REPUBLIC OF TRINIDAD AND TOBAGO

Ministry of Planning and Development

FIRST COMPENDIUM OF ENVIRONMENTAL STATISTICS TRINIDAD AND TOBAGO

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PREFACE

The compilation of environmental statistics at the Central Statistical Office (CSO) emanated from the training of a Statistician II in Munich, Germany and her subsequent recommendations initiated the collection of environmental statistics. In keeping with the organization's vision and mission of providing "relevant goods and services" and "promoting the adherence to international statistical methodologies and standards" a decision was taken to produce a compendium of environmental statistics. Given the increasing awareness of environmental issues, it was of utmost necessity that Trinidad and Tobago commence the collation of environmental data already existing in the different environmental agencies.

A key environmental agency, the Environmental Management Authority has only been in existence for five years. The CSO was established since 1952 and operates under the legal authority of the Statistical Act Chapter 19:02 of the Revised Laws of the Republic of Trinidad and Tobago (1981). Hence, CSO's role was already defined as facilitator in the collection, collation and publication of the required data. The environmental publications of other Caribbean territories were used as a guide in deciding on which areas to focus.

CSO being the only organization with the legal responsibility for data collection, could have easily implemented the conventional approach – design a questionnaire, make requests to all environmental stakeholders for data sets within a specified time frame, collate data, organise the format for publication – in a relatively short time. This approach would have definitely fulfilled the desired short-term output goal – a compendium of environmental statistics. But, there are additional intrinsic benefits to be derived if the output is accomplished using a more valuable input method. Since the CSO did not have the technical capabilities to work on its own and there was the need to incorporate the technical skills of the wider public and private environment organizations, the process of forming an Environmental Statistics Committee was imperative.

An inaugural meeting of the committee which is made up of a representative of several environmental stakeholder agencies was held on 3rd May, 2004 at CSO. The participants were required to add value to the subject matter as well as be able to take decisions on behalf of their respective agencies. Some agencies also appointed alternates who attended meetings when the nominated participant was unable to attend. The objective was that final output would be a collaborative national effort and every organization would be able to contribute for the duration of the project. Also, Trinidad and Tobago would now be able to meet the requests of national, regional and international organizations for environmental data.

The environmental committee comprised an interdisciplinary team which consisted of the following disciplines: Forestry Officer, Research Officer, Geographer, Meteorologist, Wetland Specialist, Petroleum Chemist, Social Impact Specialist, Environmental Economist, Environmental Officer, Fisheries Officer, Water Management Specialist, Regulatory Compliance Assistant, Statistician. The CSO wishes to place on record its gratitude for the support of these experts representing several Departments and Ministries. Without their invaluable contribution, this inaugural publication would not have been possible. We look forward to their continued support as we continue our work in this area.

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19 September, 2007

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LIST OF CONTRIBUTING AGENCIES

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LOCAL:

1. Airports Authority of Trinidad and Tobago, Flight Information Department
2. Buccoo Reef Trust
3. Centre for Caribbean Land and Environmental Appraisal Research (CLEAR)
4. Caribbean Industrial Research Institute (CARIRI)
5. Caribbean Meteorological Organization
6. CAREC
7. Environmental Management Authority
8. Institute of Marine Affairs
9. Land Settlement Agency
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12. Ministry of Energy and Energy Industry
13. Ministry of Public Utilities and the Environment
14. Ministry of Works and Transport
15. Housing Development Cooperation
16. Ministry of Housing
17. Ministry of Health - Insect Vector Control Division
18. National Emergency Management Agency
19. Solid Waste Management Company Limited

REGIONAL:

20. Tobago House of Assembly

21. CARICOM; General Bureau of Statistics, Suriname

22. Ministry of Planning and Development -Town and Country Planning Division

23. The University of the West Indies, Department of Chemical Engineering, Department of Surveying and Land Information

24. Trinidad and Tobago Postal Corporation

25. Tourism Development Company (TDC)

26. Water And Sewerage Authority of Trinidad and Tobago / Water Resource Agency

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27. United Nations - United Nations Statistical Division (UNSD)

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National Income

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Publications Section

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The chapter is a collaborative effort of staff of the Fisheries Division of the Ministry of Agriculture, Land and Marine Resources. It was compiled by Lara Ferreira, Fisheries Officer and representative of the Fisheries Division on the Committee of Environmental Stakeholders chaired by the Central Statistical Office (CSO). The chapter was reviewed and input provided by: Ann Marie Jobity, Director of Fisheries; Christine Chan A Shing, Senior Fisheries Officer;

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ABBREVIATIONS

A & P - Acupunctures & Pharmacies

AIA - Advance Inform Agreement

BG - British Gas

BHP - Broken Hill Proprietary Company

BOD - Biological Oxygen Demand

BPTT - British Petroleum of Trinidad and Tobago

BTEX - Benzene, Toluene, Ethyl benzene and Xylene

BWIA - British West Indian Airlines

CARIRI – Caribbean Industrial Research Institute

CBD - Convention on Biological Diversity

CEC - Certificate of Environmental Clearance

CEHI - Caribbean Environmental Health Institute

CEII - The Community Environmental Improvement Initiative

CEPEP- The Community Based Environmental Programme and Enhancement Program

CFCs - Chlorofluorocarbons

CIF - Cost of product inclusive of Insurance and Freight

CITIES - Convention on International Trade in Endangered Species of Wild Flora and Fauna

CLEAR - Center for Caribbean Land and Environmental Appraisal Research

COC - Certificate of Comfort

CO_2 - Carbon Dioxide

CPC - Contracting and Cooperating Parties

CPIA - Crown Point International Airport (Tobago)

CPR - Commercial Plastics Recycling

CSO - Central Statistical Office

CSME - The Caribbean Single Market and Economy

DART - Dead Animal Removal Team

DERT - Disaster Emergency Response Team

DNT - Dentists

DO - Dissolved Oxygen

EEZ - Exclusive Economic Zone

EOG - Energy Opportunity Growth

ESA - Environmentally Sensitive Areas

EMA - Environmental Management Authority

ESM -Environmentally Sound Management

ESS - Environmentally Sensitive Species

FAD - Fish Attraction Device

FC - Feacal Coliform

FH - Funeral Homes

FISIM - Financial Intermediation Services Indirectly Measured

FOB - Freight on Board or Free on Board

GDP - Gross Domestic Product

GRT - Gross Registered Tonnage

GNI - Gross National Income

H - Hospitals (Solid Waste)

H - Hurricane (Natural Hazards)

Hp - Horsepower

HC - Health Centres

HDPE - High Density Polyethylene

HM - Geriatric Homes, etc.

ICCAT - International Commission for the Conservation of Atlantic Tunas

IMA - Institute of Marine Affairs

ITCZ - Inter Tropical Convergence Zone

IUCN - International Union for the Conservation of Nature and Natural Resources

IWMP- Integrated Waste Management Plan

LAB - Laboratories

LLC - Limited Liability Company

LNG - Liquefied Natural Gas

LPG - Liquefied Petroleum Gas

LSA - Land Settlement Agency

MALMR - Ministry of Agriculture, Land and Marine Resources

MARPOL- Prevention of Marine Pollution from Ships

MD - Medical Practitioners

MEA - Multilateral Environment Agreement

MSD - Monthly Statistical Digest

MTBE - Methyl Tertiary Butyl Ether

NDAA - National Oceanic Atmospheric Administration

NFR - Non- filtrate Residue

NGC - Natural Gas Company

NIWMS - National Integrated Waste Management System

NPDP - National Physical Development Plan

NPCR - Noise Pollution Control Rules

NMVOC[4] – Non Methane Volatile Organic Compounds

N_2O^2 - Nitrogen Dioxide

NO_x^3 - Nitrous Dioxide

P - Phosphorous

PATT - Port Authority of Trinidad and Tobago

PC - Polycarbonate

PET - Polyethylene Terephthalate

PIA - Piarco International Airport (Trinidad)

PLIPDECO - Point Lisas Industrial Development Corporation

PNH - Private Nursing Homes

POPs - Persistent Organic Pollutants

RVSM - Reduced Vertical Separation Minimum

SPAW - Specially Protected Areas and Wildlife

SPM - Suspended Particulate Matter

SWMCOL- Solid Waste Management Company Limited

T& CPD- Town and Country Planning Division

TAC - Total Allowable Catch

T&CPD – Town and Country Planning Division

THA - Tobago House of Assembly

TED - Turtle Excluder Device

Trintomar – Trinidad and Tobago Marine Petroleum Company

TS - Tropical Storm

TSD - Total Dissolved Solids

T&TEC- Trinidad and Tobago Electricity Commission

UNCCD- United Nations Convention to Combat Desertification

UNFCCC- United Nations Framework Convention on Climate Change

USEPA- United States Environment Protection Agency

UWI - University of the West Indies

VAT - Value Added Tax

VET - Veterinary Clinic

VOC - Volatile Organic Compounds

WASA - Water and Sewerage Authority of Trinidad and Tobago

WCR - Wider Caribbean Region

WHO - World Health Organization

WISCO - West Indies Shipping Corporation

WWTP- Waste Water Treatment Plant

CARICOM SYMBOLS USED IN TABLES

..	Data not available
...	Data not applicable
0	Less than half of the unit specified
-	Nil, magnitude zero

UNITS OF MEASUREMENTS

bbl/d	Barrels per day
Gg	Gigagrams
ha	Hectares
i.m.g.d.	Imperial gallons per day
kg	Kilograms
km	Kilometers
kj	Kilojoules
ktoe	Kilotonnes of oil equivalent
mmscfd	Million standard cubic feet per day
m^3	Cubic meters
m	Meters
ml	Milliliters
mg	Milligram
mg/l	Milligrams per litre
ppm /ppb / ppt	Parts per million/ parts per billion/ parts per trillion
toe	Tonnes of oil equivalent
tcff/d	Trillion cubic feet per day
TT $	Trinidad and Tobago dollars
W	Watt
^{o} C	Degrees Celsius
%	percentage

Chapter 1

Country Introduction

1 COUNTRY INTRODUCTION

TRINIDAD AND TOBAGO

The islands of Trinidad and Tobago lie between 10 º - 11º North latitude and 60º -61º West longitude. The Republic of Trinidad and Tobago is the Caribbean's southernmost twin-island state. It lies approximately 18 km east of Venezuela on the South American continent; Trinidad and Tobago are the southernmost islands in the West Indies.

The average size of Trinidad is 4,827 km^2 with a channel of 35 km which separates the island at its north eastern point in Trinidad and the south eastern point in Tobago. The average area of Tobago is 303 km^2, altogether total land mass encompasses an area of 512,835 hectares of land (*Forest Policy in the Caribbean*).

Trinidad's Northern Range is an extension of the South American Cordilleras, the highest peaks El Cerro del Aripo, is 940 m high. The centre of the island of Tobago is characterized by the Main Ridge, which is the oldest protected rain forest in the western hemisphere (17 April 1776) with the highest point being Centre Hill (573 m). The islands are only 33.6 km apart and comprise 55 123 km^2 with a coastline extending over 362 km. Physically, the islands are a combination of high ranges, flat land, swamps, and savannahs. These ecological niches are home to a wealth of diverse flora and fauna.

The Pink and Yellow Poui, as well as the Immortelle, and Chaconia are vivid expressions of the country's highlights. The coral reefs around Tobago are an underwater exhibition for divers and the Speyside Reef boasts of the largest brain coral formation in the Caribbean. The native wildlife includes the Leatherback Turtle (Dermochelys coriacea), Scarlet Ibis (Endocimus rubber), Pawi (Pipile pipile), Agouti (Dasyprocta leporina), Lappe (Agouti paca), Tatoo (Dasypus novemcintus), Manicou (Opossum), and several species of the Humming bird. This does not include the multiplicity of mammals, birds, amphibians, fishes, butterflies and plants.

CHAPTER 2

ECONOMY AND ENERGY

Photograph courtesy Atlantic LNG

2 ECONOMY AND ENERGY

A. ECONOMY

Introduction

All economic activity is linked to the environment at various stages. At the start of many businesses, there are direct ecological impacts by clearing of land area for the building of structures. Another issue is the depletion of natural resources in the production of commodities. While engaging in the production process, air emissions and waste water effluent become areas of environmental concern. The actual products which are produced result in waste disposal problems by the pile-up of garbage. The treatment and containment of all types of waste are yet another environmental issue. The need for clearer manufacturing processes, biodegradable products and conservation of natural resources are all environmental considerations if economic development and in particular, economic growth is to be sustained for the future.

The sugar-cane industry brought its labour from Africa and India (the majority of the present population) to work on the sugar-cane plantations. Subsequently, the economic base shifted to crude oil production, most of which was exported to North America. This industry has been the basis of economic prosperity for several decades and crude oil production followed by natural gas processing is the basis for the present day economic prosperity of this twin island state.

2.1 Gross Domestic Product

The GDP in real terms for the period 2000-2004 increased from 51.4 billion (TT dollars) to 71.9 billion (Table 2.1.1). The sub industries which largely contributed to this was the Exploration and Production and Natural gas sub-industries within the Petroleum Industry. In 2004, there was a leveling off in the production of LNG following the upsurge in production in 2003 with the coming on stream of Atlantic LNG (ALNG) Train III.

The largest rate of growth for the period 2000 to 2004 was in 2003 -14.4 percent (see Table 2.1.2).The Petroleum industry contributed 31.3% of GDP in 2000 which increased to 38.1% in 2004 (see Table 2.1.3).

TABLE 2.1.1 GROSS DOMESTIC PRODUCT OF TRINIDAD AND TOBAGO AT CONSTANT 2000 PRICES (Millions of TT Dollars), 2000-2004

Activity	2000	2001	2002	2003	2004
00. Export agriculture	20.9	10.2	18.4	12.7	12.9
01. Domestic agriculture	377.6	406.9	404.3	402.0	359.1
02. Sugar industry	298.7	340.6	401.0	283.3	149.7
03. Petroleum industries	16,072.8	16,970.5	19,259.6	25,302.3	27,386.1
Manufacturing	**3,625.4**	**3,979.8**	**4,131.1**	**4,622.3**	**5,033.0**
04. Food, drink and tobacco	1,686.9	1,819.1	1,821.0	1,896.0	2,129.7
05. Textiles, garments ,footwear and headwear	112.3	104.2	86.3	84.6	90.4
06. Printing, publishing and paper converters	390.5	442.6	435.8	561.5	598.6
07. Wood and related products	127.3	122.1	116.9	134.6	144.2
08. Chemicals and non-metallic minerals	687.0	666.0	654.6	890.3	965.6
09. Assembly type and related industries	404.9	593.6	805.8	867.4	892.8
10. Miscellaneous manufacturing	216.5	232.2	210.7	187.9	211.7
Services	**31,163.9**	**31,756.2**	**33,302.4**	**35,510.2**	**38,530.3**
11. Electricity and water	888.2	924.2	1,004.8	1,057.9	1,091.8
12. Construction and quarrying	3,833.1	4,226.5	4,011.8	4,949.5	5,571.4
13. Distribution services including restaurants	8,401.8	8,168.8	8,276.9	8,441.5	8,714.9
14. Hotels and guest houses	217.0	238.1	246.3	238.1	276.8
15. Transportation, storage and communication	4,410.4	4,755.3	5,208.2	5,491.3	5,594.3
16. Finance, insurance, real estate and business services	7,305.1	7,362.0	8,211.4	8,814.0	10,727.9
17. General government	3,887.2	3,829.9	3,969.7	3,931.3	3,955.0
18. Education and cultural community services	1,411.1	1,409.3	1,509.5	1,543.9	1,538.6
19. Personal services	810.0	842.1	863.8	1,042.7	1,059.6
20. LESS: FISIM[1/]	2,216.0	2,003.8	1,990.3	2,186.8	2,441.8
21. PLUS: Value Added Tax	2,027.4	2,055.6	2,232.7	2,138.4	2,886.4
Gross domestic product	51,370.7	53,516.0	57,759.2	66,084.4	71,915.7

