total population in the PBPA.

The ED with the highest rank of those within the 10 km sphere of influence is South West 75 (SW 75), and is ranked 15. SW 75 has a population of 751 persons, of which 367 are female and 384 are male.

SW 75 represents 1.11% of the recorded population of persons in the PBPA

Table 14: Population Rank of EDs within the Portland Bight Protected Area for EDs within the 10 km Sphere of influence of the Goat Islands

Rank	Parish	ED/Special Area	Female	Male	Total	Percentage of Population in PBPA
15	St. Catherine	SOUTH WEST 75	367	384	751	1.11
20	St. Catherine	SOUTH WEST 82	333	375	708	1.05
23	St. Catherine	SOUTH WEST 79	301	368	669	0.99
36	Clarendon	SOUTH EAST 71	283	273	556	0.82
51	Clarendon	SOUTH WEST 79	239	226	465	0.69
58	St. Catherine	SOUTH WEST 85	226	224	450	0.67
63	Clarendon	SOUTH WEST 75	221	218	439	0.65
74	St. Catherine	SOUTH WEST 81	204	198	402	0.60
78	St. Catherine	SOUTH WEST 86	209	183	393	0.58
80	St. Catherine	SOUTH WEST 87	203	186	390	0.58
86	St. Catherine	SOUTH WEST 83	173	191	364	0.54
90	St. Catherine	SOUTH WEST 88	180	176	357	0.53
94	St. Catherine	SOUTH WEST 80	171	174	345	0.51
95	St. Catherine	SOUTH WEST 76	187	156	343	0.51
100	St. Catherine	SOUTH WEST 89	187	147	334	0.49
102	Clarendon	SOUTH WEST 77	153	178	331	0.49
104	St. Catherine	SOUTH WEST 92	165	154	319	0.47
105	St. Catherine	SOUTH WEST 77	151	158	309	0.46
107	Clarendon	SOUTH WEST 76	154	150	304	0.45
113	Clarendon	SOUTH WEST 82	150	142	292	0.43
119	Clarendon	SOUTH WEST 81	136	140	276	0.41
122	Clarendon	SOUTH WEST 80	153	122	275	0.41
129	St. Catherine	SOUTH WEST 90	146	109	255	0.38
131	St. Catherine	SOUTH WEST 91	141	111	252	0.37
132	St. Catherine	SOUTH WEST 84	115	125	240	0.36
142	Clarendon	SOUTH WEST 83	83	108	191	0.28
143	St. Catherine	SOUTH WEST 78	96	91	187	0.28
145	Clarendon	SOUTH WEST 78	81	79	160	0.24
Total			5,204	5,153	10,356	15.34

9.3. Main Population Centers

There are 18 main population centers within the Portland Bight and Ridge area with a total of 13,664 buildings:

Table 15: Main population centers within the Portland Bight Protected Area

Main population centers within the Portland Bight Protected Area		
Moore Pen	Lionel Town	Braits Hill
New Harbour Village Phase I & II	Mitchell Town	Hayes
Longville Park	Amity Hall	Race Course
Salt River Community	Lloyds Pen	Longwood
Hellshire Community	Bushy Park	Portland Cottage
Rocky Point	New Bowens	Dawkins Pen

9.4. Present Land Use

The PBPA is mostly undeveloped and predominantly rural with diffuse commercial activity supporting the settlements found in the area. The general land use in the area can be classified as, but not limited, to the following:

- Rural Residential
- Mixed Residential/Commercial
- Residential
- Agricultural (predominantly, sugar cane cultivation)
- Industrial
- Recreational
- Wetlands
- Grassland
- Forest/Brush

Highway 2000 is in proximity to the area and the national railway system also has terminals at Port Esquivel, St. Catherine and Jamalco's Rocky Point, Clarendon within the

area. Vernamfield, which was also a part of the '*land for destroyer swap*' between the United States of America and Great Britain, is located to the west of the area.

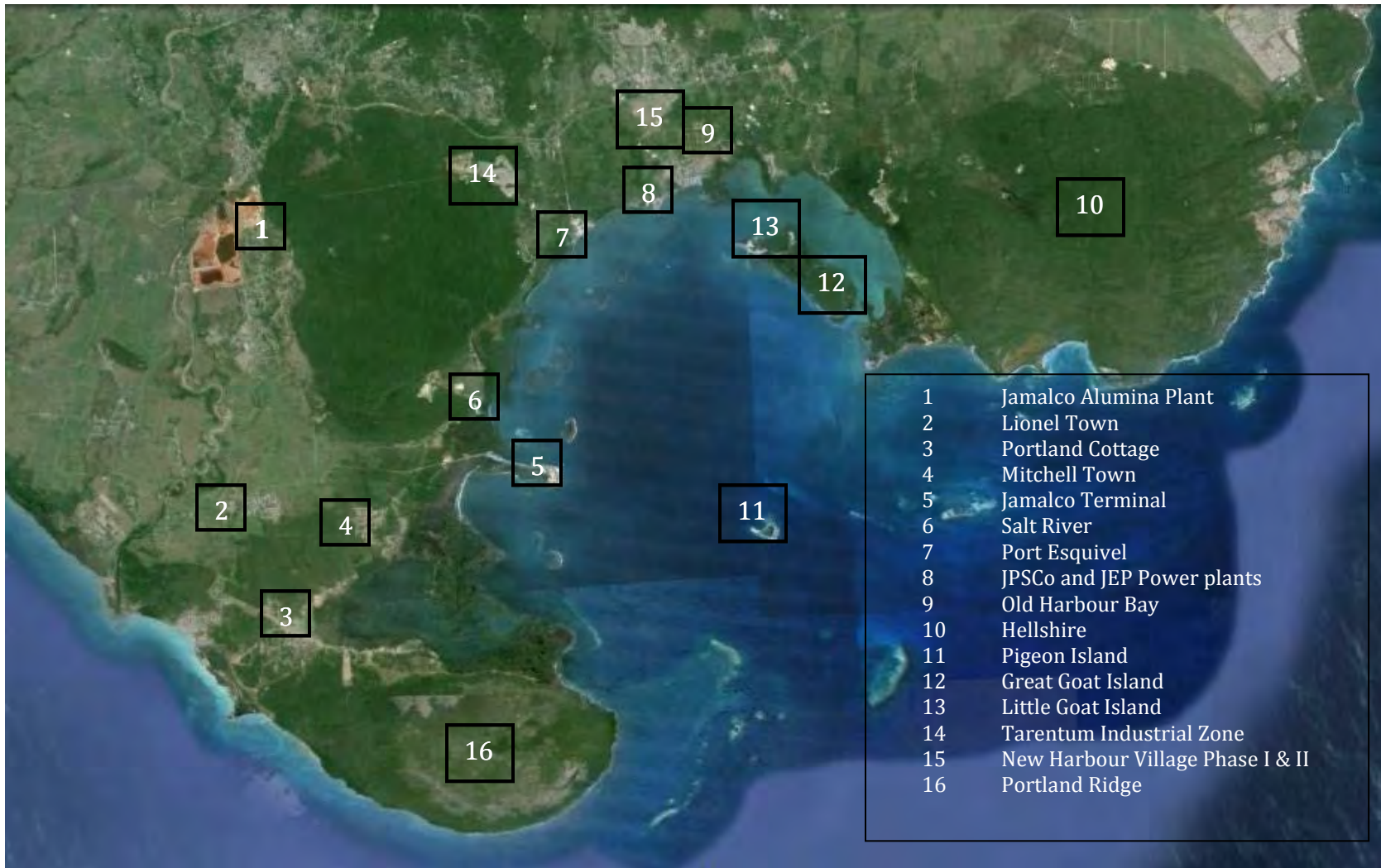


Plate 10: Facilities & Communities within the PBPA



Plate 11: Significant Natural Heritage, Recreational and Industrial Features at Salt River



Plate 12: Tarentum Industrial Estate at Salt River, Clarendon



Plate 13: Salt River Community and Salt River Spring

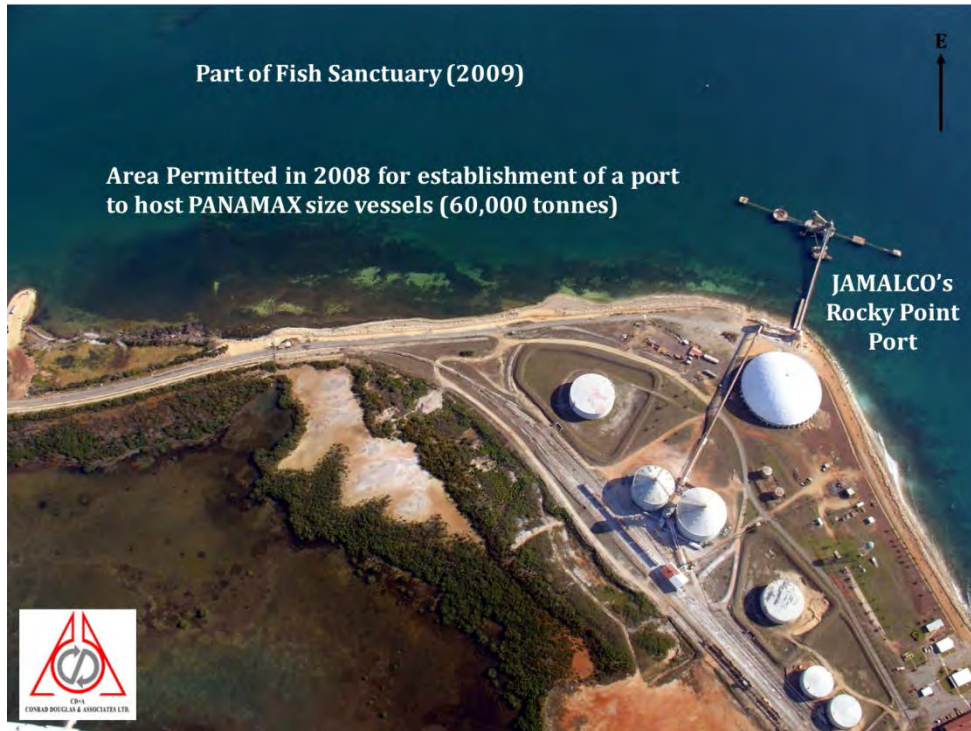


Plate 14: JAMALCO's Rocky Point Port and Adjacent Area which was permitted in 2008 for Establishment of a Port to Accommodate PANAMAX Sized Vessels



Plate 15: Burial Point and Wetlands in proximity to JAMALCO's Rocky Point Port



Plate 16: Port Esquivel – Winalco's Port and Jamaica Broilers Ethanol Plant



Plate 17: Longville Park Community and Environs



Plate 18: JPSCo Old Harbour Power Plant and JEP Barges



Plate 19: Old Harbour Bay Community

10.0. Fisheries

10.1. Background

The agricultural sector contributes approximately 7.3% of Jamaica's total gross domestic product (GDP), with the fishing industry contributing approximately 0.59% (JM\$2,985.8M) of that contribution (Ministry of Agriculture and Fisheries, 2008).

The Fisheries Division (FD) falls under the Ministry of Agriculture and Fisheries, and helps to regulate the industry by generating and maintaining a record of statistics that are relevant to the management and management goals of the industry. They, along with The Caribbean Regional Fisheries Mechanism, indicate that during the period 2001-2006, the fishing industry provided approximately 12,287 primary and secondary jobs.

Fisheries Division's records further indicate that:

- There were 18,294 registered fisher folks at the end of December 2008 operating from more than 9,000 vessels.
- There are 2,585 fishers registered with the Fisheries Division (14% of total registered fisher folks) as operating from Rocky Point and Old Harbour as of September 2013.
- The majority of these fishers make their catch on the Pedro Cays.
- The PBPA is in a degraded condition from dynamiting and over fishing.
- Galleon Harbour has deep soft sediment rich in H₂S as its substrate.
- Most of the fishers are artisanal fishermen operating from open canoe or reinforced fiberglass plastic (RFP) type boats powered by either outboard motors or oars, and
- Along the island some of the methods for fishing are fish pots, lines and nets. The dominant fishing gear is the Antillean Z-shaped trap commonly referred to as fish pots.
- 40,000 people directly and indirectly depend on Jamaica's fishing industry.