Source: Central Statistical Office, National Income Division

[1]Financial Intermediation Services Indirectly Measured

TABLE 2.1.2 GROSS DOMESTIC PRODUCT OF TRINIDAD AND TOBAGO AT CONSTANT PRICES (Percentage Change), 2000-2004

Activity	2000	2001	2002	2003	2004
00. Export agriculture	20.1	-51.2	80.4	-31.0	1.6
01. Domestic agriculture	4.5	7.8	-0.6	-0.6	-10.7
02. Sugar industry	-10.9	14.0	17.7	-29.4	-47.2
03. Petroleum industries	12.5	5.6	13.5	31.4	8.2
Manufacturing	**6.0**	**9.8**	**3.8**	**11.9**	**8.9**
04. Food, drink and tobacco	3.0	7.8	0.1	4.1	12.3
05. Textiles, garments ,footwear and headwear	28.3	-7.2	-17.2	-2.0	6.9
06. Printing, publishing and paper converters	6.8	13.3	-1.5	28.8	6.6
07. Wood and related products	1.9	-4.1	-4.3	15.1	7.1
08. Chemicals and non-metallic minerals	15.6	-3.1	-1.7	36.0	8.5
09. Assembly type and related industries	-1.7	46.6	35.7	7.6	2.9
10. Miscellaneous manufacturing	10.1	7.3	-9.3	-10.8	12.7
Services	5.6	**1.9**	**4.9**	**6.6**	**8.5**
11. Electricity and water	5.5	4.1	8.7	5.3	3.2
12. Construction and quarrying	7.6	10.3	-5.1	23.4	12.6
13. Distribution services including restaurants	5.9	-2.8	1.3	2.0	3.2
14. Hotels and guest houses	-10.2	9.7	3.4	-3.3	16.3
15. Transportation, storage and communication	8.9	7.8	9.5	5.4	1.9
16. Finance, insurance, real estate and business services	12.4	0.8	11.5	7.3	21.7
17. General government	-6.1	-1.5	3.7	-1.0	0.6
18. Education and cultural community services	-0.8	-0.1	7.1	2.3	-0.3
19. Personal services	-1.0	4.0	2.6	20.7	1.6
20. LESS: FISIM[1/]	14.4	-9.6	-0.7	9.9	11.7
21. PLUS: Value Added Tax	-1.4	1.4	8.6	-4.2	35.0
Gross domestic product	6.9	4.2	7.9	14.4	8.8

Source: Central Statistical Office, National Income Division

[1/] Financial Intermediation Services Indirectly Measured

TABLE 2.1.3 GROSS DOMESTIC PRODUCT OF TRINIDAD AND TOBAGO AT CONSTANT 2000 PRICES
(Percentage Contribution), 2000-2004

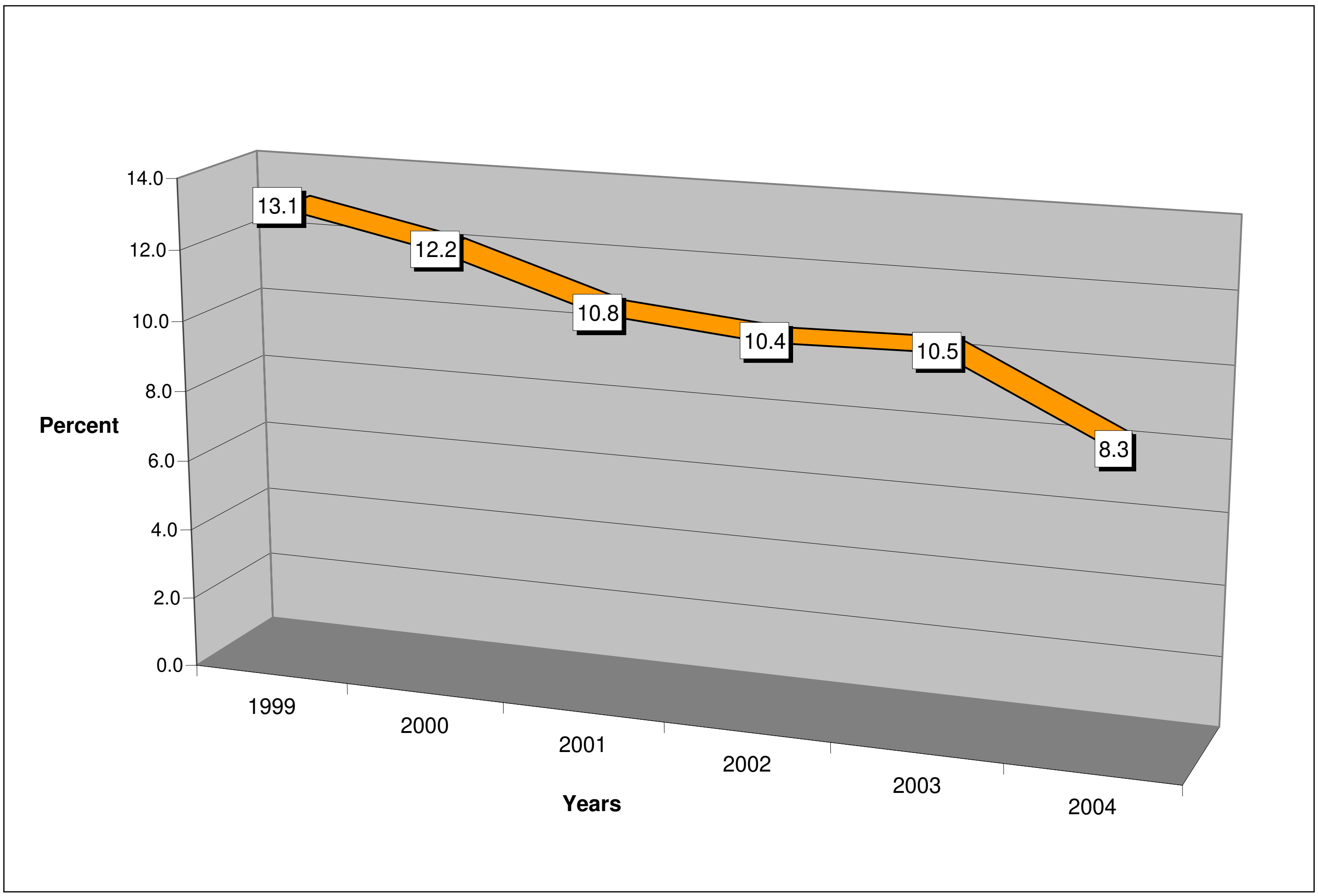
Activity	2000	2001	2002	2003	2004
00. Export agriculture	-	-	-	-	-
01. Domestic agriculture	0.7	0.8	0.7	0.6	0.5
02. Sugar industry	0.6	0.6	0.7	0.4	0.2
03. Petroleum industries	31.3	31.7	33.3	38.3	38.1
Manufacturing	**7.1**	**7.4**	**7.2**	**7.0**	**7.0**
04. Food, drink and tobacco	3.3	3.4	3.2	2.9	3.0
05. Textiles, garments ,footwear and headwear	0.2	0.2	0.1	0.1	0.1
06. Printing, publishing and paper converters	0.8	0.8	0.8	0.8	0.8
07. Wood and related products	0.2	0.2	0.2	0.2	0.2
08. Chemicals and non-metallic minerals	1.3	1.2	1.1	1.3	1.3
09. Assembly type and related industries	0.8	1.1	1.4	1.3	1.2
10. Miscellaneous manufacturing	0.4	0.4	0.4	0.3	0.3
Services	**60.7**	**59.3**	**57.7**	**53.7**	**53.6**
11. Electricity and water	1.7	1.7	1.7	1.6	1.5
12. Construction and quarrying	7.5	7.9	6.9	7.5	7.7
13. Distribution services including restaurants	16.4	15.3	14.3	12.8	12.1
14. Hotels and guest houses	0.4	0.4	0.4	0.4	0.4
15. Transportation, storage and communication	8.6	8.9	9.0	8.3	7.8
16. Finance, insurance, real estate and business services	14.2	13.8	14.2	13.3	14.9
17. General government	7.6	7.2	6.9	5.9	5.5
18. Education and cultural community services	2.7	2.6	2.6	2.3	2.1
19. Personal services	1.6	1.6	1.5	1.6	1.5
20. LESS: FISIM[1/]	4.3	3.7	3.4	3.3	3.4
21. PLUS: Value Added Tax	3.9	3.8	3.9	3.2	4.0
Gross domestic product	100.0	100.0	100.0	100.0	100.0

Source: Central Statistical Office, National Income Division

2.2 Labour Force

An increasing economic growth pattern requires greater numbers or workers in the labour force to sustain production. During the period 1999 – 2004 the Labour Force of the Republic of Trinidad and Tobago increased steadily from 563,400 in 1999 to 613,400 in 2003, an increase of 50,000 or 8.9%. Similarly, persons with jobs rose by 72,800 or 14.9 %. The unemployment rate continued to be fairly high in this period, notwithstanding the significant levels of growth over the last six (6) years. The engine of growth continues to be the highly capital intensive Petroleum industry. There has been a continuous decline over the period from 13.1 % (1999) to 12.2 % (2000), 10.8 % (2001) and further declining in 2002 to 10.4 %. But in 2003 there was minimal increase to 10.5 % eventually dropping again to its lowest level ever of 8.3 % in 2004.

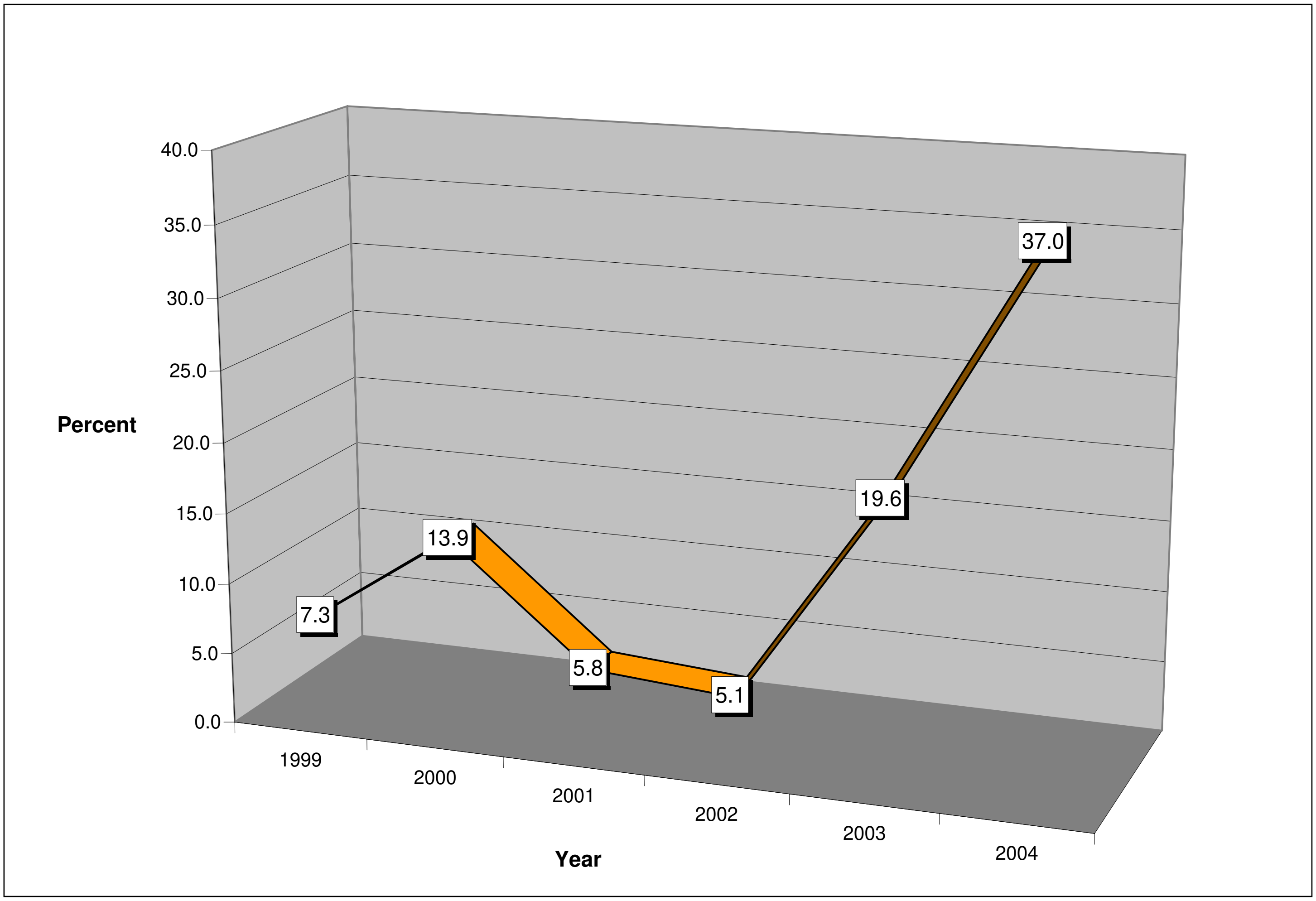
FIGURE 2.1 UNEMPLOYMENT RATE, 1999-2004



Source: Economic Statistics Division, Central Statistical Office

An analysis of the various industrial groupings show that only the Sugar industry recorded an increase in unemployment from 7.3 % in 1999 to 37.0 % in 2004 and this was due mainly to the closure of Caroni (1975) Limited – the state owned, sole sugar producer in the country. This company which operated the only sugar factory in Trinidad was closed in 2003; hence the full impact on unemployment was seen in 2004 (Figs 2.1 and 2.2).

FIGURE 2.2 UNEMPLOYMENT IN SUGAR INDUSTRY, 1999-2004



Source: Economic Statistics, Central Statistical Office

2.3 Selected Macro Economic Variables

The generation of higher levels of incomes due to the increased economic growth for the period 1999 to 2004 (Per capita GDP in Table 2.2), led to greater total disposable income which resulted in increased consumer expenditure. The exchange rate remained relatively stable.

TABLE 2.2 SELECTED MACRO ECONOMIC VARIABLES 1999 - 2004

Macro Economic Variables	1999	2000	2001	2002	2003	2004
Gross Domestic Product- Current Prices (MN US$)	6,840.4	8,180.0	8,872.1	9,064.4	11,296.9	12,731.4
Net Factor Income from Rest Of the World (MN US$)	-401.5	-628.5	-539.3	-479.8	-680.9	-597.3
Gross National Income (MN US$)	6,438.9	7,551.5	8,332.8	8,584.6	10,616.0	12,134.1
Mid Year Population (000)	1,258.2	1,262.4	1,266.8	1,275.7	1,282.4	1,290.6
Exchange Rate - US$	6.27	6.28	6.20	6.21	6.26	6.27
Per Capita GDP -US$	5,437	6,480	7,004	7,105	8,809	9,865
Per Capita GNI -US$	5,117	5,982	6,578	6,729	8,278	9,402.0

Source: Central Statistical Office -National Income Division

B. ENERGY

The twin island state of Trinidad and Tobago is a producer of oil and natural gas. It is also involved in secondary petroleum industries such as the Refining of Crude Oil and Natural Gas. This section highlights volume data on the production of crude oil and natural gas – directly extracted from the natural environment. Oil wells drilled is then presented for its relevance in terms of the ecotoxicological characteristics of the drilling fluids and oil-spill control agents used.

On shore and offshore pipelines are summarized in a tabular format for environmental monitoring in their respective locations. One impact of oil production with respect to the water courses within the oil producing fields is shown by the sampling results of oil and grease effluent. This is then followed by data on quarries which engage in the extraction of naturally occurring mineral resources. The last sub-section highlights energy sources used by the population for their daily living needs – the generation of electricity and the types of fuel used for lighting and cooking.