10.2. Overview of Fishing Areas & Target Fisheries of Jamaica

The Fishing Industry in Jamaica is regulated under the supervision of the Fisheries Division of the Ministry of Agriculture, falling under the category of inland or marine. The major marine fishing grounds are:

- Northern Shelf and Southern Shelf -Inshore
- Pedro Cays and Bank and Morant Cays, and Formigas Banks-Offshore

Local fishery target fish species found primarily in and around the continental shelf and along the Pedro Bank. These include:

- Coastal pelagic (e.g. sprat),
- Reef Fishes (e.g. snappers, parrot fishes, doctor fishes),
- Conch,
- Spiny lobster, and
- Shrimp.

The Portland Bight is primarily used to provide bait fish and as a nursery for the nearby reefs.

10.3. Overview of the Management of Special Fishery Conservation Areas in the Portland Bight Protected Area

Within the Portland Bight area there are three (3) areas zoned as special fisheries conservation area (SFCA) under the Fish Sanctuary Act of 2009. This is a special designation reserved for no-fishing zones for the reproduction of fish populations. These SFCAs have nature reserve statuses that have been declared by the Agriculture Minister under Section 18 of the Fishing Industry Act of 1975. It is illegal and punishable by law to engage in any unauthorized fishing activities in these demarcated zones.

There are three (3) declared SFCAs in the Portland Bight, all funded in whole or in part by the Government of Jamaica (GOJ). They are managed through a cooperative arrangement between the government and community organizations (non-government organizations

(NGOs)). Each partnership is formalized by a Memorandum of Agreement (MoA) between the Ministry and the collaborating organization, which outlines the responsibilities of the synergic entities. Under the MoA agreement, Government will provide financial resources for the partner NGOs to undertake the day-to-day operations of the SFCA. The Caribbean Coastal Area Management Foundation (C-CAM) is the sole environmental non-government agency engaged in the management of the PBPA. The three (3) SFCAs in the PBPA are:

- Three Bays (South of Hellshire hills in St Catherine),
- Galleon Harbour (North of the Goat Islands and South of Old Harbour Fishing Village),
- Salt Harbour, Rocky Point (Just North of Jamalco’s Rocky Point Port).

The boundaries of the three (3) SFCAs are delineated by redlines shown in Figure 52.

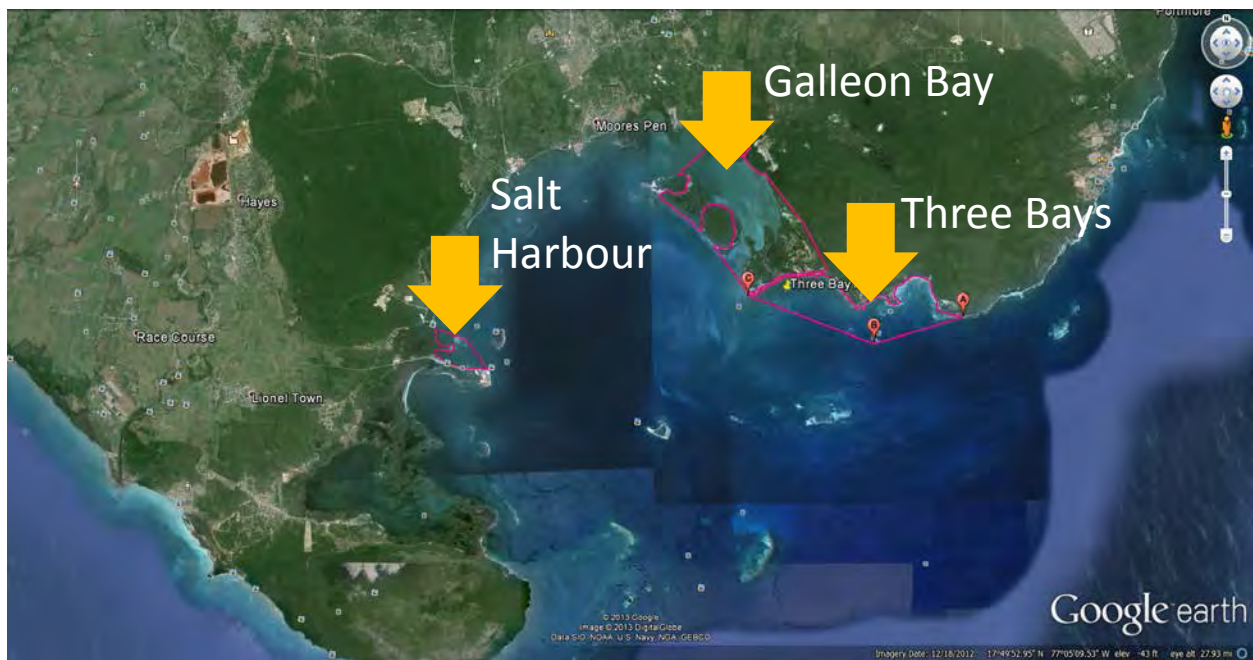


Figure 52: Boundaries of Special Fisheries Conservation Areas in the Portland Bight Protected Area

10.4. Outline of Fishable Resources near the Goat Islands of the Portland Bight Protected Area

The geographic areas covered are shown in Figure 53. This extends from Port Esquivel on the western edge of the Bay, then east to eastern Galleon Harbour and Goat Island on the eastern edge of the Bight. This represents the Upper (Northern) section of Portland Bight (Greater Old Harbour Bay), located mainly in the parish of St. Catherine. It should be noted that the outline does not cover any of the cays and islets located in the bay or the reefs associated with the areas further to the south, southeast and southwest. It is therefore specific to areas near, and around, the Galleon Harbour Fish Sanctuary.



Figure 53: Geographic boundaries of area, Port Esquivel (left arrow), the Goat Islands (centre arrow) and Galleon Harbour (right arrow). (Source: Google Earth Image).

10.4.1. Habitats

The marine area involved is dominated by the following habitats:

- a. Red and black mangroves (margins)
- b. Seagrass beds (off Port Esquivel and parts of Galleon Harbour to the east)
- c. Muddy sediment (edge of entire area, centre of area and floor of Galleon Harbour)
- d. Sandy substrate (other areas near Old Harbour Bay fishing beach near area called Moore's Pen in Figure 53 above)
- e. Estuarine (freshwater & brackish water zones, near outfall of streams draining wetlands near Cockpit close to Port Esquivel & Salt Island Creek in northeast Galleon Harbour),

Aiken (1998) and Aiken, Hay, and Montemuro (2003) describe the main characteristics of Galleon Harbour as red mangrove-seagrass junction, soft, deep H₂S-rich mud. It was noted that an adjoining area near Salt Island Creek just to the north of Galleon Harbour was dominated by very rich detritus and red mangrove with *Isognomon altus* (false oyster) on prop roots. It was also observed that Port Esquivel comprised pebbles, shingle, scattered Turtle grass (*Thalassia testudinum*), & eel grass, (*Syringodium filiforme*), brown fan alga (*Padina*) & near outfalls of the small Brower's River & Cockpit River, green sea urchins (*Lytechinus variegatus*).

10.4.2. Fishable species composition

Table 1 lists the ranked numbers (for Galleon Harbour) of fish and invertebrate species that were found by Aiken (1998) and Aiken, Hay, and Montemuro (2003).

The rankings of abundance are based on the following:

1. Identical sampling methods of two mesh diameter seine nets (a large 20 m long 20 mm mesh diameter net and a 10 m net with 1 mm diameter mesh) were used to sample areas coming in towards the shore (from a small boat) from a depth of 2 m, taking 30 paces with the 20mm mesh net and 40 paces with the 1mm mesh net and

hauling all catches on the shoreline. All catches were put into labelled containers and taken to a lab in preservative. These methods were used at all sites over the entire Bight over a 13 month period with one or two trips per month.

2. Identification and counting of all species and individuals took place in the lab and additionally, every single individual was weighed there and all results carefully recorded.

At the end of the work assignment, two indices of species abundance were obtained:

1. Numerical (frequency) occurrence, and
2. Weight or biomass.

In this way, each species (whether fish or not) was able to be ranked in terms of abundance in not one, but two ways.

It should be noted that Aiken (1998) only investigated the fishable resources in the shallows out to 3 m depth maximum based on the fishing gears used by the researchers.

Table 16: Species and Relative Numbers of Fishable Organisms Found at Galleon Harbour & Port Esquivel, St. Catherine in 1997 & 1998 (Aiken 1998) - Ranked for Galleon Harbour only.

Scientific name	Common name	Family	Port Esquivel	Galleon Harbour
<i>Eucinostomus gula</i>	Silver jenny	Gerreidae	13	138
<i>Diapterus rhombeus</i>	Caipita mojarra	Gerreidae	0	94
<i>Haemulon sciurus</i>	Bluestriped grunt	Haemulidae	1	44
<i>Scarus croisensis</i>	Striped parrot	Scaridae	0	36
<i>Anchoa lyolepis</i>	Dusky anchovy	Engraulidae	6	16
<i>Haemulon plumieri</i>	White grunt	Haemulidae	0	16
<i>Sphaeroides spengleri</i>	Bandtail pufferfish	Tetraodontidae	4	14
<i>Penaeus spp.</i>	Marine shrimp	Penaeidae	0	11
<i>Haemulon</i>	Tomtate grunt	Haemulidae	12	9

Scientific name	Common name	Family	Port Esquivel	Galleon Harbour
<i>aurolineatum</i>				
<i>Sparisome chrysopterygion</i>	Retail parrot	Scaridae	0	9
<i>Callinectes spp.</i>	Swimming crab	Portunidae	11	9
<i>Sparisome rubripinne</i>	Yellowtail parrotfish	Scaridae	0	8
<i>Lutjanus apodus</i>	Schoolmaster snapper	Lutjanidae	0	4
<i>Lutjanus synagris</i>	Lane snapper	Lutjanidae	0	4
<i>Bothus lunatus</i>	Peacock flounder	Bothidae	0	3
<i>Archosargus rhomboidalis</i>	Sea bream	Sparidae	8	2
<i>Calamus spp</i>	Porgy	Sparidae	0	2
<i>Sicomyia spp</i>	Grass shrimp	Sicomyidae	0	2
<i>Lutjanus griseus</i>	Grey snapper	Lutjanidae	0	2
<i>Rypticus maculatus</i>	Whitespotted soapfish	Serranidae	0	2
<i>Strongylura notata</i>	Redfin needlefish	Strongyluridae	0	2
<i>Scorpaena plumier</i>	Spotted scorpionfish	Scorpaenidae	0	2
<i>Caranx bartholomaei</i>	Yellow jack	Carangidae	0	1
<i>Panulirus argus</i>	Spiny lobster	Palinuridae	0	1
<i>Gerres cinereus</i>	Yellowfin mojarra	Gerreidae	0	1
<i>Synodus foetens</i>	Inshore lizardfish	Synodontidae	0	1
<i>Acanthurus bahianus</i>	Ocean surgeonfish	Acanthuridae	0	1
<i>Scorpaena brasiliensis</i>	Plumed scorpionfish	Scorpaenidae	0	1
<i>Ocyurus chrysurus</i>	Yellowtail snapper	Lutjanidae	0	1
<i>Lactophrys triqueter</i>	Smooth trunkfish	Ostracidae	0	1
<i>Urolophus jamaicensis</i>	Yellowspotted stingray	Dasyatidae	0	1
<i>Synodus intermedius</i>	Sand diver	Synodontidae	0	1

Scientific name	Common name	Family	Port Esquivel	Galleon Harbour
<i>Symphurus arawak</i>	Tonguefish	Cynoglossidae	0	1
<i>Haemulon bonairiense</i>	Black grunt	Haemulidae	0	1
<i>Lachnolaimus maximus</i>	Hogfish	Labridae	0	1
<i>Monacanthus tuckeri</i>	Slender filefish	Monacanthidae	0	1
<i>Stegastes leucostictus</i>	Beaugregory	Pomacentridae	0	1
<i>Squilla spp</i>	Mantis shrimp	Squillidae	0	1
<i>Sparisoma aurofrenatum</i>	Redband parrot	Scaridae	13	138

Table 16 shows that the shallow areas investigated in Galleon Harbour and Port Esquivel were dominated by gerreids, family Gerreidae (commonly called mojarras or maccabacks) and by grunts (Haemulidae), followed by parrotfishes (Scaridae). All three groups are commercial species, particularly the parrotfishes in recent years. Aiken (1998) and Aiken, Hay, and Montemuro (2003) showed that the 10 most abundant species (across the entire Bay) comprised three small pelagic (surface-dwelling) coastal species (anchovies, sardines and herrings) and seven benthic (bottom-dwelling) species including the swimming crabs. All of the ten most numerous species are commercial species. Crustaceans (e.g. marine shrimp and spiny lobsters) comprised only 7.1% and molluscs (e.g. queen conch, *Strombus gigas*) a mere 2% of all species taken over the entire Bight. The three most abundant finfish species are of value as baitfish in the small hook-and-line fishery and also in the gillnet fishery for sprats & thread herrings.

Table 16 indicates that Galleon Harbour had a very high species Richness Index number of 39 (species present). This level of Species Richness is relatively high for an estuarine/coastal lagoon environment (Colinvaux, 1986). In terms of Spatial Distribution of species, Aiken, Hay, and Montemuro (2003) observed that the study from Aiken (1998) indicated that (generally) the number of species found was greater per site in the eastern portion of Portland Bight than in the western portion.

10.5. Ecological links

The dusky anchovy (*A. lyolepis*, family Engraulidae) ranked fourth most abundant in Galleon Harbour (see Table 16 above) but was the most abundant species found in the entire Bight (Aiken 1998; Aiken, Hay, and Montemuro 2003). This surface dwelling schooling species had a mean size of 41.25mm total length and mean weight of 0.53 g. Despite its small size it is vital in the food chain or trophic linkages of the food web as a forage species for many larger species. The most abundant species in Galleon Harbour was the silver jenny mojarras (*Eucinostomus gula*) and was relatively common at Port Esquivel (Aiken 1998; Aiken, Hay, and Montemuro 2003). This species is strongly associated with those areas where red mangrove prop roots and muddy substrate dominate. The mean size taken from all areas of the Portland Bight was 68mm TL going up to 480 mm TL (Humann and Deloach 2006). It is therefore common in the Bight at a size when it is only one-seventh of its possible maximum size. This indicates quite strongly that it is present mostly as juveniles in the Bight. All these juveniles in the Portland Bight are preyed on by larger piscivorous species such as snappers and groupers and especially by the invasive lionfish, *Pterois volitans* (Buddo, pers. comm.) which has been present in the area since about 2008.

The Galleon Harbour area was the most diverse of all the areas sampled (Aiken 1998; Aiken, Hay, and Montemuro 2003), suggesting that the area was a major nursery and critical habitat for fishable species of all types.

It should be noted that Aiken (1998) and Aiken, Hay, and Montemuro (2003) identified the Salt Island Creek (red mangrove estuarine ecosystem) as being of great importance.

Closely coupled with this area was the extensive flat or false oyster (*Isognomon*) population found on the resident mangrove prop roots, and the large caipita mojarra (maccaback, family Gerreidae) population over the mud in the same area. This is the only location where this fish species was found, and its presence may be related to the nutrients brought down to the Portland Bight by this small but permanent tidal creek. Subsequent to the findings of Aiken (1998), selected portions of the Portland Bight were created as Fish Sanctuaries – one of which was Galleon Harbour (Aiken et al. 2012).

10.6. Overall species composition in the entire Portland Bight

The composition of the species of finfish (scalefish) found by Aiken (1998) in all parts of the Portland Bight (including Galleon Harbour and Port Esquivel) is represented in Figure 54 below.

Figure 54 shows that at 22% the gerreids or maccabacks (small benthic carnivores & omnivores) preferring muddy substrate, dominate numerically.

These fish are generally of medium to low value. Those fishes of higher value than the mojarras (such as the Haemulidae - grunts, Lutjanidae- snapper and some others) generally comprised less than 10%. The figure also shows that the sprats, herrings (Clupeidae) and anchovies (Engraulidae) together comprise 32% of the fishes found. Sprats, herrings and anchovies are low valued commercial fish species groups. These three families interestingly, make up 54% of the fishes found at sites sampled in the Portland Bight. This means that the upper portion of Portland Bight possesses a fish and commercial fishable species composition generally typical of the rest of the Bight (see Figure 53).

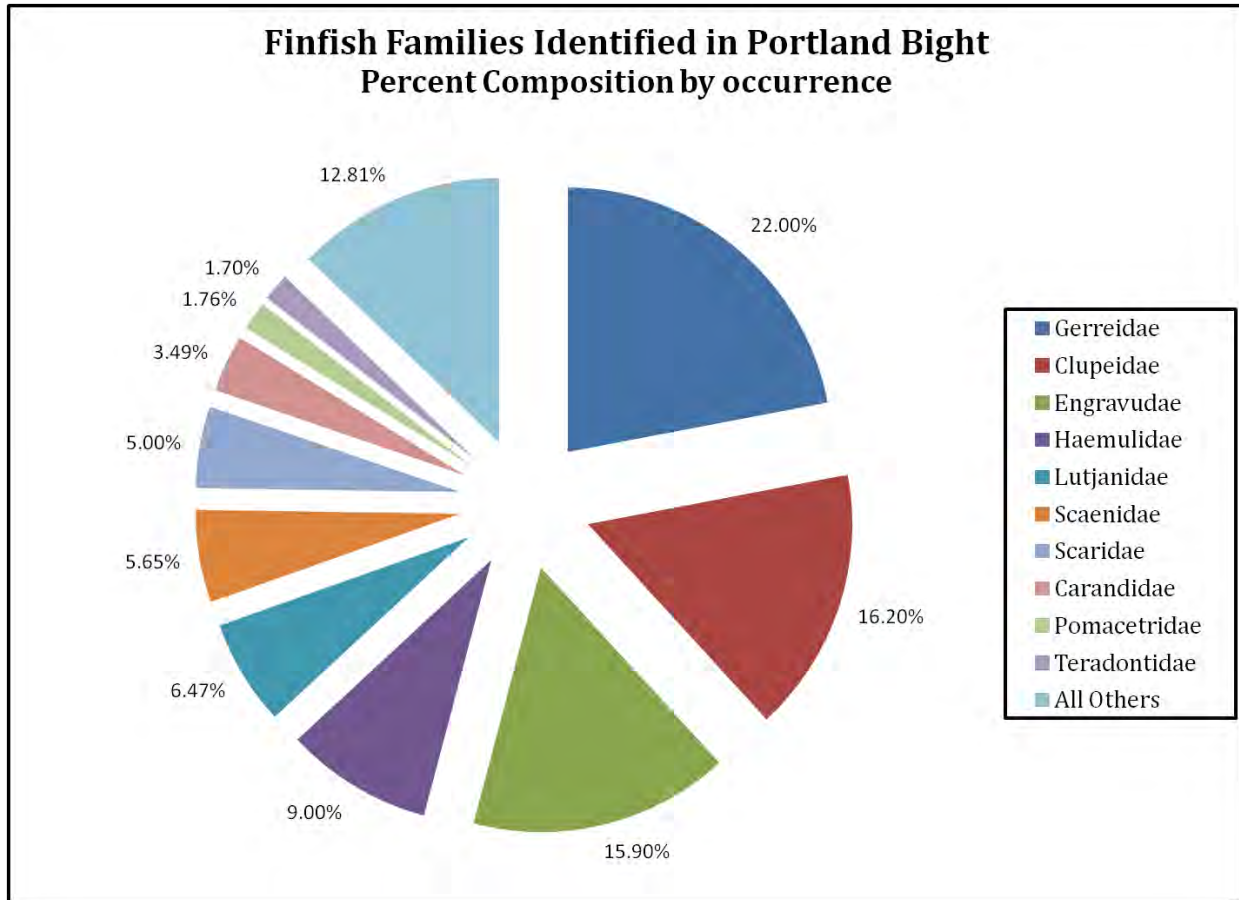


Figure 54: Percentage Finfish species composition in all areas sampled across the entire Portland Bight (Old Harbour Bay, St. Catherine), 1997-1998 (adapted from Aiken, 1998). These data include Port Esquivel and Galleon Harbour.

It is important to note that the seagrass beds out in the Bay south of Port Esquivel (Figure 52:) were not sampled in Aiken (1998). However, like all the seagrass beds over shallow water in areas that were sampled, would probably possess juveniles of several marine fish and some invertebrate species.

10.7. Employment Options for Fishers

In 1988 a study of the fisheries resources in the Bight incorporated a first sociological survey of the fisheries of western Portland Bight around the area of Salt River and Portland Cottage, Clarendon (Espeut and Grant 1990) and later Espeut (1992). It was found that a majority of fishers had additional occupations and income-earning activities in addition to their primary activity of fishing in and around Portland Bight. Some were policemen,

farmers, coal burners, jockeys, disco operators, net makers, fish pot makers, carpenters, masons, boat repairers, restaurant operators and wage workers at the Kingston airport and the JPS power plant (OHB). Some fishers are presently (that is, 2013) employed as fish sanctuary wardens after training by the Portland Bight Fisheries Management Council which in turn is managed by the Caribbean Coastal Area Management Foundation (CCAMF), based in Salt River & Lionel Town, Clarendon (Haynes and Parchment 2010). However, those now employed as wardens are but a handful of the more than 500 or more fishers operating from the landing sites around the Bight e.g. Old Harbour Bay fishing beach. Current active versus registered fisher numbers using the Bight are in need of updating.

11.0. Conclusions

Our conclusions are as follows:

- Declared in 1999 as a Multiple Use National Park the Portland Bight Protected Area (PBPA), which includes the Goat Islands, among 16 other cays and islands, is a mixture of major natural heritage resources and industrial, agricultural, commercial and residential developments.
- The area also includes an industrial zone at Tarentum.
- The PBPA does not fall into any of the IUCN categories of protected areas, being an area of mixed development consisting of major natural heritage resources and major industrial, agricultural, commercial and residential activities which have been in existence for several decades.
- The PBPA hosts the largest mangrove system in Jamaica and is a declared RAMSAR site.
- The PBPA presents itself as a Sustainable Development Area for which it was originally proposed (eco-development area by CD&A in 1992) and which was later supported by The Nature Conservancy (TNC), which proposed it as a Sustainable Development area in 2004. For these reasons, the two (2) extremes of natural resource conservation and economic development exist in the area. This illustrates that effective natural resource conservation and economic development are not necessarily mutually exclusive.
- Twenty-one (21) rare, threatened and endangered species of plants and animals are located in the PBPA. Except for the iguana, which is found in the Hellshire Hills only, five species of blind shrimps located in caves in Portland Ridge, the Portland Ridge tree frog, two species of thunder snakes, the blue tailed galliwasp and the fig eating bat which is found in the Hellshire Hills, these species are also found in other locations in Jamaica.
- There are three (3) fish sanctuaries in the PBPA which were established in 2010 under the Fishing Sanctuary Act of 2009.