The energy sector of Trinidad and Tobago is by far the most important contributor to the country's GDP, Government revenues and foreign exchange.In 2004, crude oil production[1] averaged 122,902 barrels per day (bbl/d), while natural gas production averaged 2,938 million standard cubic feet per day (mmscfd). See Table 2.3 below for more details.

TABLE 2.3 CRUDE OIL[a] AND NATURAL GAS PRODUCTION, 2000 – 2004

	2000	2001	2002	2003	2004
Crude oil					
Exploration (metres)	33,139	45,910	20,593	28,941	29,063
Daily Average Production(barrels)	119,354	113,523	130,626	134,089	122,902
Total Production ('000 barrels)	43,680	41,469	47,824	49,117	44,982
Imports ('000 barrels)	35,195	30,524	32,241	33,186	22,771
Exports ('000 barrels)	19,118	18,323	24,895	26,002	20,467
Natural gas (million cubic feet/day)					
Production	1,498.0	1,596.0	1,826.0	2,594.0	2,938.0
Utilization[b]	1,255.0	1,304.3	1,771.2	2,325.2	2,640.1
of which:					
Petrochemicals	618.5	661.0	693.8	731.1	846.5
Electricity Generation	186.5	193.3	219.2	230.1	239.4
LNG	450.0	450.0	858.2	1,364.0	1,415.3

Source: Industry Focus, Ministry of Energy and Energy Industry, 2007

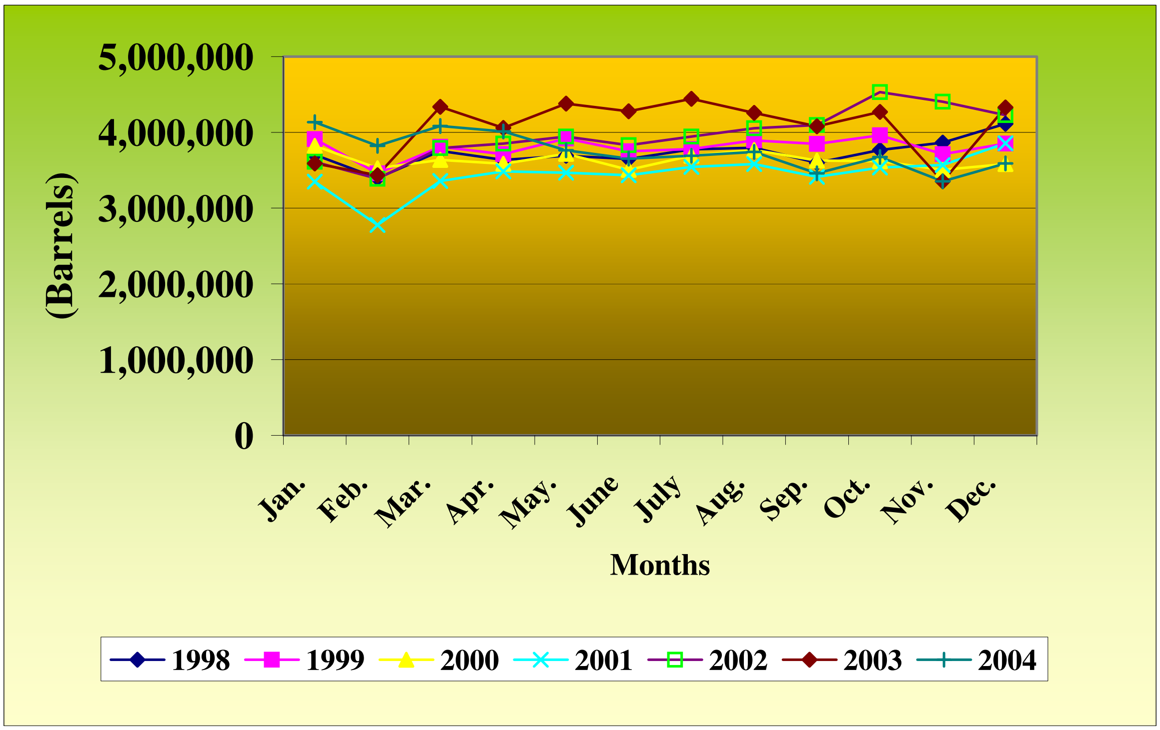
a: Also includes condensates.
b: Utilization refers to gas sales, and does not include natural gas used in own consumption

Atlantic LNG – Natural Gas Company -Trinidad

[1] **Industry Focus, Ministry of Energy and Energy Industry, 2007**

Trinidad and Tobago has made a transition from an oil-based economy to one based on natural gas. In 2004, natural gas production averaged 2.9 trillion cubic feet per day (tcf/d), compared with 2.5 tcf/d in 2003. The petrochemical sector, including plants producing methanol, ammonia, urea, and natural gas liquids, has continued to grow in line with natural gas production, which continues to expand.Trinidad and Tobago is the fifth-largest exporter of LNG in the world and the single largest supplier of LNG to the U.S., supplying between 70-75 % of all LNG imported into the U.S.

FIGURE 2.3 CRUDE OIL PRODUCTION BY MONTHS, 1998-2004



Source: Industry Focus, Ministry of Energy and Energy Industry, 2007, Central Bank MSD Feb 2006

In Figure 2.3 it is seen that there was a decline in the Crude oil production in 2000 and 2001, but it started to rise steeply in 2002 (except for November and December) and 2003. Data was not available for September up to December 2003.

The energy balance[2] in Table 2.4 gives an overview of all energy imported, produced and used in Trinidad and Tobago. The balance has three parts, indicated by the titles in capitals and the horizontal lines. The units of the table are expressed in thousand tonnes of oil equivalent (ktoe) on a net calorific value basis. This means that the energy content of all the sources has been recalculated to correspond to the energy that can be produced by one thousand metric tonnes of crude oil. The second part reports the transformation of energy supply taking place in Trinidad and Tobago.

After the transformation, 8,867 ktoe is available for consumption. The breakdown on oil products is shown in the line "Total Final Consumption" (TFC). These lines give an outline of the consumption in various sectors. The breakdown by sectors should be considered as preliminary.

[2] The energy balance is a unique data source for policy-makers, analysts and companies involved in the energy sector, as it presents an overall picture of the sector, providing detailed data on production, trade, conversion and consumption for fuels utilized in the selected countries in four consecutive years 2001-2004 (Energy Statistics, United Nations Statistics Division, 2004).

TABLE 2.4 ENERGY BALANCE FOR TRINIDAD AND TOBAGO, 2004[1]
(in thousand tonnes of oil equivalent (ktoe) on a net calorific value basis)

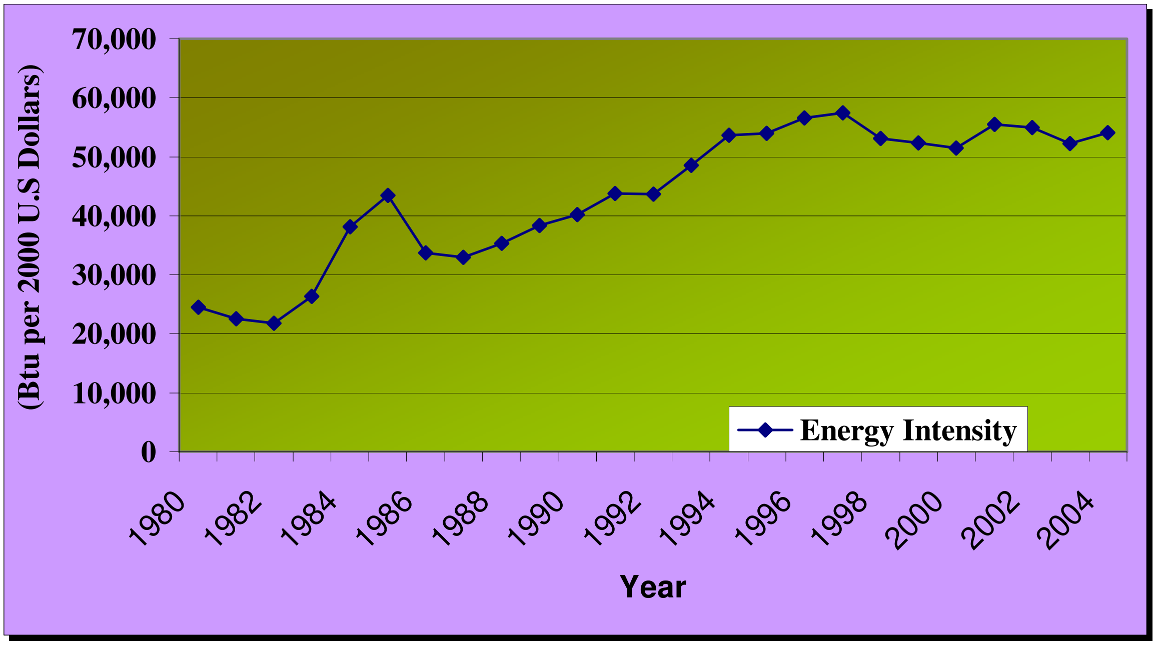
Supply and Consumption	**Crude Oil**	**Petroleum products**	**Gas**	**Geothermal, Solar, etc**	**Combustibles Renewables and Waste**	**Electricity**	**Total**
Production	7,323	-	22,010	23	23	-	29,356
Imports	3,249	245	-	-	-	-	3,494
Exports	-3,197	-5,688	-11,527	-	-	-	-20,412
International Marine Bunkers	-	-893	-	-	-	-	-893
Stock Changes	87	-343	-	-	-	-	-256
TPES	**7,462**	**-6,679**	**10,483**	**23**	**23**	-	**11,289**
Transfers	-624	705	-	-	-	-	81
Statistical	-20	297	-	-	-	-	277
Electricity Plants	0	-2	-2,087	-23	-23	553	-1,559
Petroleum Refineries	-6,818	6,648	-	-	-	-	-170
Other Transformation	-	0	-	-	-	-	-
Own Use	-	-228	-769	-	-	-21	-1,018
Distribution Losses	-	-	-	-	-	-32	-32
TFC	-	**740**	**7,627**	-	-	**501**	**8,867**
Industry sector	-	**57**	**984**	-	-	**324**	**1,365**
Transport sector	-	**608**	-	-	-	**0**	**608**
Other sector	-	**68**	-	-	-	**177**	**245**
Residential	-	68	-	-	-	125	193
Commercial and Public Service	-	-	-	-	-	52	52
Agriculture/ Forestry	-	-	-	-	-	-	-
Non-Specified	-	-	-	-	-	-	-
Non-Energy use	-	**7**	**6,643**	-	-	-	**6,650**
- of which Petrochemical Feedstocks	-	-	6,643	-	-	-	6643

Source: International Energy Agency; Energy Statistics-Oil Data for Trinidad and Tobago, 2004
www.iea.org/textbase/stats/balancetable.asp?COUNTRY_CODE=TT

[1] Hydro, Nuclear and Coal Energy not shown in table due to zero values for Trinidad and Tobago

The way energy is used in different countries and the efficiency of its use are usually quantified by an indicator called *Energy Intensity* (Energy Information Administration; World Energy Intensity, 2004), that is, the ratio between energy consumption (E) - measured in kilojoules (kJ), BTUs, or tons of oil equivalent (toe) - and GDP measured in US dollars. Long-term studies of the evolution of energy intensity in a number of countries indicate that this ratio climbs during the initial phase of development when heavy industrial infrastructure is put in place, reaches a peak, and then decreases. Figure 2.4 shows the Primary Energy Intensity over the years 1980 up to 2004, which reflects the levels of energy consumption and energy efficiency in Trinidad and Tobago. The Primary Energy Intensity, defined as the ratio between primary energy consumption and GDP, rises generally from 1986 in comparison to the years before.

FIGURE 2.4 ENERGY INTENSITY-TOTAL PRIMARY ENERGY CONSUMPTION PER DOLLAR OF GDP[1] 1980-2004



Source: Energy Information Administration- International Energy Annual 2004

[1] Using Market Exchange Rates

Energy consumption per capita is the indicator that reflects the annual consumption of commercial primary energy (coal, lignite, petroleum, natural gas and hydro, nuclear and geothermal electricity) in oil equivalents per capita. It reflects the level of industrial development, the structure of the economy and patterns of consumption. The energy consumption per capita for 2004 is 0.77 (toe/thousand-2000 US$ ppp)[3] for Trinidad and Tobago.

The increase in energy demand is related to economic and social growth and with the obligation to satisfy, both in quality and quantity terms, the growing demand for necessities. The adherence to standards of energy efficiency is required for overall efficiency, which reduces a country's overall energy demand. Savings from this can then be translated into lower capital investment or revenue transferred into much needed social developmental areas or more economic investments. Consumer welfare is enhanced by lower operating cost, businesses have greater access to the global marketplace for their energy efficient products and carbon and other emissions are reduced via a decreased requirement of for example another power-plant to supply energy needs.

[3] **OECD/IEA Energy Statistics, 2007**

2.4 Gas Production - 2003/2004[4]

Natural gas production of Trinidad and Tobago averaged 2,865 mmscf/d for the fiscal year October 2003 to September 2004 (03/04) and was 16.3 % more than the 2002/2003 average (of 2,463 mmscf/d). This increased output satisfied the demand of two new Petrochemical Plants and a new LNG Train. The increase in LNG was mainly due to Train 3 (start-up date April 2003) being in operation for the full 2003/2004-period, as compared to half the time for the 02/03-period.

BP Trinidad and Tobago LLC (bpTT LLC) produced 66.3 % of the country's total and continued to be the largest producer and supplier to both The National Gas Company (NGC) and Atlantic LNG (ALNG). Their average production increased by 16.6 % from 1,630 mmscf/d in 2002/03 to 1901 mmscf/d in 2003/04. This increase came primarily from the Kapok field, mainly to supply Train III and the new Atlas Methanol plant.

British Gas Trinidad Limited (BG) the country's second largest gas producer accounted for 23.3 % of the country's total. Their average production increased by 17.6%, from 568 mmscf/d in 2002/2003 to 668 mmscf/d in 2003/2004. This increase in production was mainly to supply ALNG Train III. From their total production, 256 mmscf/d came from the Dolphin field and was sold to NGC.

EOG Resources Trinidad Limited (EOGR) accounted for 7.0 % of the country's total gas produced. Their average production increased by 9.9 % from 182 mmscf/d in 2002/2003 to 200 mmscf/d in 2003/2004. The increased production came from two fields, Osprey and Parula and was sold to the domestic market (NGC).

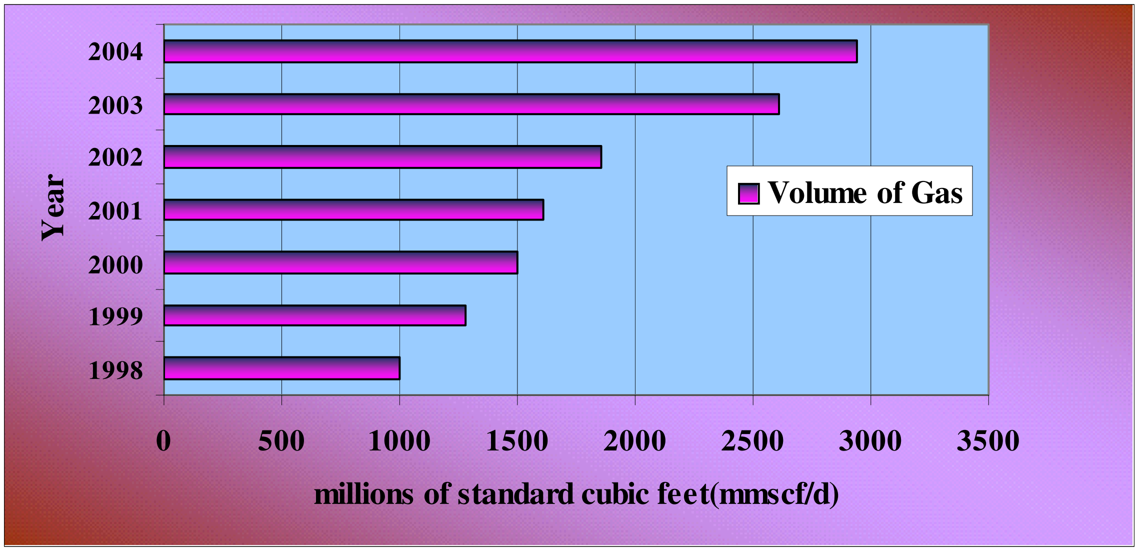
Trinidad and Tobago Marine Petroleum Company (Trintomar) produced at an average daily rate of 0.30 mmscf/d, while Petrotrin-Trinmar marine operations, average daily rate was 62 mmscf/d. Petrotrin-Trinmar's gas production was mainly that associated with the company's oil production.