- Of 18,294 registered fishers in Jamaica, 2,500 (14% of registered fishers) operate from landing sites in Hellshire, Old Harbour Bay and Rocky Point, spanning parts of the coastline of the parishes of St. Catherine and Clarendon.
- There are about 500 active fishers (2.7% of registered fishers) in the area who use artisanal boats. The majority of these fish outside of the PBPA. Fishing provides mainly supplemental income to other activities in which they are engaged such as farmers, policemen, coal burners, jockeys, disco operators, net makers, fish pot makers, carpenters, masons, boat repairers, restaurant operators and wage workers at the Kingston airport and the JPS power plant at Old Harbour Bay. A few of the fishers are also employed as wardens in the fish sanctuary.
- Some 40,000 persons directly or indirectly find employment through Jamaica's fishing industry.
- The fisheries in the PBPA are in a degraded condition as a result of over fishing and dynamiting over the years.
- The substrate of the Galleon Harbour primarily consists of relatively deep hydrogen sulphide enriched, soft sediment mainly of terrestrial origin.
- The Goat Islands are still inhabited by wild goats.
- It does not appear that there are iguanas on the Goat Islands.
- The Goat Islands have experienced anthropogenic intrusion (human activity) from Pre Columbian times. During World War II, Little Goat Island was developed as a United States of America Naval Station under the 'destroyers for land exchange' between Great Britain and the United States of America. 75,000 gallons of fuel were stored in 11 Underground Storage Tanks (USTs). There was a power plant on the site. Water was barged to the site and treated and stored. 2.8 million cubic yards of dredged spoils was extracted in creating a jetty for sea planes and naval access to the site. It would appear that the dredged spoils, at least in part, was stored adjacent to and between the Goat Islands and might have influenced its current bio-physical condition.
- There is significant scope for improvement in the management of the PBPA. This reportedly results mainly from insufficient funding.

- There are 68 pieces of international and national legislation, which may be taken into account in developing a transshipment port and associated logistics hub in a protected area.
- The project is conceived in the following socio-economic context:
 - ✓ Jamaica is engaged in a four year extended fund programme with the International Monetary Fund (IMF).
 - ✓ Jamaica has a Special Drawing Rights (SDR) with the IMF that now stands at 225%.
 - ✓ Jamaica's debt is JM\$1.8 trillion.
 - ✓ Jamaica has the highest debt risk burden in the world (Johnston 2013).
 - ✓ The total annual budget of the country is over JM\$6 billion, with more than 50% being used for debt servicing.
- The major sectors that generate income for the Jamaican economy in order of ranking are:
 - ✓ The Diaspora in the form of remittances
 - ✓ Tourism
 - ✓ Bauxite
 - ✓ Export agriculture
- Jamaica also has a high unemployment rate. The official unemployment rate jumped in April 2013 to 16.3 percent which is an increase from 14.5 percent in January and 14.4 percent a year earlier (IMF 2013).

12.0. Recommendations

Our recommendations are as follows:

1. Consequent on the ecological, social and economic importance of the Portland Bight Protected Area, it is strongly recommended that any project to establish a Transshipment Port and Logistics Hub in the PBPA, be subjected to a detailed Environmental Impact Assessment (EIA). In this regard, we have prepared a Draft Terms of Reference (See Appendix I). However, in this Executive Summary we highlight the following among the various tasks, which must be carried out:
 - Detailed description of the project (Electro-mechanical, structural and civil engineering designs for the pre-construction, construction and operation phase). Projected ship traffic analysis.
 - Alternatives analyses
 - Voluntary and mandatory ongoing public participation and consultations, inclusive of contact socio-economic surveys
 - Estimates of natural resource valuation
 - Cost Benefit Analyses at the macro and micro economic levels, inclusive of estimates of the Economic Rate of Return (ERR) for the proposed project
 - Description of the bio-physical and socio-cultural environment
 - Detailed oceanographic assessments
 - Drainage assessment
 - Analysis of the regulatory framework
 - Identification of potential impacts
 - Impact Mitigation
 - Risk assessment to inform, among other things impact identification and impact mitigation
 - Detailed environmental management & monitoring plan
 - Preparation of an Emergency Response Plan

2. Because there are risks associated with any project and several unknowns in developing a transshipment port in the PBPA, a risk assessment must be carried out as part of the detailed Environmental Impact Assessment.
3. Develop a plan for the institutional strengthening of the Protected Areas Trust. This should be aimed at enabling the improved, efficient and effective management of the natural resources of the proposed and declared protected areas in the Portland Bight Protected Area and Jamaica, in general.
4. The substrate of the Galleon Harbour is enriched with hydrogen sulphide and exists as a deep soft sediment. This appears to result from the influent of high sediment and organic loading from industrial installations and the drainage regime of both the natural and built environment. This may lead to the development of anoxic conditions through degradation of complex organic compounds (polycyclic aromatic compounds, humenes, fulvenes, humic and fulvic acids, humates and fulvates) by microorganisms. It is not known if the wave action and currents in the area are sufficient to facilitate turbulence and mixing to minimize the possible existence of anoxic conditions. It must be noted that the Portland Bight area hosts the driest conditions (highest evapo-transpiration rate and lowest rainfall) in Jamaica, at Portland Cottage at which a solar salt production facility was established.

From the marine survey conducted along the coast of the Goat Islands, it is evident that there are distinct differences between the terrestrial and marine influences of the northern and southern sides of the Goat Islands, respectively.

According to Aiken, et al, the following must be noted: *“The Galleon Harbour area was the most diverse of all the areas sampled (Aiken 1998; Aiken, Hay, and Montemuro 2003), suggesting that the area was a major nursery and critical habitat for fishable species of all types.”*

It is therefore recommended that the scientific criteria used for selecting any area as a fish sanctuary should be based on detailed physico-chemical and biological information (as well as the biophysical and socio-cultural information of the area, in

general) obtained by systematic investigation over a scientifically acceptable period of time.

It is highly probable that there are other areas in Portland Bight which are more suitable for the establishment of fish sanctuaries than the Galleon Harbour.

13.0. Glossary

Alluvium	Sediment deposited by flowing water, as in a riverbed, flood plain, or delta
Anoxic	Absence of oxygen
Anthropogenic	Caused by humans
Avi-fauna	The birds of a specific region or period
Ballast	Any substance, such as sand or water, used to stabilize a ship when it is not carrying cargo.
Beach	An area of sand or pebbles sloping down to the sea or lake.
Benthic	Relating to the bottom of a sea or lake or to the organisms that live there
Bight	A bend or curve, especially in a shoreline
Carbonaceous sandy clay	Soil composed of a mixture of carbonaceous sand, clay, and silt
Cay	A small low island or bank of sand and coral fragments.
Clay	A sedimentary material with grains smaller than 0.002 millimeters in diameter
Conservation	The protection, preservation, management, or restoration of wildlife and of natural resources such as forests, soil, and water
Coral Reef	A marine ridge of reef consisting of coral and other organic material consolidated into limestone, lying just beneath the surface of the sea.
Drogue	A funnel-shaped device towed as a target by an airplane
Endangered	Species in danger of becoming extinct
Endemic	Present with a localized area or only found in a particular group of animal
Environmental Impact Assessment	A study of all the factors which a land development or construction project would have on the environment in the area, including population, traffic, schools, fire protection, endangered species, archeological artifacts, and community beauty
Estuary	The widening channel of a river where it nears the seas.
Fauna	All the animal life of a given plane and time
Fishery	The industry or occupation devoted to the catching, processing, or selling of fish, shellfish, or other aquatic animals

Flora	All plant life of a given place and time
Fulvates	The salts of fulvic acid
Fulvenes	C ₆ H ₆ A yellow oil, an isomer of benzene
Fulvic acid	The acid radical found in humic matter which is soluble in alkali, acid, methyl ethyl ketone, and methyl alcohol
Geomorphology	The study of the characteristics, origin, and development of the form or surface features of the earth or other celestial bodies
Habitat	The natural home of an animal or plant
Hard Coral	Are marine corals that generate a hard skeleton commonly made of calcium carbonate
Herbaceous	Relating to or characteristic of an herb as distinguished from a woody plant
Holocene era	Of or belonging to the geologic time, rock series, or sedimentary deposits of the more recent of the two epochs of the Quaternary Period, beginning at the end of the last Ice Age about 11,000 years ago and characterized by the development of human civilizations
Humates	are the salts of humic acids and come from the remains of plant and animal life
Humenes	the collective name for the acid radicals found in humic matter.
Humic acid	Typically separated from humic matter by alkaline extraction the acid radical found in humic matter which is soluble in alkali but insoluble in acid, methyl ethyl ketone, and methyl alcohol.
Hydrogen sulphide	A colourless poisonous soluble flammable gas with an odour of rotten eggs: used as a reagent in chemical analysis
Indigenous	Originating or occurring natural in a country or area
Island	A piece of land that is completely surrounded by water
Legislation	The act or process of making laws; enactment
Mangrove	A tropical evergreen tree or shrub with intertwining aerial roots that forms dense thickets along coasts
Marine	Of, found in, or relating to the sea.
Marine Pollution	The introduction by man, directly, or indirectly, of substances or energy to the marine environment resulting in deleterious effects
Maritime	Of or relating to shipping
Midden	A dunghill or pile of refuse
Migratory	To go from one place to settle in another

Mitigation	To act in such a way as to cause an offense to seem less serious
National Park	An area of land protected by a national government for its scenic or environmental importance.
Natural Resources	Naturally occurring materials such as coal, oil and minerals
Nature Reserve	An area of land that is preserved and managed in order to protect to protect its animals and plants
Panamax	Mid-sized cargo ships that are capable of passing through the lock chambers of the Panama Canal which are 1,050 ft (320.04 m) in length, 110 ft (33.53 m) in width, and 41.2 ft (12.56 m) in depth.
Policy	A plan or course of action, as of a government, political party, or business, intended to influence and determine decisions, actions, and other matters
Protected Area	Geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values
Regulation	A governmental order having the force of law.
Remote Sensing	The use of an instrument, such as a radar device or camera, to scan the earth or another planet from space in order to collect data about some aspect of it
Ridge	A long narrow raised land formation with sloping sides esp one formed by the meeting of two faces of a mountain or of a mountain buttress or spur
Riverine	Of or pertaining to a river
Saline	Of, containing, or tasting of common salt; salty
Sandy Clays	Soil composed of a mixture of sand, clay, silt, and organic matter
Seagrass	Underwater flowering plants growing in shallow coastal waters
Sediment	Solid fragments of inorganic or organic material that come from the weathering of rock and are carried and deposited by wind, water, or ice
seine net	A large fishing net made to hang vertically in the water by weights at the lower edge and floats at the top
Soft Coral	Are an order of corals which do not produce calcium carbonate skeleton
Spatial Distribution	The geographic occurrence or range of an organism
Standards	An acknowledged measure of comparison for quantitative or qualitative value

Substrate	A surface on which an organism grows or is attached
Sustainable Development	This is development that meets the needs of the present without compromising the ability of future generations to meet their own needs
Terrestrial	Of the land as opposed to the sea or air
Threatened species	Animal species; that are on the verge of extinction
Transshipment port	A port which facilitates the movement of goods from one shipping vessel to another.
Unconsolidated Sands	A loose, caving sand
Van Veen Grab Sample	An instrument to sample sediment in the ocean
Vertebrate	Having a segmented backbone
Vulnerable Species	Animal species capable of or susceptible to being extinct
Wetland	A area of marshy land
Wilderness Area	A wild uninhabited uncultivated region
Xerophyte	A plant adapted to living in a dry arid habitat

14.0. Bibliography

The preparation of this report was informed by more than forty-three (43) studies conducted by CD&A in the PBPA; and other publications and other authors cited in the bibliography. It is also informed by several other studies locally and internationally on related facilities. Examples of these are:

- Environmental Impact Assessments for establishing the Port Authority of Jamaica's Gordon Cay Terminal,
- Environmental Monitoring of Dredging Operations in Kingston Harbour,
- Assessment of Jamaica Gypsum Quarries Harbour Facilities,
- EIA for the Establishment of Cement Terminals in Vieux Fort St. Lucia,
- EIA for Establishment for Cement Terminal in Land of Canaan in Guyana,
- Review of Port Facilities in Guatemala,
- Review of Shipping Facilities in the Mississippi,
- Environmental Due Diligence Audit of Port Kaiser and Port Rhodes Jamaica,
- EIA for the Establishment of a Caustic Soda Plant in Jamaica in which all existing and potential sites for the establishment of a port and shipping facilities were evaluated,
- A Technical and Engineering Audit of The Nikolaev Alumina Plant which included a study on fugitive dust formation and dispersion at the Nikolaev Alumina Plant's port facilities in The Ukraine,
- EIA and environmental monitoring for the expansion of the Montego Bay Freezone for The Port Authority of Jamaica,
- An Environmental Opinion Statement for the Establishment of a Cement Plant and Jamaica Bauxite Mining Port at Lydford and Ocho Rios St. Ann.