The natural gas production from the land fields of the State owned company Petrotrin averaged 15 mmscf/d. Central Block, which was previously operated by Vermillion Oil and Gas Trinidad Ltd. is now operated by British Gas as a joint venture with Petrotrin. The average production during the fiscal period 2003/2004 was 20 mmscf/d.

[4] **Ministry of Energy**

The increase in natural gas production between 1998 and 2003 is shown in Figure 2.5. Gas production increased to a total of 2,607 (mmcf/day) in 2003, an increase of 41 % over the previous year.

FIGURE 2.5 NATURAL GAS PRODUCTION, 1998-2004

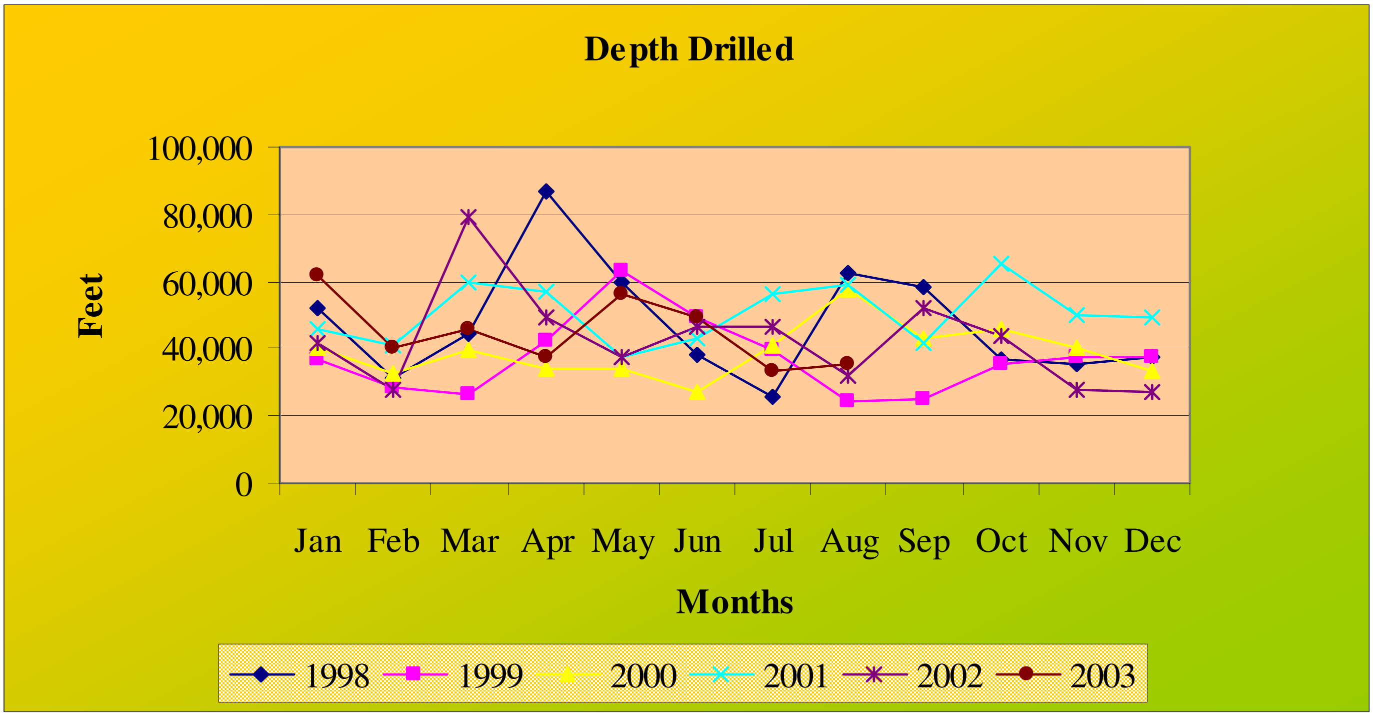


Source: Ministry of Energy

2.5 Drilling

Ninety-five development wells were drilled in 2004. This figure represents a two percent decline below that of 2003 during which ninety-seven wells were drilled. No exploration work was done on land during 2004. Total footage drilled in 2002 was 510,372 feet, approximately 16% decrease when compared to the 606,329 feet drilled in 2001.

FIGURE 2.6 DEPTH DRILLED (feet) 1998-2003



Source: Ministry of Energy

2.5.1 Pipeline infrastructure

Table 2.5 presents some facts on the major offshore ad onshore pipeline infrastructure as documented by the Ministry of Energy.

TABLE 2.5 MAJOR OFFSHORE AND ONSHORE PIPELINES IN TRINIDAD

	Pipeline	**Year of Construction**	**Location**
Major Offshore Pipelines	24" NGC gas pipeline	1978	Teak B to Poui A to Galeota Pt to Guayaguayare Bay Pipeline
	30" NGC gas pipeline	1982	Cassia Platform to Mayaro Regulator Stat
	24" BG gas pipeline	1995	Dolphin Platform to Poui Platform
	40" bpTT LLC gas pipeline	1998	Mahogany Platform to Rustville
	12 " bpTT LLC condensate pipeline	1998	Mahogany to Galeota
	24" BG gas pipeline	2001	Hibiscus Platform to Pt. Fortin
	6" EOG condensate pipeline	2001	Osprey Platform to Pelican Platform
	16" EOG gas pipeline	2001	Osprey Platform tied in to NGC 24"
	26" bpTT LLC multiphase pipeline	2002	Kapok Platform to Cassia Platform
	48" bpTT LLC gas pipeline	2002	Cassia Platform to Rustville
	12" EOG multiphase line	2004	Parula Platform to Pelican Platform
	30" BHP oil pipeline	-	Landfall at Guayaguayare Bay to Pipeline End Manifold, Guayaguayare
	24" BG multiphase pipeline	-	Dolphin Platform to Rustville
	36" NGC gas pipeline	-	Cassia Platform to Rustville
	18" BHP oil pipeline	-	Central Processing Platform (Kairi) to La Brea Village (Mayaro/Guayaguayare Rd)
Major Onshore Pipelines	24" NGC gas pipeline	1978	Guayaguayare Bay to Beachfield
	30" NGC gas pipeline	1982	Mayaro Regulator Station to Abyssinia to Phoenix Park
	36" NGC gas pipeline	1999	Beachfield to Phoenix Park
	24" BG gas pipeline	2001	Pt. Fortin to ALNG
	36" NGC gas pipeline	1998	Leased to bpTT LLC to transport gas to Atlantic LNG.- Beachfield to ALNG
	40" bpTT LLC gas pipeline	1998	Rustville to Beachfield
	48" bpTT LLC gas pipeline	2002	Rustville to Beachfield
	56" NGC gas pipeline	-	Beachfield to ALNG
	36" NGC gas pipeline	-	Rustville to Abyssinia
	48" NGC gas pipeline	-	Abyssinia to Beachfield
	18" BHP oil pipeline	-	La Brea village (Mayaro/Guayaguayare Rd) to Rust Road, Guayaguayare
	30" BHP oil pipeline	-	Rust Road to landfall at Guayaguayare Bay
	24" BG multiphase pipeline	-	Rustville to Beachfield

Source: Ministry of Energy

Pipelines in Chatham, Trinidad

2.6 Electricity

The Trinidad and Tobago Electricity Commission (T&TEC) is the power transmission and distribution utility for the Republic of Trinidad and Tobago. T&TEC is responsible for the design, construction, operation and maintenance of the country's electric transmission and distribution network. The utility supplies electric power to customers on both islands via a single interconnected grid. T&TEC purchases bulk electric power from independent generation companies for resale. This, notwithstanding, by its legislation, the Commission has the exclusive right for power generation in the country. T&TEC is also responsible for securing fuel supplies for the generation companies. It is state owned and regulated and is by law the sole retailer of electric power in the twin-island republic.

There are presently two major power generation companies operating in the country, namely, PowerGen and Trinity Power. Steps are being taken to expand electricity generation capacity in order to meet with the increasing demands particularly of heavy industry.

TABLE 2.6 ELECTRICITY GENERATION AND DISTRIBUTION, 1991-2004

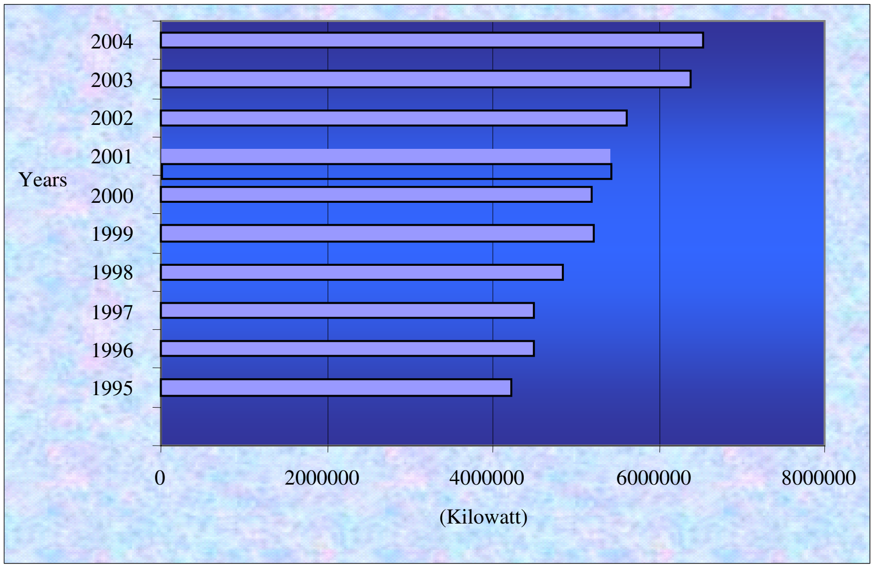
YEAR	TOTAL GENERATED	DISTRIBUTION OF ELECTRICITY							
		DOMESTIC USE		COMMERCIAL USE		INDUSTRIAL USE		STREET LIGHTING	REVENUE FROM KILOWATT HOURS SOLD $000
	KILOWATT HOURS 000	CONSUMER NUMBER	KILOWATT HOURS 000	CONSUMER NUMBER	KILOWATT HOURS 000	CONSUMER NUMBER	KILOWAT T HOURS 000	KILOWAT T HOURS 000	
1991	3,642,379	265,414	849,669	28,279	342,152	1,782	2,009,913	14,379	395,806
1992	3,851,564	267,160	894,611	28,323	341,952	1,814	2,116,205	14,520	522,035
1993	3,816,888	268,676	935,875	28,041	334,462	1,817	2,062,260	14,568	660,561
1994	4,032,912	268,988	921,155	28,034	343,940	1,863	2,210,461	15,076	728,120
1995	4,228,575	262,309	897,241	26,354	319,855	1,840	2,178,077	15,057	782,674
1996	4,487,723	272,547	1,002,041	27,309	360,403	1,872	2,565,626	15,643	854,356
1997	4,840,965	276,180	1,060,166	25,625	410,278	1,905	2,877,565	15,912	1,158,741 r
1998	5,228,008	280,151	1,117,945	28,378	432,262	1,989	3,127,392	18,770	1,223,607
1999	5,190,921	283,613	1,144,684	29,418	456,613	2,045	3,186,697	17,337	1,249,254
2000	6,307,789	285,019	1,250,643	28,544	475,128	2,102	3,271,728	17,875	1,302,192
2001	5,688,286	299,652	1,285,000	30,631	522,911	2,235	3,158,388	18,806	1,351,795
2002	6,036,006	303,901	1,398,664	31,281	520,224	2,338	3,706,752	20,327	1,489,242
2003	6,423,935	312,805	1,541,567	32,419	581,389	2,409	3,941,961	23,175	1,600,695
2004	6,709,605	320,422	1,493,686	33,190	545,325	2,532	3,800,806	24,293	1,600,820

Source: Annual Statistical Digest – Central Statistical Office

r- Revised figure

According to Table 2.6 the industry sector and the household sector were the main electricity consumers in 2000, 52 % and 20 % respectively. The household sector consumed 22 % in 1999 and the industry 61 % of the total energy generated. In addition, the average kilowatt hours consumed is higher in the industry sector in comparison with the other sectors. In Figure 2.7, is found an overview of total electricity generated in Trinidad and Tobago between 1995 and 2004. This was the most dominant type of lighting used by households in both Trinidad and Tobago.

FIGURE 2.7 AN OVERVIEW OF THE ELECTRICITY GENERATION, 1995-2004



Source: Ministry of Energy, 2005

Kerosene was the second dominant type of lighting used by households in Trinidad and Tobago. Gas was the least used source of energy for lighting purposes. (Table 2.7)

TABLE 2.7 DISTRIBUTION OF HOUSEHOLD BY TYPE OF LIGHTING AND FUEL USED FOR COOKING AND MUNICIPALITIES, 2000

Municipality	Type of Lighting for 2000				
	Electricity	Gas	Kerosene	Other	Not Stated
Trinidad	265,473	678	22,006	1,441	1,668
Port of Spain	11,468	15	345	67	71
San Fernando	13,226	20	498	34	115
Arima	7,183	15	229	37	50
Chaguanas	15,391	35	680	69	76
Point Fortin	4,644	10	621	26	22
Diego Martin	23,709	58	783	132	166
San Juan/ Laventille	36,630	123	1,481	310	373
Tunapuna/Piarco	43,453	77	2,473	219	343
Couva/Tabaquite/Talparo	34,868	85	4,126	157	153
Mayaro/RioClaro	6,512	35	1,321	29	26
Sangre Grande	12,455	31	2,744	134	71
Princes Town	19,142	46	2,589	68	82
Penal/ Debe	18,543	48	1,665	78	50
Siparia	18,249	80	2,451	81	70
	Type of Lighting for 2000				
Municipality	**Electricity**	**Gas**	**Kerosene**	**Other[1]**	**Not Stated**
Tobago	11,940	33	386	105	141
St. George	1,216	4	52	12	16
St. Mary	629	3	47	8	7
St. Andrew	3,712	13	68	21	53
St. Patrick	2,801	4	65	14	35
St. David	1,699	2	48	34	16
St. Paul	1,155	4	57	10	10
St. John	728	3	49	6	4
Trinidad and Tobago	277,413	711	22,392	1,546	1,809

Source: Population and Housing Census 2000

[1] – e.g. Batteries

According to the 2000 Census, Gas/LPG was the dominant fuel used for cooking and was the most common fuel source among rural and low-income households. Electricity and wood/ charcoal were respectively at the second and third place as sources or fuel used for cooking. (see Table 2.8).

TABLE 2.8 DISTRIBUTION OF HOUSEHOLD BY TYPE OF FUEL USED FOR COOKING BY MUNICIPALITIES, 2000

Municipality		Cooking Fuel				
		None	Electricity	LPG/ Cooking Gas	Kerosene	Wood/ Charcoal
Trinidad		1,640	12,674	270,709	1,523	2,172
	Port of Spain	159	1,081	10,424	161	35
	San Fernando	55	1,029	12,541	77	29
	Arima	45	408	6,950	25	27
	Chaguanas	81	553	15,403	33	46
	Point Fortin	36	64	5,107	43	26
	Diego Martin	106	3,691	20 644	91	90
	San Juan/Laventille	303	1,480	36,220	272	136
	Tunapuna/Piarco	222	2,412	43,107	143	234
	Couva/Tabaquite/Talparo	206	802	37 679	161	326
	Mayaro/RioClaro	28	45	7,583	70	145
	Sangre Grande	101	144	14,608	116	337
	Princes Town	92	203	21,133	111	232
	Penal/ Debe	100	461	19,367	75	285
	Siparia	106	301	19,943	145	224
Tobago		70	545	11,699	32	65
	St. George	4	28	1,240	4	7
	St. Mary	2	4	664	2	8
	St. Andrews	16	243	3,513	10	12
	St. Patrick	16	203	2,651	7	4
	St. David	23	34	1,709	1	14
	St. Paul	4	22	1,181	2	10
	St. John	5	11	741	6	10
Trinidad and Tobago		1,710	13,219	282,408	1,555	2,237

Source: Population and Housing Census 2000, Central Statistical Office

2.7 Environmental Quality

The Ministry of Energy and Energy Industries monitors environmental quality in areas such as:

- Land and marine operations in exploration and production of oil and gas
- Refineries at Pointe-a-Pierre and Point Fortin
- Petrochemical plants at the Point Lisas Industrial Estate
- Gas and service stations
- Other energy related facilities.

The monitoring programme is conducted by the Inspectorate Division through:

i) Investigations of all oil spills and chemical discharge incidents.

ii) Regular inspections of petroleum installations and surrounding areas, including:

- Drilling and Work over Rigs
- Production Platforms
- Gathering Stations
- Rivers and Coastal areas including beaches.

iii) Monthly sampling of effluents from oil and petrochemical facilities, which are performed at strategic points where wastewater enters public waterways. These samples are analyzed by CARIRI to check for levels of oil and grease. Other checks are made for levels of ammonia, and pH, among others. Variances from allowable limits are communicated to the respective company, in order to affect corrective measures.

River polluted with oil in Vessigny, Trinidad following a damaged pipeline during land clearing.

A river in an oil producing area in south Trinidad.

Table 2.9 is a summary of effluent samples taken from 1995-1999. The data indicates that there is a wide variation in the results obtained. The method used for the oil and grease measurement is the US EPA Method 1664: N-Hexane Extrables Material (HEM). The limits for this is set at 10 mg/L (ppm) for discharge into land inland surface water, 15 mg/L for coastal nearshore and 100mg/L for the marine environment (see Appendix 2.I for more details).

TABLE 2.9 SUMMARY RESULTS OF OIL AND GAS EFFLUENT SAMPLING IN TRINIDAD AND TOBAGO, 1995- 1999[5]

Site	Years	Min. Value	Max. Value
Petrotrin Molai Oil Catch	1995 - 1999	2	433
Petrotrin Pt.Fortin Central Main Storage Oil Catch	1995 - 1999	50	13,071
Petrotrin Guapo TB5 Oil Catch	1995 - 1999	29	588
Petrotrin TNA Secondary Oil Catch	1995 - 1999	28	775
Petrotrin Vessigny River	1995 - 1999	1	189
Petrotrin Vance River Oil Catch	1995 - 1999	1	3,442
Petrotrin Arrow Head Dam	1995 - 1999	1	1,715
Petrotrin TB33 Oil Catch	1995 - 1999	1	769
Petrotrin LB3 Oil Catch	1995 - 1999	31	1455
Petrotrin Coora Oil Catch	1995 - 1999	5	119
Petrotrin John River Oil Catch	1995 - 1999	1	372
Petrotrin 10A Oil Catch	1995 - 1999	4	585
Petrotrin Guapo Main Storage 1995 - 1999	1995 - 1999	4	2,591
Petrotrin Moruga 108 Oil Catch	1995 - 1999	6	81
Petrotrin TB.6 Oil Catch	1995 - 1999	1	61
Petrotrin Brighton G/Stn. #13 Oil Catch	1995 - 1999	99	882
T.N.A. Main STGE. Oil Catch	1995 - 1999	12	520
P.C.O. Molai Oil Catch	1995 - 1999	1	233
A.T.O.C Pt.Galeota Settling Pond	1995 - 1999	44	1,059
A.T.O.C Pt.Galeota Oily Water Pond	1995 - 1999	7	554

Source: Ministry of Energy and CARIRI

[5] Interpretation of values can be made using the Trinidad and Tobago Standard for the specification of the effluent from Industrial Processes Discharged into the Environment TTS 547: 1998

2.8 Quarrying

The Trinidad and Tobago quarry industry, in 2004, comprised fifty-six (56) active quarries of which thirty-eight (38) are sand and gravel quarries. Of the sand and gravel quarries, twelve (12) were operating illegally. Total production from the quarry sector for 2002 was approximately seven million cubic yards (*Draft Quarry Policy for Trinidad and Tobago, 2005*). Of this production, 4.5 million cubic yards were sand and gravel, approximately 50 per cent of this figure resulting from illegal quarrying.

Quarrying in North Trinidad

Quarries structured by type of product in Trinidad and Tobago are categorized as follows:

Sand and gravel	22
Andesite	3
Blue limestone	14
Prorcellanite	4
Clay	4
Oil sand	1
Yellow limestone	5
Plastering/ fill sand	3

Source: Draft Quarry Policy for Trinidad and Tobago, 2005

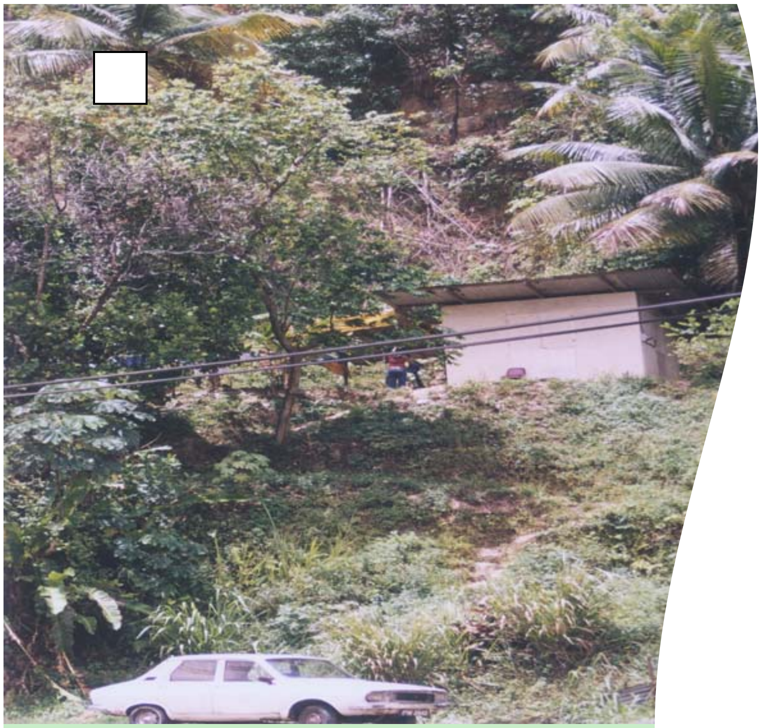
Approximately 80 % of the quarries are located on state lands and 50 % of the state's quarry materials are vested in the state-own company, National Quarries Company Limited. Possible quarry reserves as at 1 January 2004 in Trinidad and Tobago were 2,530 million cubic yards spread over 8,430 acres (Table 2.10). Fifty percent of this reserve is clay.

TABLE 2.10 POSSIBLE UNAUDITED AND UNRISKED QUARRY RESERVES IN TRINIDAD AND TOBAGO

Type	Acres	Reserves (million cubic yards)
Valencia Sands and gravel	5,000[1]	300
Blue limestone	500	150
Andesite	1,200	400
Yellow limestone	600	150
Clays	5,000*	1,200
Porcellanite	230	30
Tar sand	900	300
Total	8,430	2,530

Source: Draft Quarry Policy for Trinidad and Tobago, 2005

* refers to same area



CHAPTER 3

HUMAN SETTLEMENT

Photographs courtesy Satee Boodoo

3 HUMAN SETTLEMENT

Introduction

Historically to the present time, the pattern of human habitation has impacted on the natural environment in several ways. Each human being on the planet occupies land area, consumes water, requires air and is responsible for the creation of waste. In their life's journey, people build homes, businesses, require recreational areas and other institutional facilities. These buildings impact on the physical environment whether it be slums or cities. Issues of overcrowding, squatting and housing shortages, land tenure, availability of food, clothing and shelter, consumption of water, building of transportation routes, air pollution, health concerns or generation of tonnes of waste become an environmental focus area which arises from the development of human settlements.

The impacts of population size and distribution on the environment are linked to economic production levels, natural resource consumption, land use patterns and pollution and waste generation. An increased population density results in higher concentrations of e.g. waste products, emissions, sewage. In addition, environmental health becomes an area of concern because of the higher risk for environmentally-related diseases. Human settlements provide the living space for people's day to day living activities, therefore healthy and safe environments are the central focus in sustainable development. Their characteristics also describe important facets of the living conditions.

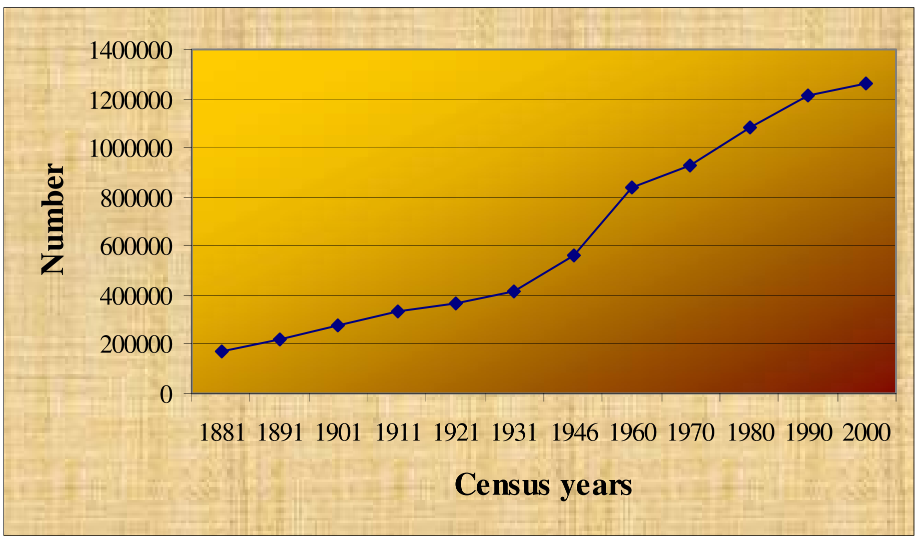
Human settlements are connected to the following:

- food and nutrition
- air quality and noise pollution
- adequate access to transport
- vector control
- safe drinking water and treatment of discharged wastewater
- increased energy needs
- greater consumption of materials for buildings and infrastructure
- feedstock requirements for manufacturing of products and household consumption of these products.
- environmental hazards and toxic materials, levels of contamination of soil and groundwater
- waste management

3.1 Population

The interrelation between population growth and the environmental quality is as mentioned very complex. Population growth rates can exert pressure on the environment, which can affect long-term sustainability of natural resources and can also affect the quality of life; proper measures, actions, planning and regulation should be put in place. Population growth is not conceived as a problem in Trinidad and Tobago. The Trinidad and Tobago population at all censuses ever taken, starting in 1881 up to 2000, is shown in figure 3.1. It shows an even increase from about 0.2 million inhabitants in 1881 to 1.3 million in 2000. For the years after 2000, annual estimates of the population are derived using the census as a base, with the births and deaths provided by the Vital Registration Office and estimates of migration derived from records of the Immigration Department being applied.

FIGURE 3.1: POPULATION AT CENSUS YEARS, 1881-2000



Source: Central Statistical Office

According to the 2003 mid-year population estimates the population of Trinidad and Tobago grew by 0.5 % to 1,290,646 persons in 2004, from 1,282,447 persons in 2003.Population data according to age groups in 2004, indicated that 45% of the population was 24 years or under, 45% was between 25 and 59 years, and 10% 60 years or over (CSO – Population and Vital Statistics). The gender distribution of the population remained stable with males accounting for 50.2% of the population and females the remainder.

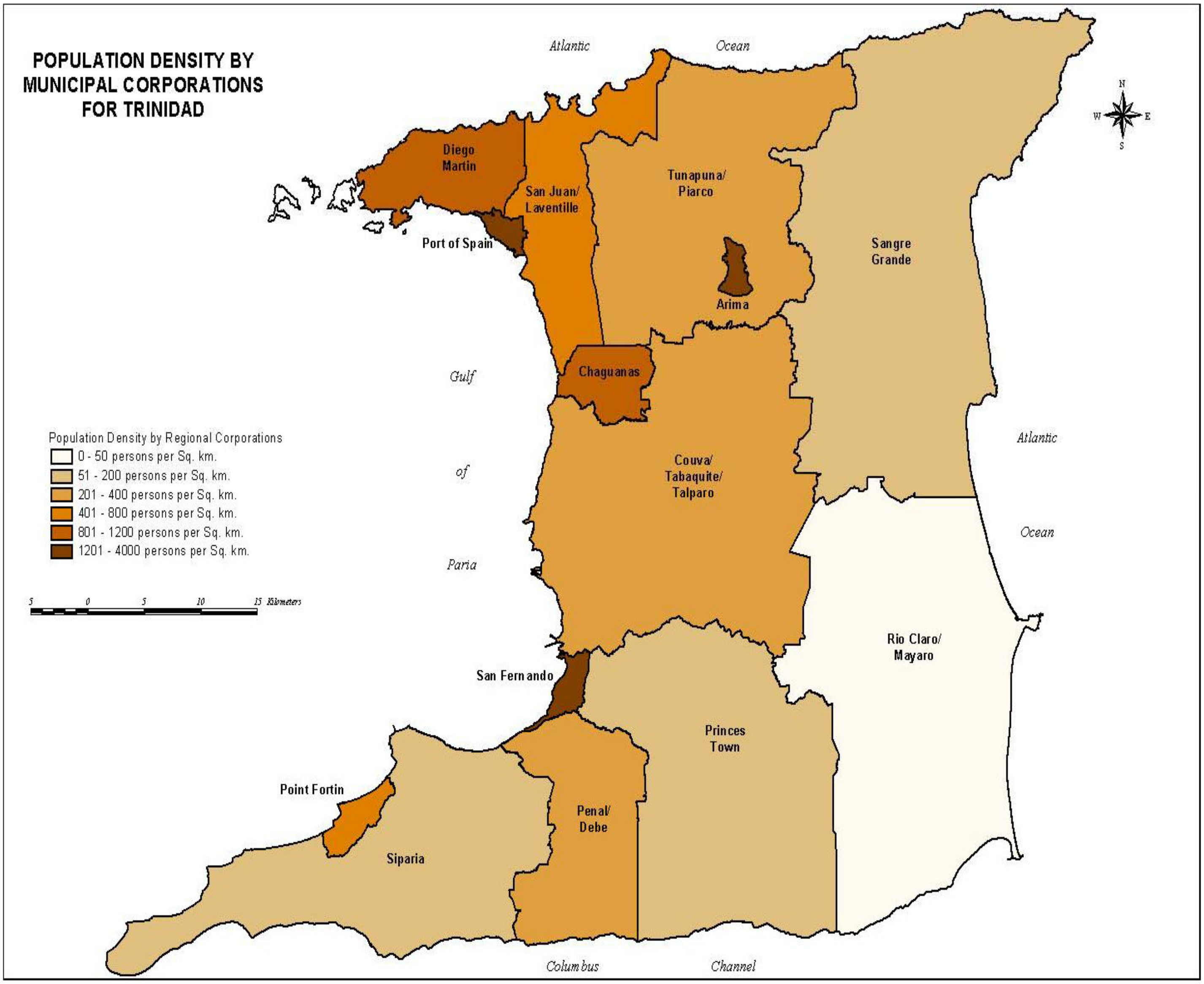
Trinidad and Tobago population density is increasing, at both the national and municipality level. The 2000 population density was 246 persons per square kilometer, 9 persons more than that of 1990. The highest densities were found in Port of Spain, San Fernando, Arima and Chaguanas.