Aiken, Karl. *Report on Survey of Fishable Resources of Portland Bight and Adjacent Areas 1997-1998*. Kingston: South Coast Conservation Foundation, 1998.

Aiken, Karl, Brandon Hay, and Steven Montemuro. *Preliminary Assessment of Nearshore Fishable Resources of Jamaica's Largest Bay, Portland Bight*. Proc. Gulf & Carib. Fish. Instit, 2003.

Aiken, Karl, G Oliver Squire, Andre Kong, and Stephen Smikle. *Creating a Fish Sanctuaries Network in Jamaica, West Indies*. Proc. Gulf & Carib. Fish Institute, 2012.

"An Assessment of the Economic Impact of Climate Change on the Agriculture Sector in Jamaica." United Nations Economic Commission for Latin America and the Caribbean, October 21, 2011.

Asprey, G.F., and R.G. Robbins. *The Vegetation of Jamaica: Ecological Monographs*, 1953.

Black, Clinton Vane de Brosse. *The History of Jamaica*. Harlow: Longman, 1988.

Bowman, T.E. "Stygiomysis Major: A New Troglobitic Mysid from Jamaica and Extension of the Range of *S. Holtuisi* to Puerto Rico (crustacean: Mysidacea: Stygiomysidae)." *International Journal of Speleology* (1976): 365–373.

Bowman, T.E. "A Review of the Genus *Anthromysis* Including New Species from Jamaica and Oaxaca, Mexico, and Redescription and New and Cave Fauna of the Yucatan Peninsula." *Association for Mexican Cave Studies, Bulletin 5* (1977): 27–38.

CD&A. *A Plan for a National System of Protected Areas*. Jamaica: Jamaica Conservation and Development Trust, 1992.

———. "Assessed a Heavy Fuel Oil (HFO) Storage Site at Port Bustamante and Its Carrying Capacity for Shell Company (West Indies) Limited, Kingston, Jamaica;," n.d.

———. "Assessment of a Plan to Store Spent Power Plant Stack Gas Scrubbing Material in Jamaica for Jamaica Bauxite Mining Limited (JBML)," n.d.

———. "Audiometric Survey for the Doctor Bird Power Station, Old Harbour, St. Catherine, Jamaica," 1997.

- . “Baseline Study for Alumina Spillage on the Marine Environment at JAMALCO’s Rocky Point Facility, Clarendon, Jamaica,” 1996.
- . “Climatic Studies and Preliminary Impact Assessment of the Proposed Salt River Coal/Oil Fired Generating Plant, Clarendon,” 1995.
- . “Closure Plan for Five (5) Facilities Operated by the Jamaica Broilers Group, Spring Village, Clarendon,” 2011.
- . “Comments to the Bureau of Standards Jamaica (BSJ) on the ISO 14001 (Environmental Management System [EMS] Standard,,” n.d.
- . “Conducted a Professional Document Review and Developed Recommendations for Polychlorinated Biphenyl (PCB) Management in Jamaica,” n.d.
- . “Contamination Assessment and Decommissioned Multiple Diesel Oil Underground Storage Tanks (USTs) for ALPART Mining Venture Limited (AMV), Manchester, Jamaica,,” n.d.
- . “EIA for a Major Chemical Caustic Soda Complex to Be Located at Port Esquivel, Clarendon on Behalf of Jamaica Venture Fund, Caribbean Development Bank and the European Development Bank,” 1994.
- . “EIA for Chemical Lime Corporation for Establishment of a Limestone Quarry, Lime Plant Shipping Port and Infrastructure, Portland Bight, Clarendon,” 1993.
- . “EIA for JAMALCO’s 2.8 MTPY Efficiency Upgrade Including Mines, Refinery and Port at Rocky Point,” 2004.
- . “EIA for the Construction and Operation of a Temporary Barge Unloading Facility at Rocky Point, Clarendon,” 2007.

- . “EIA for the Construction of a 12 Million MTPY Limestone Shipping Port and Conveyor Corridor to Facilitate PANAMAX Size Vessels for the CEMEX/Rinker Jamaica Facility at Rocky Point, Clarendon, Jamaica,” 2008.
- . “EIA for the Construction of Heritage Bay Hotel and Marine Resort Development,” 2007.
- . “EIA for the Construction of Run-off Water Storage (ROWS) Ponds at JAMALCO Halse Hall, Clarendon, Jamaica a Part of Portland Bight, Harris Savannah and Braziletto Area,” 2010.
- . “EIA for the Establishment of a Steel Plant Based on Red Mud for Zia Metallurgical, Portland Bight, Clarendon,” 2001.
- . “EIA for the Expansion of the Rinker Braziletto Quarry,” 2008.
- . “EIA for the Rehabilitation and Construction of a Residue Disposal Area (RDA) for a Major Bauxite Operation in Jamaica, a Part of Portland Bight, Harris Savannah and Braziletto Area,” n.d.
- . “Environmental Assessment of Damage Caused by Hurricane Ivan to Jamalco’s Rocky Point Port, Clarendon,” 2007.
- . “Environmental Baseline Study (EBS) for the JPSCo’s Proposed Coal/oil Fired Power Plant at Salt River,” 1995.
- . “Environmental Due Diligence Audit (EDDA) of Chemical Lime Company, Salt River, Clarendon, Jamaica,” 2008.
- . “Environmental Impact Assessment (EIA) in Jamaica for the Inter- American Development Bank,” 1992.
- . “Environmental Impact Statement for a Renewable Based Power Generation Facility, Clarendon,” 1994.

- . “Environmental Monitoring of the Construction Activities at Norman Manley International Airport,” 1998.
- . “Environmental Monitoring Services for the Dredging of the Kingston Harbour, Kingston, Jamaica for Port Authority of Jamaica,” 1996.
- . “Environmental Pre-feasibility Study and Risk Profile for the EXMAR Consortium’s Floating Liquefied Natural Gas (LNG) Storage and Regassification Facility Proposed for Port Esquivel, St. Catherine, Jamaica,” n.d.
- . “Facilitated a Solid Waste Management Workshop for Caribbean Nationals for UWICED/IDB,” n.d.
- . “Implemented the Local Certification Requirements for ISO 14001 (EMS) at the ALCAN Alumina Plants in Kirkvine, Manchester, Jamaica,” n.d.
- . “Institutional Framework for a Regional Disaster Management Organization,,” n.d.
- . “Institutional Strengthening of the Natural Resources Conservation Authority,” 1994.
- . “Management of Agricultural, Hazardous and Toxic Waste Generated at ALCAN Jamaica Company, Jamaica,,” 1993.
- . “Management of Industrial, Toxic and Hazardous Wastes for ALCAN Jamaica Company, Kirkvine Works, Ewarton Works and Its Dairy Farms,” 1993.
- . “Management Plans for the Institutional Strengthening of the Natural Resources Conservation Authority (NRCA) of Jamaica for the IDB,” n.d.
- . “Outdoor Air Quality Assessment as Part of an EIA for the Expansion of the Rinker Braziletto Quarry,” 2008.

- . “Outdoor Air Quality Assessments and Environmental Impact of Atmospheric Emissions from JAMALCO and ALPART Alumina Plant,” 1996.
- . “Preliminary Environmental Assessment for a Dolomite Limestone Quarry at Thetford Hall, St. Catherine,” 2013.
- . “Preliminary Work for the Location of a Routing of the Natural Gas Pipelines for EXMAR Consortium Which Included the Old Harbour Bay and Rocky Point Areas,” n.d.
- . “Remediated Contaminated Sites as Part of an EDDA for Shell Company (West Indies) Limited, Kingston, Jamaica,” n.d.
- . “Survey for the National Water Commission’s (NWC) Kingston Harbour Project, Kingston, Jamaica,” 1993.
- Center for History and New Media. “Zotero Quick Start Guide,” n.d. http://zotero.org/support/quick_start_guide.
- . “Zotero Quick Start Guide,” n.d. http://zotero.org/support/quick_start_guide.
- Centre for Advanced Engineering. *Risk & Realities*. New Zealand: Centre for Advanced Engineering, 1997.
- Chape, S., S. Blyth, L. Fish, P. Fox, and M. Spalding. *United Nations List of Protected Areas*. Gland, Switzerland; Cambridge, UK; UNEPWCMC, Cambridge, UK: IUCN, 2003.
- Chlistunoff, J. *Advanced Chlor-Alkali Technology, Final Technical Report, 2004*. New Mexico: Los Alamos National Laboratory, 2004.
- . *Advanced Chlor-Alkali Technology, Final Technical Report, 2004*. New Mexico: Los Alamos National Laboratory, 2004.
- Colinvaux, Paul. *Ecology*. John Wiley & Sons, 1986.

Dudley, Nigel, Andalusia (Spain), Consejería de Medio Ambiente, IUCN World Commission on Protected Areas, Fundación Biodiversidad, and IUCN--The World Conservation Union. *Guidelines for Applying Protected Area Management Categories*. Gland, Switzerland: IUCN, 2008.

ECLAC, United Nations. "An Assessment of the Economic Impact of Climate Change on the Agriculture Sector in Jamaica." Economic Commission for Latin America and the Caribbean LAC, United Nations, October 22, 2011.

Espeut, Peter. *Fishing for Finfish in Belize & the Jamaican South Coast: A Socio-Economic Analysis Final Report Vol. IV*. Kingston, Jamaica: ICOD/UWI/Jamaica/Belize Reef Fisheries Management Planning Project, 1992.

Espeut, Peter, and Sandra Grant. *A Social and Economic Study of Small-Scale Fisheries in Jamaica*. Kingston: Institute of Social & Economic Research, U.W.I., Mona campus, 1990.

Fabiano, Leonard. "Brine Dechlorination," n.d.
http://www.google.com/patents?id=JMk1AAAAEBAJ&pg=PA2&source=gbs_selected_pages&cad=1#v=onepage&q&f=false.

———. "Brine Dechlorination," n.d.
http://www.google.com/patents?id=JMk1AAAAEBAJ&pg=PA2&source=gbs_selected_pages&cad=1#v=onepage&q&f=false.

Fernandez, B.P. *A Geologic Interpretation of the Innswood Area Based on Geophysical and Lithologic Criteria*. Kingston: Journal of the Geological Society of Jamaica, 1983.

Fincham, A.G. *Jamaica Underground: The Caves, Sinkholes and Underground Rivers of the Island*. Kingston, Jamaica: University of West Indies Press, 1997.

Guidelines for Consequence Analysis of Chemical Releases. New York: American Institute of Chemical Engineers, 1999. <http://www.knovel.com/knovel2/Toc.jsp?BookID=1306>.