TABLE 3.1: POPULATION AND POPULATION DENSITY FOR ALL MUNICIPALITIES, 2000

Municipalities	Population (2000) Census	Square kilometers	Population density
Trinidad and Tobago	**1,262,366**	**5,127**	**246**
Port of Spain	49,031	12	4,086
San Fernando	55,419	19	2,917
Arima	32,278	12	2,690
Chaguanas	67,433	59	1,143
Point Fortin	19,056	25	762
Diego Martin	105,720	126	839
San Juan /Laventille	157,295	239	658
Tunapuna / Piarco	203,975	510	400
Couva /Tabaquite/Talparo	162,779	723	225
Mayaro /Rio Claro	32,143	814	41
Sangre Grande	65,680	927	69
Princes Town	91,947	620	148
Penal/Debe	83,609	246	340
Siparia	81,917	495	165
Trinidad	**1,208,282**	**4,827**	**250**
Tobago	**54,084**	**300**	**180**

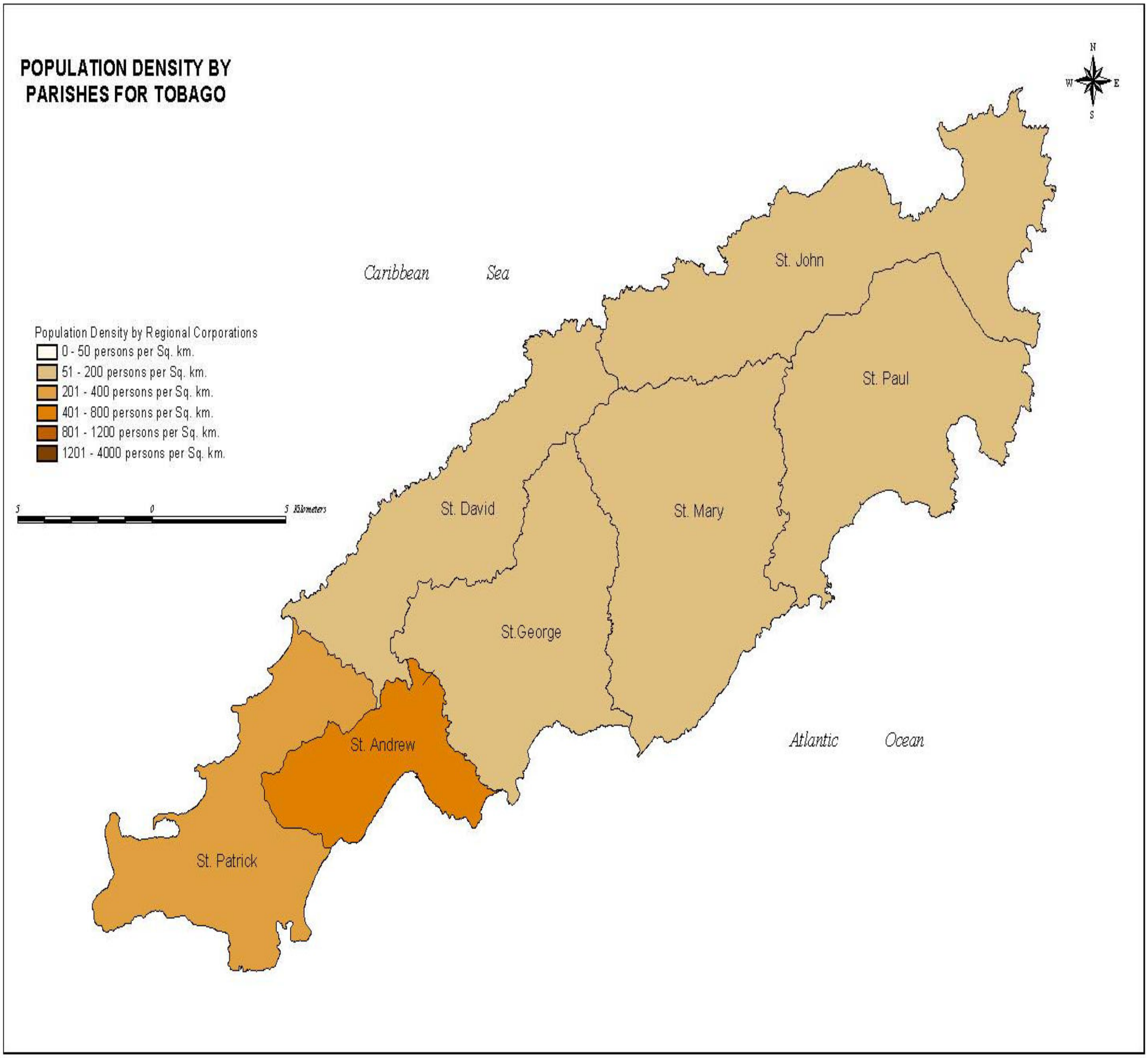
Source: Central Statistical Office

MAP 3.1 POPULATION DENSITY BY MUNICIPAL CORPORATIONS FOR TRINIDAD



Source: Population and Housing Census, 2000

MAP 3.2 POPULATION DENSITY BY PARISHES FOR TOBAGO



Source: Population and Housing Census, 2000

The development of human settlement involves a transformation of the natural environment into a man-made environment thus giving rise to many different environmental concerns. Rapid urbanization is one of the most challenging features of the development affecting the environment within human settlements as well as the area surrounding them. There are very large differences in density between the municipalities (see table 3.1 population by Municipality). Some municipalities are predominantly rural.

3.2 Housing

The National Housing Policy 2002 for housing was based on the philosophy that the state has a responsibility to formulate and develop measures for implementing a comprehensive policy framework for the sector. This policy was intended to:

- Widen the range of alternatives for housing and living environments available to the different segments of the population, especially the poor and vulnerable groups;
- Facilitate as many households as possible to access housing of their choice within means; and
- Assist directly the households to acquire appropriate housing.

It was estimated that 115,027 new housing units would have been required in Trinidad and Tobago during the ten-year period between 1995 and 2005. A breakdown of the estimated effective housing demand for that period was as follows:

Residential Area, Oropouche, Trinidad

Residential Area, Moka, Trinidad

TABLE 3.2: ESTIMATED HOUSING DEMAND IN TRINIDAD AND TOBAGO

Income Range	Units needed						
	East/ West Corridor	Caroni	San Fernando	Secondary Towns	Rest of T&T	Tobago	Total
Low income	10,037	5,286	2,528	2,931	25,441	1,892	48,115
Middle income	13,253	4,728	3,150	2,934	19,822	1,954	45,841
High income	6,654	2,007	2,092	1,876	7,763	679	21,071
TOTAL	**29,944**	**12,021**	**7,770**	**7,741**	**53,026**	**4,525**	**115,027**

Source: National Housing Policy, Ministry of Housing, 2002

It is important to note the monthly income ranges at the mid point of this ten year period: low income below; $3,632TT, middle income; $3,633 - $8,843TT and high income $8,843TT and over. It was estimated that 14,944 acres of land would be required over the period, 1995 – 2005 to satisfy total residential needs.

The distribution of home ownership had remained relatively unchanged since 1980. In 2000 approximately 76% of the households owned the dwelling they lived in, compared to 74% in 1990. In 1980, the ownership of dwellings was 65 %.
The distribution of home ownership by municipalities in 2000 varied between 87% and 52%, while the distribution of home ownership by administrative areas in 1990 varied between 48% and 83%.

Residential Area, Laventille, Trinidad

TABLE 3.3.1: PERCENTAGE DISTRIBUTION OF DWELLING UNITS BY TYPE OF TENURE AND MUNICIPALITIES, 2000

Municipalities	Type Of Tenure											
	Owned	Rented			Leased			Rent free	Squat-ted	Other	Don't know	Not Stated
		Rented private	Rented govern-ment	Total rented	Leased private	Leased govern-ment	Total leased					
Trinidad and Tobago	**76.12**	**13.18**	**1.95**	**15.14**	**0.19**	**0.39**	**0.58**	**6.64**	**0.48**	**0.44**	**0.09**	**0.51**
Port of Spain	52.17	24.68	12.94	37.62	0.19	0.25	0.45	8.56	0.39	0.27	0.10	0.44
San Fernando	62.82	22.23	3.71	25.94	0.17	0.68	0.85	7.35	1.51	0.64	0.11	0.78
Arima	76.19	13.17	1.93	15.10	0.15	0.27	0.42	7.42	0.13	0.24	0.11	0.39
Chaguanas	80.63	11.14	0.72	11.85	0.27	0.11	0.37	5.64	0.37	0.66	0.09	0.38
Point Fortin	75.21	13.24	0.49	13.73	0.17	0.13	0.30	9.94	0.11	0.34	0.08	0.28
Diego Martin	74.36	17.40	0.98	18.38	0.19	0.31	0.49	4.87	0.40	0.54	0.22	0.74
SanJuan/ Laventille	65.09	22.56	3.17	25.72	0.19	0.13	0.32	6.73	0.88	0.39	0.08	0.79
Tunapuna/ Piarco	74.35	14.55	3.11	17.67	0.21	1.16	1.37	5.25	0.32	0.37	0.09	0.58
Couva/Tabaquite /Talparo	83.99	6.42	0.92	7.34	0.29	0.59	0.88	6.48	0.50	0.42	0.06	0.33
Mayaro/Rio Claro	86.69	5.76	0.11	5.88	0.22	0.18	0.39	5.89	0.28	0.42	0.17	0.28
Sangre Grande	81.78	7.72	0.84	8.56	0.20	0.13	0.33	8.20	0.25	0.29	0.09	0.49
Princes Town	84.28	6.49	0.08	6.57	0.17	0.12	0.28	7.27	0.63	0.49	0.06	0.42
Penal/Debe	84.60	6.72	0.18	6.90	0.08	0.04	0.13	7.54	0.22	0.36	0.04	0.20
Siparia	83.25	8.29	0.19	8.49	0.09	0.06	0.15	7.07	0.35	0.40	0.06	0.24
Trinidad	**76.19**	**13.10**	**2.02**	**15.12**	**0.19**	**0.40**	**0.59**	**6.60**	**0.49**	**0.42**	**0.09**	**0.49**
Tobago	**74.34**	**15.15**	**0.53**	**15.68**	**0.21**	**0.19**	**0.40**	**7.55**	**0.13**	**0.93**	**0.10**	**0.87**

Source: Population and Housing Census, 2000

TABLE 3.3.2: PERCENTAGE DISTRIBUTION OF DWELLING UNITS BY TYPE OF TENURE AND ADMINISTRATIVE AREAS, 1980 AND 1990

Administrative Area	Type Of Tenure					
	Owned	Leased	Rented	Rent free	Squatted	Other
	1980					
Trinidad and Tobago	**64.57**	**0.38**	**24.28**	**9.38**	**0.47**	**0.92**
Port-of-Spain	41.24	0.33	46.32	10.29	0.78	1.04
San Fernando	40.71	0.20	50.62	7.56	0.08	0.83
Arima	70.05	0.02	20.06	8.58	0.16	1.15
St. George	57.93	0.47	30.34	9.47	0.61	1.19
Caroni	77.60	0.30	11.53	9.57	0.25	0.76
Nariva/Mayaro	73.16	0.13	13.37	11.83	0.95	0.55
St. Andrew/St. David	72.33	0.56	14.72	11.45	0.44	0.51
Victoria	71.72	0.08	17.90	9.23	0.40	0.67
St. Patrick	73.43	0.08	17.24	8.26	0.41	0.58
Tobago	**71.23**	**2.32**	**16.73**	**8.06**	**0.06**	**1.61**
	1990					
Trinidad and Tobago	**74.27**	**0.46**	**15.77**	**8.12**	**0.47**	**0.90**
Port-of-Spain	47.75	0.16	40.50	9.50	0.66	1.44
San Fernando	54.25	0.66	33.84	9.27	0.90	1.07
Arima	76.40	1.31	14.38	6.75	0.13	1.03
St. George	68.82	0.52	21.43	7.65	0.52	1.07
Caroni	82.56	1.05	7.61	7.31	0.80	0.68
Nariva/Mayaro	83.08	0.14	7.96	7.45	0.32	1.05
St. Andrew/St. David	82.19	0.11	6.94	9.26	0.38	1.13
Victoria	79.88	0.23	9.74	9.21	0.38	0.56
St. Patrick	82.25	0.10	9.66	7.32	0.21	0.46
Tobago	**74.84**	**0.24**	**12.63**	**10.56**	**0.05**	**1.68**

Source: Population and Housing Census, 1980 & 1990

According to the 2000 census, approximately 84% of dwellings had access to pipe water; this percentage includes public piped into dwelling 61%, public piped into yard 9%, public stand pipe 10% and private piped into dwelling 4%. The percentage in 1980 and 1990 were respectively 90% and 86%.Piped water is safer for consumption because it undergoes a treatment process. This indicates that more people are getting access to pipe and safer drinking water.

TABLE 3.4.1: PERCENTAGE DISTRIBUTION OF DWELLING UNITS BY TYPE OF WATER SUPPLY AND MUNICIPALITIES, 2000

Municipalities	Type Of Water Supply								
	Public piped into dwelling	Public piped into yard	Public stand pipe	Private piped into dwelling	Private catch-ment not piped	Truck borne	Spring water	Other	Not Stated
Trinidad and Tobago	**60.53**	**8.76**	**9.58**	**4.46**	**8.36**	**2.07**	**1.50**	**4.11**	**0.61**
Port of Spain	80.88	5.00	10.10	2.19	0.45	0.29	0.06	0.76	0.29
San Fernando	86.33	2.61	5.44	2.19	0.78	0.36	0.01	1.40	0.89
Arima	88.02	4.51	3.31	1.38	0.40	0.07	0.27	1.52	0.52
Chaguanas	71.36	8.59	3.88	5.74	4.18	1.25	1.04	3.41	0.55
Point Fortin	38.80	9.85	23.26	9.85	14.85	1.08	0.13	1.89	0.30
Diego Martin	59.95	3.38	13.18	4.68	3.51	3.90	5.69	4.96	0.76
San Juan /Laventille	62.42	6.29	14.47	4.99	3.90	1.83	2.63	2.61	0.87
Tunapuna /Piarco	80.68	4.54	5.68	2.45	1.96	0.60	1.51	1.95	0.63
Couva/Tabaquite/Talparo	53.32	13.58	8.84	4.17	10.42	2.93	0.80	5.45	0.49
Mayaro/Rio Claro	25.34	9.69	7.85	5.83	38.28	5.43	0.28	6.93	0.37
Sangre Grande	44.66	7.79	13.91	3.75	18.73	1.42	2.72	6.49	0.53
Princes Town	44.31	10.42	11.41	6.30	15.80	3.02	0.61	7.61	0.52
Penal/Debe	43.03	18.35	7.26	5.63	16.59	3.24	0.29	5.29	0.32
Siparia	41.38	15.60	10.56	6.56	14.67	3.44	0.61	6.74	0.43
Trinidad	**60.34**	**8.66**	**9.64**	**4.45**	**8.55**	**2.11**	**1.52**	**4.14**	**0.58**
Tobago	**64.99**	**11.08**	**8.14**	**4.80**	**4.02**	**1.14**	**1.16**	**3.47**	**1.21**

Source: Population and Housing Census, 2000

TABLE 3.4.2: PERCENTAGE DISTRIBUTION OF DWELLING UNITS BY TYPE OF WATER SUPPLY AND ADMINISTRATIVE AREAS, 1980 AND 1990

Administrative Area	Public piped into dwelling	Public piped into yard	Private piped into dwelling	Private catch-ment not piped	Public stand pipe	Other
			1980			
Trinidad and Tobago	**44.43**	**15.83**	**4.04**	**1.82**	**25.39**	**8.50**
Port-of-Spain	67.36	17.72	4.54	0.16	9.48	0.73
San Fernando	91.77	4.8	0.15	0.20	2.54	0.54
Arima	65.36	15.15	2.75	0.26	15.51	1.09
St. George	50.45	13.57	4.27	0.98	22.28	8.46
Caroni	31.16	27.82	3.59	2.11	25.59	9.43
Nariva/Mayaro	17.27	9.33	5.72	11.76	29.64	26.29
St. Andrew/St. David	30.47	13.21	3.63	4.20	31.27	17.22
Victoria	39.22	16.74	3.29	1.89	30.76	8.10
St. Patrick	29.36	13.77	6.55	2.63	38.42	9.28
Tobago	**41.17**	**17.53**	**1.39**	**0.80**	**34.69**	**4.42**
			1990			
Trinidad and Tobago	**55.02**	**12.11**	**4.23**	**5.15**	**15.04**	**8.45**
Port-of-Spain	75.35	10.21	3.95	0.48	8.84	1.16
San Fernando	91.36	1.77	0.28	0.40	4.81	1.38
Arima	77.81	9.54	4.93	1.87	3.62	2.23
St. George	64.06	7.57	3.82	3.07	15.46	6.02
Caroni	51.7	20.00	4.18	3.68	11.05	9.38
Nariva/Mayaro	28.40	14.93	3.38	14.15	21.55	17.60
St. Andrew/S. David	38.31	10.27	3.95	13.84	16.50	17.14
Victoria	48.63	15.59	4.27	4.76	16.83	9.92
St. Patrick	34.10	14.48	6.32	11.37	2.74	12.99
Tobago	**51.34**	**15.33**	**5.37**	**5.99**	**14.77**	**7.20**

Source: Population and Housing Census, 1980 & 1990

The 2000 Census data on type of toilet facility indicates that 50% of the dwelling units in 2000 used "WC not linked to sewer" and 27% used "pit/ latrine". The different types of facilities between the various municipality areas are shown in table 3.5.1. In addition, 74% of the dwellings in Port of Spain used "WC linked to sewer" while 63% of the dwelling units in Tobago used "WC not linked to sewer". The majority of the dwelling units used "pit" in 1980 (58%) as well as in 1990 (41%). The differences in the toilet facilities in 1980 and 1990 by the various administrative areas are shown in the table 3.5.2.