- Haynes, Ann, and Ingrid Parchment. *Galleon Harbour Fish Sanctuary Management Plan 2010-2015 Summary*. Kingston: Caribbean Coastal Area Management Foundation, 2010.
- Humann, Paul, and Ned Deloach. *Reef Fish Identification*. 3rd ed. Jacksonville, Florida: New World Publications, 2006.
- Jamaica Bauxite Institute. *JB I News Brief on Caustic Prices Effect on Bauxite Industry*, n.d. http://jbi.org.jm/news/item/the_bauxite_alumina_industry_down_but_not_out.
- . *JB I News Brief on Caustic Prices Effect on Bauxite Industry*, n.d. http://jbi.org.jm/news/item/the_bauxite_alumina_industry_down_but_not_out.
- Johnston, Jake. “The Multilateral Debt Trap in Jamaica | Reports.” *Center for Economic and Policy Research*, June 2013. <http://www.cepr.net/index.php/publications/reports/the-multilateral-debt-trap-in-jamaica>.
- “JPAT > Interactive Virtual Tour > Portland Bight Protected Area.” Accessed October 1, 2013. <http://www.jpat-jm.com/virtour/portland/portlandbight.html>.
- McFarlane, D.A. *Cave Bats in Jamaica*. Oryx, 1986.
- . *Radiant Darkness - the Many Facets of the Caves of Jacksons Bay, Jamaica*. Terra (Natural History Museum of Los Angeles County), 1987.
- McFarlane, D.A., J. Lundberg, and A. G. Fincham. *A Late Quaternary Paleoecological Record from Caves of Southern Jamaica, West Indies*. *Journal of Cave and Karst Studies*, n.d.
- Mona Geoinformatics. “Location Statistics: Kingston & Portland Bight.” Mona Geoinformatics, 2013.
- National Forest Management and Conservation Plan*. Kingston: Government of Jamaica, 2001.

Peck, S.B. *The Invertebrate Fauna of Tropical American Cave Part III: Jamaica An Introduction*. 1975, n.d.

Reid, Kennedy. "The Story Of Portmore An Illustrated History Of Jamaica's Sunshine City." Great House Omnimedia Limited, 2009.

Seaga, Edward. "Chinese Chance Of A Lifetime." September 15, 2013, The Sunday Gleaner edition. <http://jamaica-gleaner.com/gleaner/20130915/focus/focus3.html>.

"Seismic Hazard Maps: Jamaica," April 2001. <http://www.oas.org/CDMP/document/seismap/jamaica.htm>.

Street-Perrott, F.A., P.E. Hales, R.A. Perrott, J.C. Fontes, V.R. Switsur, and A. Pearsons. "Late Quaternary Palaeolimnology of a Tropical Marl Lake: Wallywash Great Pond, Jamaica: Journal of Paleolimnology." *Journal of Paleolimnology* (1993): 3-22.

Wadge, G., A.G. Fincham, and G. Draper. "The Caves of Jacksons Bay and the Cainozoic Geology of Southern Jamaica." *Transactions of the British Cave Research Association* (1979): 70-84.

Yugorsky, Patrick, and Ann Sutton. *Biodiversity Report: Working Paper 1 - Categorization of Protected Areas in Jamaica*. Kingston: The Nature Conservancy in Jamaica, 2004.

APPENDIX

Appendix 1: Draft Terms of Reference

Draft Terms of Reference
Environmental Impact Assessment
for
Trans-shipment Port as a Component of the Logistics Hub
proposed location at
The Goat Islands, Portland Bight & Ridge Area
Prepared by Conrad Douglas & Associates Limited

Portland Bight and Ridge is located on Jamaica's southern coast and hosts important natural and historical heritage resources. Importantly, Portland Bight & Ridge hosts the largest single stand of mangroves in Jamaica.

The area was declared as a Multiple Use National Park in 1999. Located within Portland Bight & Ridge are a number of industrial, agricultural, commercial and residential developments. There is also one declared industrial zone, the Tarentum Industrial Estate and various areas which have been considered as conservation zones.

The consultants should work closely with its clients and their partners, to complete a high quality Environmental Impact Assessment (EIA) report that addresses all environmental and engineering concerns that may be associated with the construction of a Transshipment Port at the Goat Islands in the Portland Bight area, St. Catherine.

In keeping with the NRCA Act of 1991, it is mandatory that an EIA be conducted on the proposed development because it falls within one of its '*Prescribed Categories of Development*'. This includes port construction and transportation linkages (pipelines and conduits) to and from the Goat Islands, dredging of Portland Bight, disposal of dredged spoils and possibly land reclamation. The applications and EIA will be submitted to the National Environment and Planning Agency (NEPA), and other regulatory agencies for their review and consideration for permitting. This is a pre-requisite for implementation of the plans.

Terms of Reference

The Environmental Impact Assessment should:

- 1) Provide a complete description of the existing site proposed for the Transshipment Hub. Detail the elements of the project, highlighting and flagging areas to be reserved for construction and the areas which are to be preserved in their existing state.
- 2) Identify the environmental issues of concern through the presentation of baseline data which will include social and cultural considerations. Assess public perception of the proposed development.
- 3) Outline the International and National Policies, Legislation, Regulations and Standards relevant to the project.
- 4) Predict the likely impacts of the project on the environment, including direct, indirect and cumulative impacts, and indicate their relative importance to the design and function of the facilities.
- 5) Identify mitigation actions to be taken to minimise adverse impacts and quantify associated costs.
- 6) Conduct risk assessments on all phases of the project
- 7) Design a Monitoring Plan which will ensure that the mitigation plan is adhered to.
- 8) Design an Emergency Response Plan
- 9) Describe the alternatives to the project that could be considered at that site
- 10) Conduct macro and micro socio-economic cost benefit analysis

To ensure that a thorough Environmental Impact Assessment is carried out, the following tasks should be undertaken:

Task 1: Description of the Project

A detailed description of all elements of the project during the (i) pre-construction, (ii) construction and (iii) operational phases will be prepared. The elements to be analyzed will

include the infrastructure of the project including: materials and their handling; drainage features; utilities; roads; waste (solid waste and liquid sewage) generation, and management; and utility requirements.

The consultants shall provide a comprehensive description of the project explaining details of the works and infrastructure proposed for the Transshipment Port as a component of the Logistics Hub, noting areas reserved for construction and areas to be dredged and reclaimed. Areas to be reserved for construction, areas to be preserved in their existing state as well as activities and features which will introduce risks or generate impact (negative or positive) on the environment should be noted. This should involve the use of satellite imagery, maps, site plans, low altitude aerial photographs and other graphic aids and images, as appropriate, and include information on location, general layout and size, as well as (i) pre-construction, (ii) construction, and (iii) post-construction plans. A description of raw material inputs, technology and processes to be used, will be necessary.

Sewage treatment system including treated effluent disposal should be necessarily outlined as well as solid waste disposal management system. In addition, plans for storm water collection and disposal as well as plans for providing utilities and other services should be analysed. This should involve the use of maps at appropriate scales, site plans, aerial photographs and other graphic aids and images, as appropriate.

In terms of beach modification, the proposed works on the foreshore and the floor of the sea should be clearly described including but not limited to any seagrass or mangrove removal and replanting. The generation of dredged spoils and its disposal/use/storage should be analysed.

The complete vertical and horizontal profile of the footprint of the development in terms of its unit and master plot plans or layout are necessary and should be done. Fuel storage and handling should be assessed.

Design Standards and specification

The complete electro-mechanical, structural and civil engineering designs for the marine and terrestrial environments should be analysed and assessed. The operations description and schedule will be analysed. All emission and effluents from any operation from the site will be determined and assessed.

Review of Trans-shipment Ports internationally in relation to the environment.

Task 2: Alternatives Analysis

The EIA process should include the examination of alternatives to the project including the no-action alternative. This examination of project alternatives should incorporate the history of the overall area in which the site is located and previous and potential future uses of the site itself. In addition other sites should be identified, analyzed, and considered.

Cost-benefit analyses will be done at the macro and micro economic levels for each alternative analyzed and assessed.

Task 3: Description of the Environment

For EIA Report, the consultant generate baseline data which will be used to describe the study area in terms of:

- i. physical environment
- ii. biological environment
- iii. socio-economic and cultural constraints
- iv. historical heritage

Methodologies employed to obtain baseline and other data will be clearly detailed. Baseline data will include:

(A) Physical

- i) A detailed description of the existing **geology** and **hydrology**. Emphasis should be placed on storm water run-off, drainage patterns, impact on groundwater and coastal waters. Any slope stability issues that could arise should be thoroughly explored.
- ii) An **oceanographic assessment**
- iii) **Water quality** of any existing wells, rivers, ponds, streams or coastal waters in the vicinity of the project. A complete water chemistry report shall be detailed; Quality Indicators should include but not necessarily be limited to oil and grease, nitrates, phosphates, total and faecal coliform, and total suspended solids.
- iv) Sediment sampling will be done to determine the quality of the dredged material

Climatic conditions and air quality (TSP) in the area of influence including wind speed and direction, precipitation, relative humidity and ambient temperatures,
- v) Noise levels of the undeveloped site and the ambient noise in the radius of influence.
- vi) Obvious sources of pollution existing and extent of contamination.
- vii) Availability of solid waste management facilities and procedures.

(B) Biological

The consultant shall will present a detailed description of the flora and fauna of the area, with special emphasis on rare, endemic, protected or endangered species. Migratory species should also be considered. Generally, species dependence, niche specificity, community structure and diversity will be considered. This should include an extensive assessment of the marine environment, including but not limited to:

- landscape impacts of excavation and construction
- Loss of natural features, habitats, and species by construction and building
- Impact on coastal, surface and ground waters
- Impact of dredging and spoil disposal
- Risk assessment
- Loss and replanting of mangroves
- Oil/fuel spills and their clean-up
- Solid waste management
- Hazard vulnerability

(C) Socio-economic & cultural

Present and projected population; present and proposed land use; planned development activities; issues relating to squatting and relocation; (housing demand and supply) community structure; economic base /employment; distribution of income; goods and services; utilities; recreation; public health and safety; cultural peculiarities, aspirations and attitudes should be explored.

The historical importance (heritage, archaeological sites and feature) and other material assets of the area should also be examined. While this analysis is being conducted, an assessment of public perception of the proposed development should be conducted, and should take the form of consultation meetings with the public and key stakeholders as well as questionnaires/surveys.

Task 4: Legislative and Regulatory Considerations

The EIA should outline the pertinent policies, legislations, regulations and standards governing environmental quality, protection of sensitive areas, protection of endangered species, siting and land use control at the national and local levels. The examination of the legislation should include at a minimum, legislation such as the NRCA Act, policies and regulations from the Water Resources Authority, the Watershed Protection Act, The Clean Air Act, Public Health Act, Beach Control Act, Building Codes and Standards, Development

Orders and Plans and any appropriate international convention/protocol/treaty where applicable.

Additionally, consideration should be made for the Protected Area status and RAMSAR designation of the Portland Bight Protected Area. The site was given RAMSAR designation on 2nd February, 2006, as Portland Bight Wetland and Cays (RAMSAR Site No. 1597). Consideration should also be given to industrial zoning and other land, riverine and marine uses in the area.

Task 5: Identification of Potential Impacts

The consultant shall will identify the major environmental issues of concern and indicate their relative importance to the design of the facility. Identification of potential impacts as they relate to (but are not restricted by) the following:

- change in drainage pattern
- flooding potential
- excavation and construction
- loss of natural features, habitats and species by construction and operation
- pollution of surface and ground water
- air pollution
- capacity and design parameters of proposed sewage handling/treatment facility
- socio-economic and cultural impacts
- risk assessment
- noise
- leaching of substances or chemicals into ground water supply

The EIA Report should:

1. **Identify** - the interaction between different impacts and impacts of other projects. In addition, the impacts that have occurred and those impacts

which could still occur as a consequence of the clearing works at the site should also be identified and analysed.