TABLE 3.5.1: PERCENTAGE DISTRIBUTION OF DWELLING UNITS BY TYPE OF TOILET FACILITY AND MUNICIPALITIES, 2000

Municipalities	Type Of Toilet Facility					
	WC linked to sewer	Septic tank/ Soakaway	Pit/latrine	Other	None	Not Stated
Trinidad and Tobago	**21.72**	**50.20**	**26.78**	**0.09**	**0.43**	**0.78**
Port of Spain	73.79	9.77	14.92	0.07	0.88	0.56
San Fernando	50.04	39.68	8.64	0.05	0.25	1.34
Arima	50.41	36.34	11.82	0.19	0.28	0.97
Chaguanas	14.70	64.66	19.69	0.07	0.23	0.65
Point Fortin	10.56	53.91	34.56	0.04	0.49	0.43
Diego Martin	37.47	39.21	21.94	0.08	0.38	0.92
San Juan /Laventille	33.15	41.94	22.90	0.11	0.51	1.38
Tunapuna /Piarco	31.73	50.17	16.75	0.12	0.29	0.95
Couva/Tabaquite/Talparo	7.33	60.42	31.21	0.09	0.46	0.49
Mayaro/Rio Claro	1.46	47.74	50.03	0.04	0.33	0.41
Sangre Grande	3.83	46.29	48.52	0.15	0.65	0.56
Princes Town	4.07	56.09	38.95	0.06	0.40	0.44
Penal/Debe	5.58	61.37	32.15	0.09	0.47	0.35
Siparia	1.25	61.91	35.77	0.05	0.56	0.44
Trinidad	**22.47**	**49.66**	**26.57**	**0.09**	**0.43**	**0.77**
Tobago	**4.31**	**62.56**	**31.54**	**0.14**	**0.38**	**1.06**

Source: Population and Housing Census, 2000

TABLE 3.5.2: PERCENTAGE DISTRIBUTION OF DWELLING UNITS BY TYPE OF TOILET FACILITY AND ADMINISTRATIVE AREAS, 1980 AND 1990

Administrative Area	Type Of Toilet Facility				
	Pit/latrine	WC linked to sewer	WC not linked to sewer	Other	Not Stated
	1980				
Trinidad and Tobago	**58.05**	**19.95**	**21.14**	**0.07**	**0.80**
Port-of-Spain	27.58	65.38	5.58	0.05	1.41
San Fernando	14.30	76.66	8.43	0.01	0.60
Arima	41.73	44.14	13.20	0.16	0.77
St. George	49.61	28.23	21.30	0.04	0.82
Caroni	74.50	2.32	22.60	0.02	0.56
Nariva/Mayaro	81.24	4.24	13.09	0.28	1.15
St. Andrew/St. David	78.76	2.97	17.58	0.10	0.59
Victoria	66.89	3.47	28.89	0.06	0.69
St. Patrick	71.47	5.23	22.49	0.10	0.72
Tobago	**65.31**	**3.37**	**29.89**	**0.18**	**1.25**
	1990				
Trinidad and Tobago	**41.31**	**21.96**	**35.73**	**0.07**	**0.93**
Port-of-Spain	20.00	72.14	6.06	0.19	1.60
San Fernando	9.79	81.50	7.30	0.06	1.35
Arima(Borough)	22.70	50.71	25.32	0.05	1.21
St. George	32.30	33.81	32.79	0.09	1.01
Caroni	47.41	9.28	42.60	0.05	0.68
Nariva/Mayaro	67.16	1.91	29.55	0.01	1.37
St. Andrew/St. David	64.81	3.00	31.33	0.10	0.77
Victoria	47.00	5.68	46.65	0.03	0.64
St. Patrick	54.73	3.35	41.17	0.04	0.72
Tobago	**47.03**	**6.09**	**45.16**	**0.08**	**1.65**

Source: Population and Housing Census, 1980 & 1990

The most often used material of outer walls in the year 2000 “was brick/ concrete”: in Trinidad 65% and in Tobago 59%. In addition, the differences between the municipalities varied between 35% and 82%.The second dominant material used by dwelling was in both Trinidad and Tobago was a combination of “wood/brick/concrete”. In the 1980 census “brick” (41%) was the dominant used material for outer walls followed by “wood” (33%). This was also the case in 1990 but with different percentages: “brick” 39% and “wood” 28%.

TABLE 3.6.1: PERCENTAGE DISTRIBUTION OF DWELLING UNITS BY TYPE OF MATERIAL OF OUTER WALL AND MUNICIPALITIES, 2000

Municipalities	Brick/ Concrete	Wood	Wood/ brick/ Concrete	Wood/ Galvanize	Wattle/ Adobe/ Tapia	Other	Not Stated
Trinidad and Tobago	**64.28**	**12.28**	**20.23**	**2.22**	**0.45**	**0.20**	**0.35**
Port of Spain	73.92	13.01	9.56	2.36	0.79	0.23	0.13
San Fernando	72.75	11.94	11.29	2.66	0.61	0.04	0.71
Arima	77.54	8.78	7.3	1.41	2.72	1.87	0.37
Chaguanas	80.66	6.68	11.15	1.17	0.02	0.02	0.31
Point Fortin	49.05	15.52	32.07	2.85	0.04	0.13	0.33
Diego Martin	82.22	6.93	8.84	1.33	0.16	0.09	0.43
San Juan/Laventille	77.12	8.81	11.17	1.5	0.66	0.09	0.65
Tunapuna/Piarco	77.98	7.04	10.68	2.32	1.09	0.4	0.49
Couva/Tabaquite/Talparo	60.48	11.91	24.35	2.6	0.14	0.31	0.21
Mayaro/Rio Claro	34.56	17.41	46.03	1.58	0.16	0.03	0.23
Sangre Grande	56.95	9.35	29.04	3.78	0.58	0.08	0.22
Princes Town	39.36	20.67	36.59	3.13	0.02	0.04	0.19
Penal/Debe	48.2	19.09	30.19	2.33	0.03	0.02	0.13
Siparia	44.34	19.76	32.87	2.53	0.23	0.13	0.14
Trinidad	**64.51**	**11.96**	**20.25**	**2.26**	**0.47**	**0.21**	**0.34**
Tobago	**59.18**	**19.2**	**19.72**	**1.29**	**0.00**	**0.04**	**0.58**

Source: Population and Housing Census 2000

TABLE 3.6.2: PERCENTAGE DISTRIBUTION OF DWELLING UNITS BY TYPE OF MATERIAL OF OUTER WALL AND ADMINISTRATIVE AREAS, 1980 AND 1990

Administrative Area	Material Of Outer Walls							
	Brick	Concrete	Wood and concrete	Wood and brick	Wood	Wattle/ adobe tapia	Other	Not Stated
	1980							
Trinidad and Tobago	**41.23**	**12.61**	**6.62**	**2.74**	**32.59**	**3.30**	**0.39**	**0.52**
Port-of-Spain	34.60	28.47	14.67	2.11	17.82	1.47	0.24	0.62
San Fernando	32.49	27.85	12.01	4.62	20.89	1.48	0.02	0.64
Arima(Borough)	49.91	16.38	2.05	1.50	14.17	15.16	0.24	0.59
St. George	59.36	13.27	3.71	1.85	15.47	5.28	0.35	0.70
Caroni	51.99	6.90	4.44	2.71	29.52	3.43	0.58	0.42
Nariva/Mayaro	11.13	5.82	8.36	2.19	70.75	1.06	0.42	0.27
St. Andrew/St. David	37.36	12.02	5.28	3.12	36.19	5.07	0.75	0.21
Victoria	23.25	6.88	9.16	4.59	55.29	0.28	0.21	0.34
St. Patrick	16.38	8.09	9.00	3.08	61.17	1.35	0.60	0.31
Tobago	**27.63**	**26.15**	**7.96**	**2.41**	**34.81**	**0.12**	**0.21**	**0.71**
	1990							
Trinidad and Tobago	**38.71**	**20.11**	**7.88**	**3.31**	**28.08**	**1.03**	**0.43**	**0.44**
Port-of-Spain	35.84	35.22	11.29	1.87	13.83	1.18	0.30	0.47
San Fernando	36.62	32.01	11.89	2.71	14.90	0.96	0.18	0.74
Arima(Borough)	49.21	21.82	2.61	1.61	14.11	6.90	2.90	0.85
St. George	51.89	23.89	3.82	2.04	15.71	1.66	0.43	0.57
Caroni	47.50	15.85	5.40	2.71	27.29	0.02	0.50	0.30
Nariva/Mayaro	16.56	8.51	11.05	3.85	59.12	0.05	0.31	0.29
St. Andrew/St. David	31.54	18.32	7.55	1.44	39.03	0.04	0.44	0.33
Victoria	24.49	14.37	13.04	6.45	41.10	0.06	0.22	0.27
St. Patrick	19.29	14.08	12.35	4.88	48.45	0.36	0.39	0.20
Tobago	**26.06**	**26.04**	**14.01**	**4.39**	**28.27**	**0.05**	**0.15**	**1.02**

Source: Population and Housing Census 1980 & 1990

The average number of person per household is sometimes used as an indicator for overcrowding. By definition, (United Nation, 1998) dwellings with densities of three or more persons per room should be considered overcrowded under any circumstances. The average number of person per household was 3.7 in Trinidad and Tobago for the 2000 census. The average number in the 1980 and 1990 censuses were 4.5 and 4.1 respectively.

TABLE 3.7.1: AVERAGE NUMBER OF PERSON PER HOUSEHOLD BY MUNICIPALITIES, 2000

Municipalities	Population	Number of households	Percentage distribution of household	Average number of persons in household
Trinidad and Tobago	**1,114,772**	**303,871**	**100**	**3.67**
Trinidad	**1,070,582**	**291,266**	**95.85**	**3.68**
Port of Spain	37,965	11,966	3.94	3.17
San Fernando	48,784	13,893	4.57	3.51
Arima	28,310	7,514	2.47	3.77
Chaguanas	61,897	16,251	5.35	3.81
Point Fortin	17,755	5,323	1.75	3.34
Diego Martin	86,805	24,848	8.18	3.49
San Juan/Laventille	136,759	38,917	12.81	3.51
Tunapuna/Piarco	170,767	46,565	15.32	3.67
Couva/Tabaquite/Talparo	152,483	39,389	12.96	3.87
Mayaro/Rio Claro	30,298	7,923	2.61	3.82
Sangre Grande	58,311	15,435	5.08	3.78
Princes Town	85,682	21,927	7.22	3.91
Penal/Debe	77,756	20,384	6.71	3.81
Siparia	77,010	20,931	6.89	3.68
Tobago	**44,190**	**12,605**	**4.15**	**3.51**

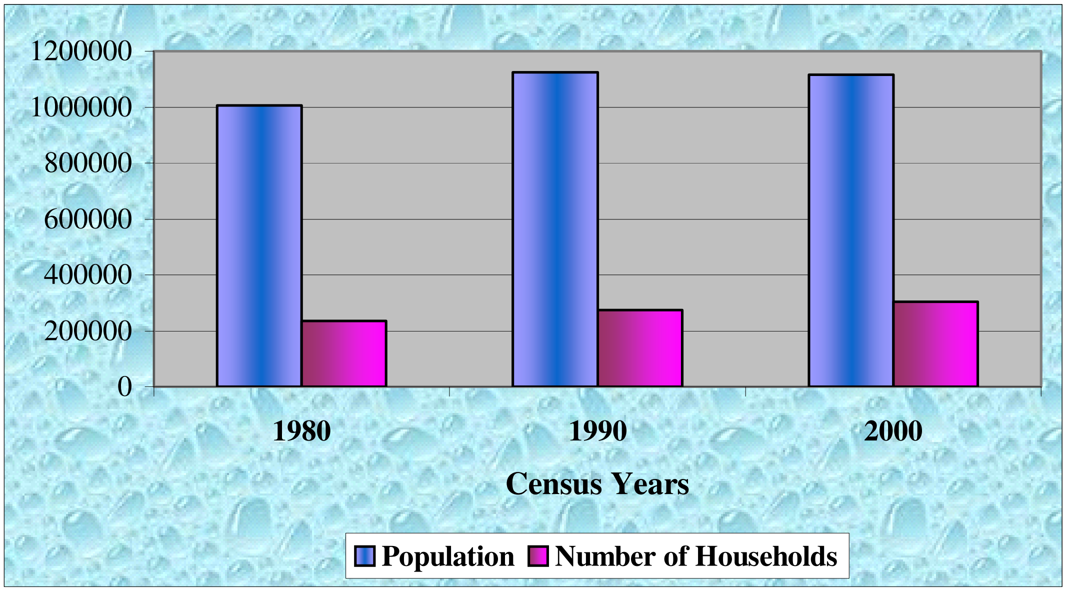
Source: Population and Housing Census, 2000

TABLE 3.7.2: AVERAGE NUMBER OF PERSON PER HOUSEHOLD BY ADMINISTRATIVE AREAS, 1980 AND 1990

Administrative Area	Population	Number of households	Percentage distribution of household	Average number of persons in household
			1980	
Trinidad And Tobago	**1,005,763**	**234,727**	**100**	**4.3**
Port Of Spain	55,800	15,083	6.4	3.7
San Fernando	33,395	7,930	3.4	4.2
Arima	24,112	5,128	2.2	4.7
Point Fortin	16,710	4,083	1.7	4.1
St. George	370,572	85,797	36.4	4.3
Caroni	140,385	28,363	12.1	4.9
Nariva/Mayaro	30,883	6,765	2.9	4.6
St. Andrew/St. David	50,171	11,054	4.7	4.5
Victoria	187,009	38,999	16.6	4.8
St. Patrick	107,202	22,693	9.7	4.7
Tobago	**39,524**	**8,832**	**3.8**	**4.5**
			1990	
Trinidad And Tobago	**1,125,128**	**274,846**	**100**	**4.1**
Port Of Spain	42,605	12,654	4.6	3.3
San Fernando	26,483	6,871	2.5	3.9
Arima	26,528	6,165	2.24	4.3
Point Fortin	18,622	4,986	1.82	3.7
St. George	394,345	100,376	36.52	3.9
Caroni	168,831	38,546	14.03	4.4
Nariva/ Mayaro	33,606	7,760	2.82	4.3
St. Andrew/St. David	58,837	13,857	5.04	4.3
Victoria	197,729	45,762	16.65	4.3
St. Patrick	112,492	26,471	9.63	4.3
Tobago	**45,050**	**11,398**	**4.15**	**4.0**

Source: Population and Housing Census, 1980 & 1990

FIGURE 3.2: POPULATION BY CENSUS YEAR AND NUMBER OF HOUSEHOLDS 1980, 1990 and 2000



Source: Population and Housing Census, 1980 & 1990

3.3 Squatting

Squatting has a long history. It was estimated that one billion people – one in six on the planet live as squatters in the world's cities. This figure was projected to swell to two billion within the next generation. Reliable and consistent estimates on the extent of squatting in Trinidad are not readily available. The latest estimate suggests that over 15% of the population is squatting *(Trinidad and Tobago Experience in Informal Settlement, 2006*).