2. **Distinguish** - between significant positive and negative impacts, reversible or irreversible direct and indirect, long term and immediate impacts as well as avoidable and irreversible impacts.
3. **Characterize** - the extent and quality of the available data, explaining significant information deficiencies, assumptions and any uncertainties associated with the predictions of impacts. Project activities and impacts should be represented in matrix form with separate matrices for pre and post mitigation scenarios

Task 6: Mitigation

The consultant should prepare guidelines for avoiding, as far as possible, any adverse impacts due to the proposed project and utilising of existing environmental attributes for optimum development. For those impacts which are unavoidable, mitigative measures should be proposed. The report, should also quantify and assign financial and economic values to mitigating methods, where applicable.

Task 7: Drainage Assessment

An assessment of Storm Water Drainage should be conducted. The EIA Report should cover, but not be limited to:

- i. Drainage for the site during construction, to include mitigation for sedimentation to the marine environment
- ii. Drainage for the site during operation, to include mitigation for sedimentation to the marine environment

Task 8: Risk Assessment

This should be conducted for all phases of the project and should include:

- Natural hazards
- Construction activities
- Operations
- Spills
- Potential changes in ocean current
- Changes in bathymetry

Risk reduction and mitigation should be address as part of the mitigation plan.

Task 9: Environmental Management &Monitoring

The consultant should will design a plan to monitor, the implementation of mitigatory or compensatory measures and project impacts before, during and post construction. An Environmental Management Plan and Historic Preservation Plan (if necessary) for the long term operations of the site will also be prepared.

An outline of the monitoring programme should be included in the EIA, and a detailed version submitted to NEPA for approval after the granting of the permit and prior to the commencement of the development. At the minimum the monitoring programme and report should include:

- An introduction outlining the need for a monitoring programme and the relevant specific provisions of the permit license(s) granted.
- The activity being monitored and the parameters chosen to effectively carry out the exercise.
- The methodology to be employed and the frequency of monitoring.
- The sites being monitored. These may in instances, be pre-determined by the local authority and will incorporate a control site where no impact from the development is expected.
- Frequency of reporting to NEPA

The Monitoring report should also include, at a minimum:

- Raw data collected.
- Tables and graphs, where appropriate
- Discussion of results with respect to the progress of work, highlighting any parameter(s) which exceed the expected standard(s).
- Recommendations
- Appendices of data and photographs.

Task 10: Public Participation / Consultation Programme

Voluntary and mandatory public presentations on the project and findings of the EIA to inform, solicit and discuss comments from the public on the proposed development should be conducted. As a part of this process, the following should be done:

- Document the public participation programme for the project.
- Describe the public participation methods, timing, type of information to be provided to the public, and stakeholder target groups.
- Summarise the issues identified during the public participation process
- Discuss public input that has been incorporated into the proposed project design; and environmental management systems

All Findings should be presented in the **EIA Report** and should reflect the headings in the body of the TOR, as well as references. Eight hard copies and an electronic copy of the report will be submitted to NEPA for distribution to stakeholders and review. The report should include an appendix with items such as maps, site plans, the study team, photographs, and other relevant information.

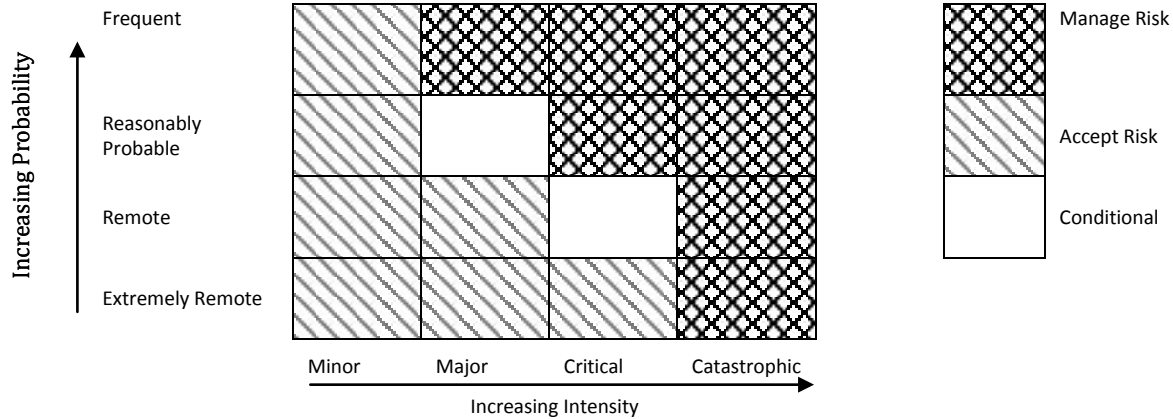
Appendix 2: Risk Assessment

The design and implementation of any successful anthropogenic activity can have various impacts inclusive of and beyond the agent's immediate goals and intentions. Therefore; however beneficial the primary purpose of the activity may be, there may be potentially negative impacts associated with achieving these goals. Some of these, such as accidents, were clearly not originally intended.

These accidents can be classified as either hazardous or non-hazardous in the sense that the former has the potential to result in direct (or indirect) damage to people, property or the natural environment. Those accidents which are hazardous must be rationalized with the positively intended consequence(s) of the anthropogenic activity in order for the activity (as whole) to be classified as reasonable and responsible within a certain framework.

This rationalization process involves the development of a quantitative estimate of a useful and significant measure of the injury, economic loss or damage suffered by humans and/or the built and natural environment in a way which considers both their likelihood and magnitude (*Guidelines for Consequence Analysis of Chemical Releases* 1999). The actual useful and significant measure is referred to as risk, and the development and rationalization process is called risk analysis and risk assessment, respectively.

Therefore, risk (as used in engineering), is quantitative and therefore has a numerical value. This value can be translated to have qualitative significance (or meaning) in terms of the ability of the receptors to endure or recover from the effects of the incident, with the extremes being regarded as negligible and disastrous/catastrophic given their immediate and broader contexts of perception – in particular contexts of technical, social, and managerial values. Therefore, the management of potential impacts is done based on a calculated risk such that the decision to intervene, manage and mitigate is based on a two-dimensional problem in which consideration is given to the severity of the consequences and frequency of the event. A typical risk management or acceptance criteria matrix is shown below in Figure 55.

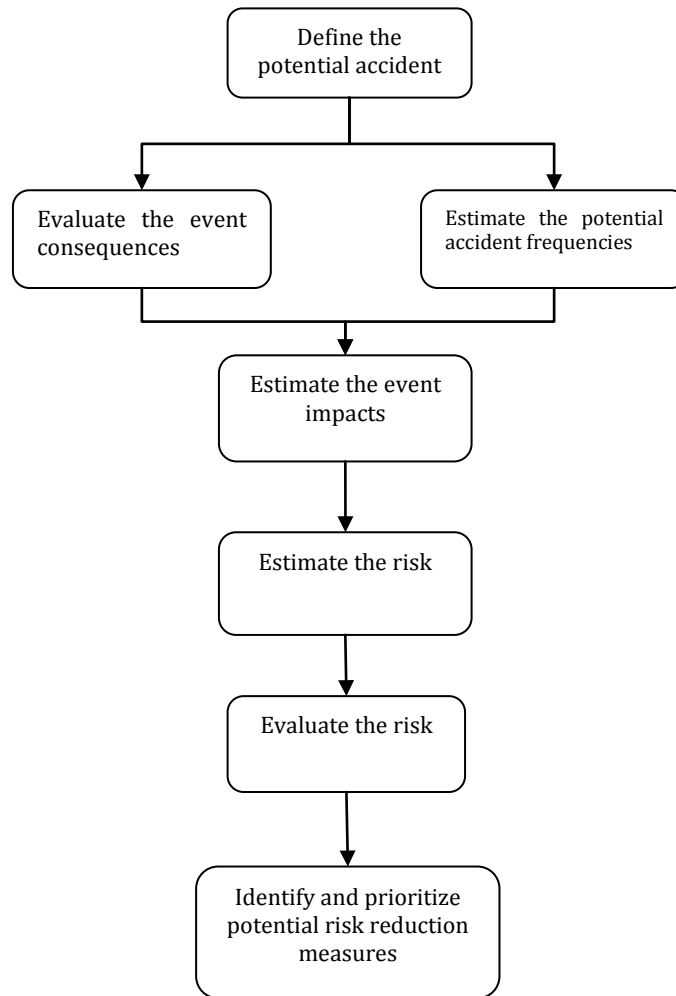


**Figure 55: Risk Management and Acceptance Criteria
Adapted from Centre for Advanced Engineering (1997)**

This matrix can be regarded as the culmination of the risk analysis and risk assessment process in which an objective and reproducible decision can be made by any party in the same immediate context.

The major steps of a risk assessment can be described by Figure 56 below.

In the case of the trans-shipment port, there will be certain defined activities that occur during the pre-construction, construction and operations phases of the port. The activities which could bear a negative impact during these phases should be flagged and evaluated based on the design elements and schedule of activities of the proposed project. This should be done in relation to the environment in which it is proposed to take place and what is known from similar experience. The objective is to determine which events are hazardous and the actions which must be taken to avoid or mitigate them.



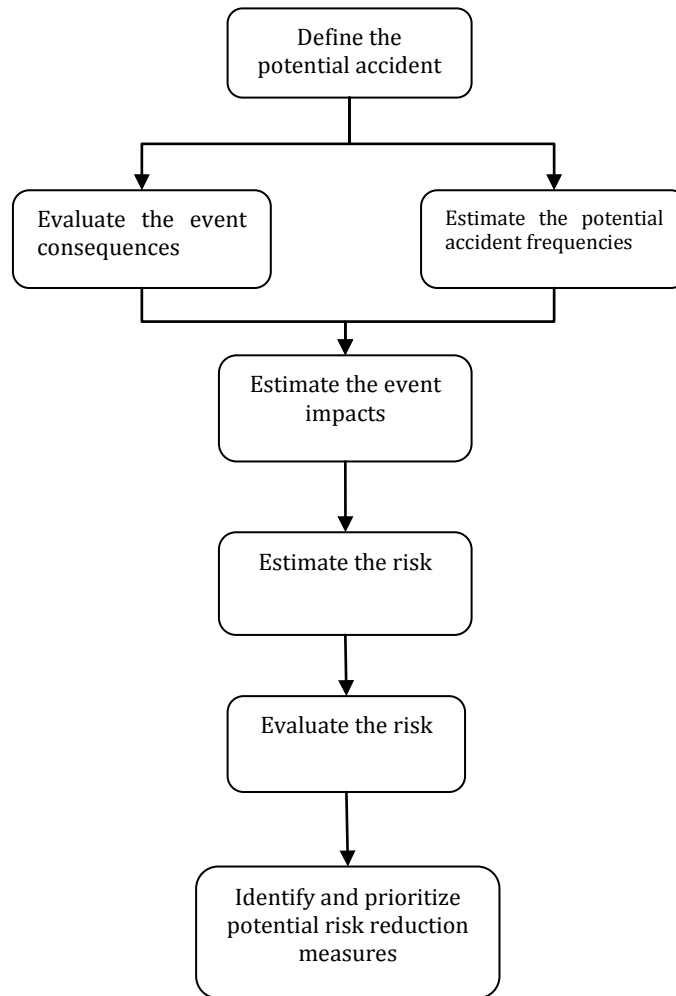


Figure 56: Major Steps in Risk Assessment
(Guidelines for Consequence Analysis of Chemical Releases 1999)

For example, a major event will involve the dredging of the ship channel and turning basin. This will result in changes in the bathymetric profile and probable changes in the hydrodynamics in the area. These could in turn influence materials transport on the ocean shore and the shore line resulting in changes in conditions in the general area and on the beaches.

Other hazards associated with various activities in the operations of transshipment ports include, but are not limited to:

- oil spills in the marine environment
- effluent discharge
- explosions
- introduction of an invasive species
- collision of certain types and numbers of vessels

The frequency and probability of certain hazards would also have to be analyzed in terms of the changes in the world climate and the capacity of operators to mitigate against an incident by either lowering the frequency (or probability), lowering the consequence, or both.

These are not new to Jamaica as they apply to all our existing ports, which must operate in compliance with the international and national regulatory framework.

The alternative analysis would take into account the risks and hazards associated with the alternatives including the 'no action' plan.

Appendix 3: Some endemic, rare, threatened and endangered species of plants and animals in the Portland Bight Protected Area (PBPA)



Plate 21: *Galactia pendula* (endemic)
Source: www.lepage-vivaces.com



Plate 20: *Agave harrisii* (endemic)
Source: Fairchild Tropical Botanic Garden, Miami, Florida, USA. Scott Zona



Plate 23: *Bumelia rotundifolia* (endemic)



Plate 22: *Cordia bullata* (endemic)



Plate 25: Wild Orange (*Esenbeckia pentaphylla*) (endemic)
Source: H. Zell, <http://intermountainbiota.org>



Plate 24: Bastard Lignum Vitae (*Ziziphus sarcomphalus*) (endemic)
Source: M.C. Johnst, <http://atrium.brit.org>



Plate 27: Velvet-leaved Maiden Plum (*Comocladia velutina*) (endemic)
Source: A. K. Neill, <http://atrium.brit.org>



Plate 26: Black Birch (*Bursera lunanii*) (endemic)
http://www.sierrapotomac.org/W_Needham/BlackBirch_060113.htm



Plate 28: Broom Thatch (*Thrinax parviflora*) (endemic)
Source: Bo-Göran Lundkvist, purehost.com



Plate 29: Jamaican silver thatch (*Coccothrinax jamaicensis*) (endemic)
Source: <http://www.palmtalk.org>



Plate 31: God Okra (*Hylocerus triangularis*) (endemic)
Source: Jose M. Pantaleon,
<http://www.flickr.com/photos/cimarronmayor>



Plate 30: *Calliandra pilosa* (endemic)
Source: <http://florademisiones.blogspot.com>



Plate 32: Blood Red Broughtonia (*Broughtonia sanguinea*) (endemic) - Source:
<http://www.orchidphotos.org/gallery2/v/Broughtonia/slide.html>



Plate 33: Jackie's Saddle (*Peperomia amplexicaulis*) (endemic) Source:
<http://buixuanphuong09blogspot.blogspot.com>

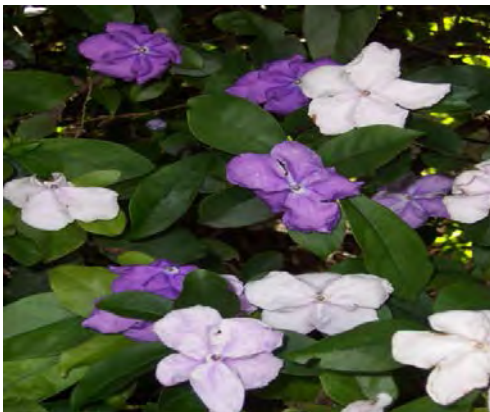


Plate 34: *Brunfelsia membranacea* (endemic)
http://it.wikipedia.org/wiki/File:Brunfelsia_uniflora.jpg



Plate 35: Jamaican Euphonia (*Euphonia jamaica*) (endemic) Source: Steve Metz,
<http://www.pbase.com/stevemetz/image/122025384>



Jamaican Mango (*Anthracothorax mango*)
© Photo by Lee Hunter <http://www.flickr.com/people/51435649@N05/> Used by permission

Plate 36: Jamaican Mango Hummingbird (*Anthracothorax mango*) (endemic) - Source Lee Hunter,
<http://www.avianweb.com/jamaicanmangos.html>



Plate 37: Jamaican Vireo (*Vireo modestus*) (endemic) - Source: Ken Havard,
<http://ibc.lynxeds.com/photo/jamaican-vireo-vireo-modestus/perched-bird>



Plate 39: Jamaica Tody (*Todus todus*) (endemic) - Source; Mikko Pyhälä, <http://ibc.lynxeds.com/>



Plate 38: Jamaican Woodpecker (*Melanerpes radiolatus*) (endemic) - Source: Lee Hunter, <http://ibc.lynxeds.com/>



Plate 43: Olive-throated Parakeet (*Aratinga nana*) (endemic) - Source: <http://www.hondurassilvestre.com>



Plate 42: Sad Flycatcher (*Myiarchus barbirostris*) (endemic) - Source: http://www.mun.ca/serg/Jamaica_trip.html



Plate 41: Blue tailed galliwasp (*Celetus duquesneyi*) (endemic) http://www.wildherps.com/images/herps/standard/05031302PD_skink.jpg



Plate 40: Jamaican boa (*Epicrates subflavus*) (endemic) - Source: Tim Vickers, commons.wikimedia.org



Plate 44: Loggerhead sea turtle (*Caretta caretta*) (endemic)

http://brunswickplantationliving.com/carreta-caretta-turtle-watch-at-sunset-beach-treasures-their-loggerhead-turtles-by-bev-filer/



Plate 47: Leather back sea turtle (*Dermochelys coriacea*) is critically threatened - Source:

http://www.tartarugas.avph.com.br/tartarugadecouro.html



Plate 45: Hawksbill sea turtle (*Eretmochelys imbricata*) is critically threatened - Source: *Caroline Rogers,*

http://www.costaricaturtles.org/costa_new_seaturtles.html



Plate 46: American crocodile (*Crocodylus acutus*) is threatened - Source:

http://www.vivanatura.org/Crocodylus%20acutus%20ExtraPhotos.html



Plate 49: Jamaican Iguana (*Cyclura collei*) (endemic and critically endangered) - Source;

Terraristic-free-wallpapers/Lizard/The-Jamaican-Iguana-(Cyclura-collei).html



Plate 48: Grahams anole (*Anolis grahami*) (endemic) - Source: *Garden State Hiker*



Plate 51: Jamaican Giant anole (*Anolis garmani*) endemic - Source: http://www.saumfinger.de/agarmanipics/3-garmani-1_0.jpg



Plate 50: Skink (*Mabuya mabouya*) vulnerable threatened - Source <http://reptile-database.reptarium.cz/species?genus=Mabuya&species=mabouva>



Plate 52: Dwarf Snake (*Trophidophis stullae*) endemic and vulnerable threatened - Source: <http://www.reptileradio.net/boa-constrictor/12502-very-rare-boa.html>



Plate 53: West Indian manatee (*Trichechus manatus*) vulnerable threatened - Source: <http://qpanimals.pbworks.com/w/page/5925200/West%20Indian%20Manatee>



Plate 55: Jamaican Coney (*Geocapromys brownie*) identified, is currently endemic and vulnerable threatened - Source: http://www.jamaica-allspice.com/green_ja_species.html

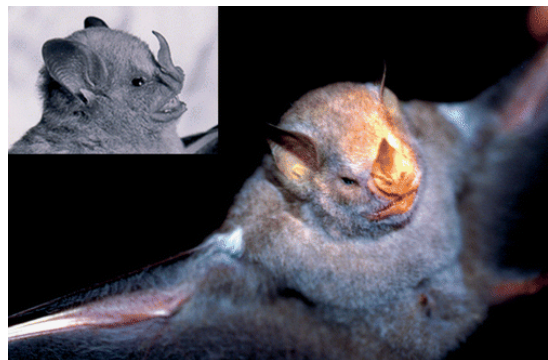


Plate 54: Jamaican fig-eating bat (*Ariteus flavescens*) identified, is currently endemic - Source: R. J. Baker, <http://www.planet-mammiferes.org/drupal/en/nod>

Appendix 4: Photo Inventory



Plate 56: Limestone Formation of the Hellshire Hill projecting into the sea from Rodney's Arms



Plate 57: Typical xerophytic plants found at Rodney's Arms Hellshire Hill



Plate 58: Great Salt Pond, Hellshire Hill (Viewed from Hellshire Main Road)



Plate 59: Sign on Hellshire Main Road used to notify the public of the Portland Bight Wetland and Cay Zone under the Ramsar Convention



Plate 60: Entrance to Half Moon Bay and Hellshire Beach



Plate 61: Hellshire Beach



Plate 62: Fisherman Scaling the Catch of the Day



Plate 63: Red and Button Mangroves surrounding the fringes of the Hellshire Coast



Plate 64: View of Hellshire Beach from Hellshire Hills



Plate 65: Limestone out-cropping in the hills of Hellshire



Plate 66: Typical Xerophytic Plants found in Hellshire Hills



Plate 67: Prevailing Land use at Half Moon Bay Hellshire coast and The Hellshire Hill



Plate 68: Open Land in Old Harbour Bay



Plate 69: Sign posted at Old Harbour Bay used to notify the public of the Portland Bight Wetland and Cay Zone under the Convention of Ramsar



Plate 70: Brown Pelican



Plate 71: Major Culvert through Old Harbour Bay Fishing Village



Plate 72: JPSCo's Old Harbour Bay Power Plant



Plate 73: Goat Islands (background) as seen east of main access road to JPSCo's Old Harbour Bay Power Plant



Plate 74: Entrance to Port Esquivel





Plate 75: Jamaica Broilers Ethanol Plant



Plate 76: Spring along Salt River Road



Plate 77: Great Egret (Top right) hunting in Salt River



Plate 78: Moorhen



Plate 79: Green Backed Heron



Illegal Felling of Mangroves for Bee-Keeping



Illegal Dumping and Wash-up in Mangrove



Illegal Felling of Trees for Charcoal



Illegal Dumping and Wash-up in Mangrove

Plate 80: Illegal Activities Within the Salt River Community

Source: EIA for the Construction of a Port and Conveyor Corridor, CD&A, 2009



**Plate 81: Wisco Sugar Factory Warehouse (decommissioned), along Salt River road.
Adjacent to entrance of Salt River**



Plate 82: Enforcement and Conservation Signs along Salt River entrance

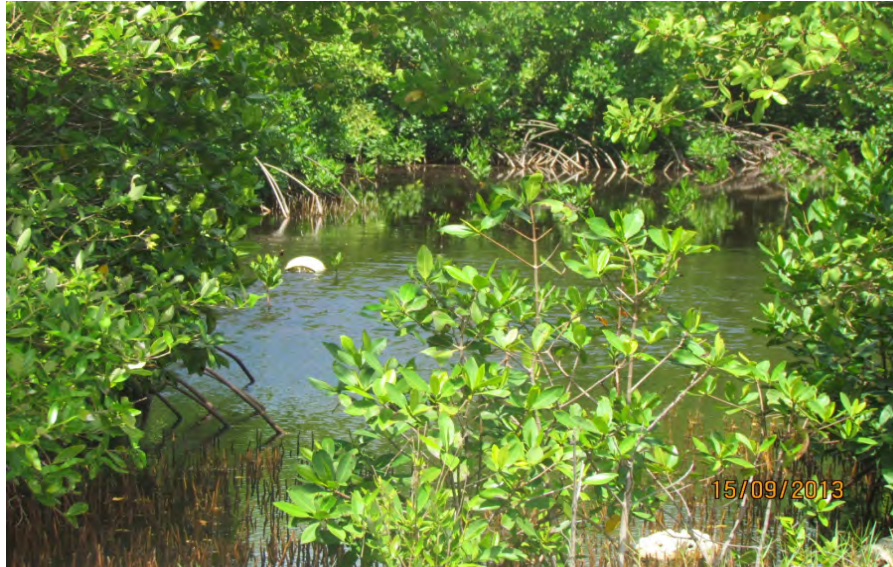


Plate 83: Mangrove Forest with black and red mangroves



Plate 84: Mangrove Forest with Red Mangroves



Plate 85: JAMALCO's Rocky Point Port



Plate 86: Marsh lands located at Portland Cottage