There are many reasons for squatting in Trinidad and Tobago: however it is clear that the majority of the squatters in the country come from poor families who cannot access land on the real estate market or through government's housing policy. Table 3.8 shows the number of applications for Certificates of Comfort.

TABLE 3.8: GEOGRAPHIC SPREAD OF CERTIFICATES OF COMFORT[1] APPLICATIONS RECEIVED BY LAND SETTLEMENT AGENCY (LSA) FOR REGULARIZATION

Geographic area	Number of Applicants / Households	Percentage
North West	2,900	13%
East - West	7,400	33%
North East	2,100	9%
Central	2,500	11%
South West	6,700	30%
South East	700	3%
Total	22,300	100%

Source: Land Settlement Agency, 2006

[1]*a document that protects a squatter from land ejection*

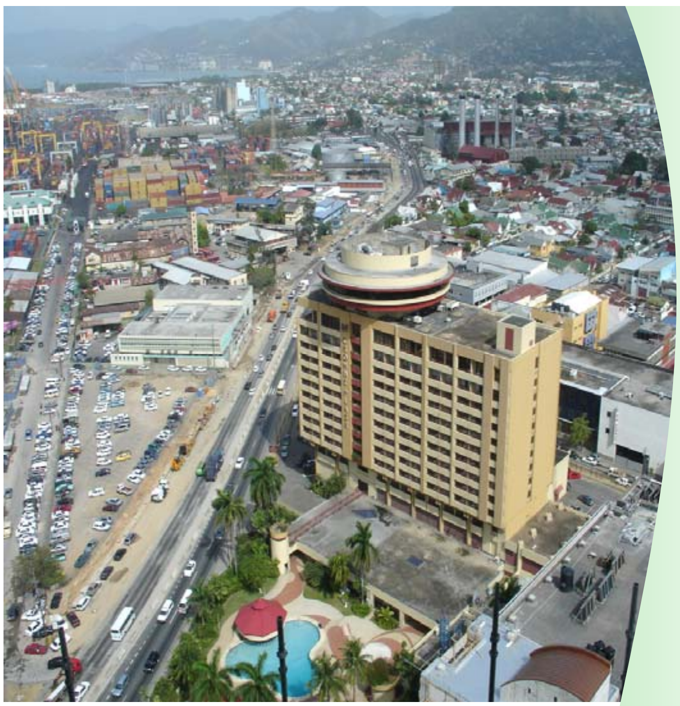
The policy framework for the regularization of squatter settlements encompasses:

- A comprehensive approach to the regularization of certain (designated) squatter settlements
- The provision of land settlement areas (sites and services) for the landless.

Government recognizes that the provision of housing to citizens of Trinidad and Tobago is a fundamental human right and has framed its Housing Policy accordingly.

CHAPTER 4

LAND USE



Photographs courtesy Town and Country Planning Division

4 LAND USE

4.1 Land Use Planning and the Environment

Land use or physical planning and the environment are intricately linked. There will always be decisions to be made regarding the allocation of lands for different uses because land use planning is a major part of human development. Either formally or informally (illegally) land use decisions can remove forests, develop industries, create human settlements and exploit natural resources. These actions can and usually do have negative impacts on the environment and ways to mitigate these impacts are constantly being assessed. Trinidad and Tobago, as a small island state have unique land development issues, some of which are outlined below.

Port of Spain, Trinidad

Considerations for Land Use Development in Trinidad & Tobago:

1. The two islands consist of limited land area. This indicates the necessity for careful planning of this resource.
2. Tobago, though territorially part of the country of Trinidad and Tobago, is physically separated from Trinidad. This isolation creates unique developmental problems.
3. Both islands experience a climate that is well suited to a variety of crops, but has a seasonality of rainfall which requires that careful attention be paid to irrigation or drainage in specific areas for the cultivation of certain crops.

4. In northern Trinidad and north-east Tobago, there exist large tracts of land which are not suitable for both built development and intensive agriculture because of slope characteristics and other topographic constraints.
5. There exists very active erosion on many of the steeper slopes of the country particularly in the Northern Range and in Tobago indicating the need for good land use practices and conservation methods designed to minimise this threat.
6. There is need for the effective and sustainable management and exploitation of mineral deposits- oil, natural gas and asphalt deposits as well as the significant quantities of gravels, sands, clays, limestone and porcelanite- to ensure that their economic value is realised.
7. Spatial planning includes awareness that there exist natural factors such as soils with impeded drainage, erosion, heavy rainfall, high run-off, prevalence of high tides and settlement development in the flood plains of main rivers which make certain areas susceptible to flooding.
8. There is the occurrence of significant quantities of ground and surface water resources in Trinidad, and surface water resources in Tobago, which can be impacted upon by development.
9. There are very limited quantities of well-drained, deep soils of very high agricultural capability (Classes I – III). This indicates a strong need for agricultural policies to seek to make the best use possible of the available land suitable for agriculture. These areas are to be managed in such a way to prevent, as much as possible, the loss of such lands to built development.
10. There are constraints to large scale port development on most of the coast (except the west coast of Trinidad) because of the unsuitability of existing coastal areas.
11. There exists the opportunity to explore and develop the potential that the combination of tropical climate, scenic resources, diversity of flora and fauna etc., have for recreational activities particularly in Tobago.
12. There is the existence of ecologically sensitive areas (e.g. the swamps and reefs) which require careful planning of any proposed development."[1]

[1] **Adapted from The National Physical Development Plan Trinidad and Tobago. Volume I – Survey & Analysis. 1980 – Town and Country Planning Division**

The land use planning framework highlights the need to develop a comprehensive policy strategy to protect and preserve fragile ecosystems, increase awareness within the general populace to do this, perform remedial actions to reverse some of the negative effects already accruing and to re-establish control of land development on the whole. Environmental Areas considered critical to conserve and which therefore would need extensive assessments in order to develop them include:

- Upland areas of the Northern Range.
- Parts of the Central Range
- Marine reef areas.
- The Caroni & Nariva Swamps
- Other environmentally sensitive areas.

Some interesting historical facts about the islands of Trinidad & Tobago as it relates to physical development:

- Trinidad is the oldest settled island in the West Indies. The first recorded settlement is at Banwari Hill in South-West Trinidad at the edge of the Oropouche Lagoon established by *Meso Indians* from South America 7,200 years ago.
- Historically, development was very limited in Trinidad, "for nearly two hundred years it remained undeveloped and isolated…up to the 1780's Trinidad remained essentially an Amerindian society."[2] Physical development was initiated almost 200 years after most of the other established West Indian colonies. The Spanish Cedula of Population in 1783 gave land parcels up to 3000 acres to free people in exchange for the island's development. This had implications for the present day ownership, use and distribution of large amounts of land.
- The first permanent European settlements in Tobago were established by the Dutch in the 17th century.[3] During the 18th century when Tobago came under British occupation, the Parishes were formed and the locations of towns as they exist today were established. At this time also, lots were determined and land grants totalling almost 25,000 acres were distributed.

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[2] **Besson, Gérard & Brereton, Bridget. 1992. *The Book of Trinidad*. 2nd ed. Port of Spain: Paria Publishing Co. Ltd. ISBN 976-8054-36-0.**

[3] **Report on the 1987 Archeological Historical Survey of Tobago. Arie Boomert, mar RA. Ortiz-Troncoso, H.H. Van Regteren Altena. – Albert Egges Van Giffen Instituut Voor Prae- En Protohistories, University of Amsterdam, The Netherlands. September 1987.**

4.2 Land Area

The total land area for the country is 5,128 km^2, out of this Tobago is approximately 300km^2. Trinidad is approximately 13 km away from Venezuela on the South American main land with Tobago being approximately 32km north east of Trinidad.

Topography Trinidad:

Five main physiographic regions:

1. The Northern Range
2. The Northern Basin
3. The Central Range
4. The Southern Basin
5. The Southern Range

Topography Tobago:

Two main physiographic regions:

1. The Main Ridge
2. Flat Coastal Plain of coral terraces in South West Tobago

4.3 Legal Background

Land use planning in Trinidad and Tobago is governed under the Town and Country Planning Act Chapter 35:01 and administered through the Town and Country Planning Division. The Town and Country Planning Act, "has its roots in the resolution of urban development problems and in related public health and housing legislation of Victorian England." In Trinidad and Tobago, planning law enforcement and continual reform is highlighted as a significant means of preserving and safeguarding the environment where it was noted that "over the past quarter century there has been a growing awareness of the environmental limits to growth and the adverse impacts of development on the natural environment. The need for planning law, as one of our major tools for environment management, to explicitly accommodate these concerns, has been recognized…"[4]

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[4] **Taking up the Challenge of Designing Indigenous Planning Laws Editors Christine Toppin-Allahar and Barbara A. Chow. CIDA/UWI/McGill, 1994 Caribbean Planning Law, Workshop Proceedings, Kingston, Jamaica.**

4.4 Physical Planning Administration in Trinidad & Tobago through the Town & Country Planning Division (T&CPD)

4.4.1 Development Planning

Under the Town & Country Planning Act, the Minister of Planning, through the T&CPD, is mandated to carry out the necessary surveys and develop land use plans to identify areas for compatible land use activity. A physical development plan should:

a) Define the sites of roads, public and other buildings and works, airfields, parks, pleasure grounds, nature reserves and other open spaces;
b) Allocate areas of land for the use of agricultural, residential, industrial or other purposes of any class specified in the plan;
c) Designate, as land subject to compulsory acquisition by the Minister-
    I. Any land allocated by the plan for the purposes of any of his functions or the functions of a local authority or of statutory undertakers;
    II. Any land located in an area defined as an area of comprehensive development (including any land therein that is allocated by the plan for any such purpose as is mentioned in subparagraph (I), or any land contiguous or adjacent to any such area;
    III. Any other land that, in the opinion of the Minister, ought to be subject to compulsory acquisition for the purpose of securing its use in the manner proposed by the plan.

TABLE 4.1: LAND USE PLANS DEVELOPED BY THE TOWN AND COUNTRY PLANNING DIVISION.[5]

Title of Plan	Type of Plan	Publication Date
POS Central Business Redevelopment Plan	Local Area	1970 Approved By Parliament 1972
The Santa Cruz Valley Strategy for Development	Local Area	1972
East Port Redevelopment Plan	Local Area	1973
The Chaguaramas Development Plan	Local Area	1973 Approved by Parliament in 1974

[5] **Source: The Town & Country Planning Division From 1956 to the Present Time, Published by the T&CPD August, 1986 & T&CPD Database** (Plans listed are either Published Draft or Approved by Parliament.)

The National Framework	Local Area	1974
Maracas Valley Strategy for Development	Local Area	1974
The Caroni Region	Regional	1974
Tobago Regional Plan 13 Technical Papers	Regional	1974
The San Fernando Region	Regional	1975
The South –East Region	Regional	1975
The South West Region	Regional	1975
The Capital Region	Regional	1975
Santa Cruz Valley Strategy	Local Area	1976
Maraval Valley Strategy	Local Area	1976
New Malabar Structure Plan	Local Area	1978
Valencia Village Expansion	Local Area	1978
Greater Arouca Development Study/ Bon Air Garden Estates	Local Area	1978
Layout of Land at Agostini Village	Local Area	1979
A Development Study of Five Rivers Estate	Local Area	1979
San Fernando Hill Report	Local Area	1979
Old Government farm Tobago- Layout Proposals	Local Area	1979
A Development of the Five Rivers District	Local Area	1979
A Development Study of Hermitage Estate Claxton Bay	Local Area	1980
Harmony Hall	Local Area	1981
The National Physical Development Plan	National	1981 Approved by Parliament 1984
Couva Structure Plan	Local Area	1987
POS Land Use Plan	Local Area	1987
The South East Capital Region	Regional	1987
San Jose Estate/ Lopinot Settlement	Local Area	1988
Northern Range Hillside Development Study.	Regional	1988
River Estate Study	Local Area	1988

Chaguaramas Development Plan (Revised)	Local Area	1988
The North-East Region	Regional	1989
Greater Arima Plan	Local Area	1990
Rural Victoria Land Use Study	Local Area	1990
Tobago Region Physical Development Plan	Regional	1991
Point Fortin Land Use Plan	Local Area	1991
Greater San Fernando Land Use plan	Local Area	1992
North Coast Region Policy	Regional	1995
Sangre Grande Land Use Plan	Local Area	1995
South-West Tobago Development Strategy	Regional	1996

Source: The Town and Country Planning Division from 1956 to the Present Time, Published by the T&CPD August, 1986 & T&CPD Database

Note: No Land Use Plans were done by the Town & Country Planning Division from 1997 onwards.

4.4.2 Development Control*:*

In addition to the development of land use plans, the Minister of Planning, through the T&CPD, conducts Development Control on the use of land and all changes of use covered under the term ‘development’. As defined in the Act, ‘development’ refers to:

I. The carrying out of building, engineering, mining or other operations in, on, over, or under any land;

II. The making of any material change of use of any building or other land;

III. The subdivision of any land.

TABLE 4.2: LAND USE CATEGORIES IN TRINIDAD AND TOBAGO

Categories in 1963	Present Categories
• Agriculture	• Forestry/Agriculture/Fisheries
• Forestry	• Residential
• Fishing	• Office
• Recreation	• Trade
• Industry	• Industrial
• Commerce	• Institutional
• Public building	• Protective/Health/Welfare Services
• Public open space	• Transport/Communication/Warehousing
• Education	• Education Utilities
• Health	• Recreation (Active & Passive)
• Defence	• Vacant land
• Religion	• Under Construction
• Roads	
• Railway	
• Airports	
• Harbours	
• Public services	

Source: Land and Building Use Codebook

4.5 Land Use Planning: Administrative Structure

Development control and Development Planning is conducted within defined ***Planning Regions*** and sub regions known as ***Settlement Areas*** and fall under the purview of the four Regional planning offices, three of which are located in Trinidad and one in Tobago. The designation of Planning Regions and Settlement Areas was important in order to "rationalise and co-ordinate the orderly physical development of the country, defined geographically in technically acceptable administrative boundaries within which projects and programmes may be comprehensively evaluated against coherent, social, economic and physical data." [6] These boundaries essentially followed the counties boundaries. In 1990, the Municipal Corporations Act modified the county boundaries; however, the Planning Regions and Settlement Areas have remained the same. (see Maps 4.1, 4.2, 4.3 and 4.4)

TABLE 4.3: REGIONAL OFFICES AND THE AREAS ADMINISTERED

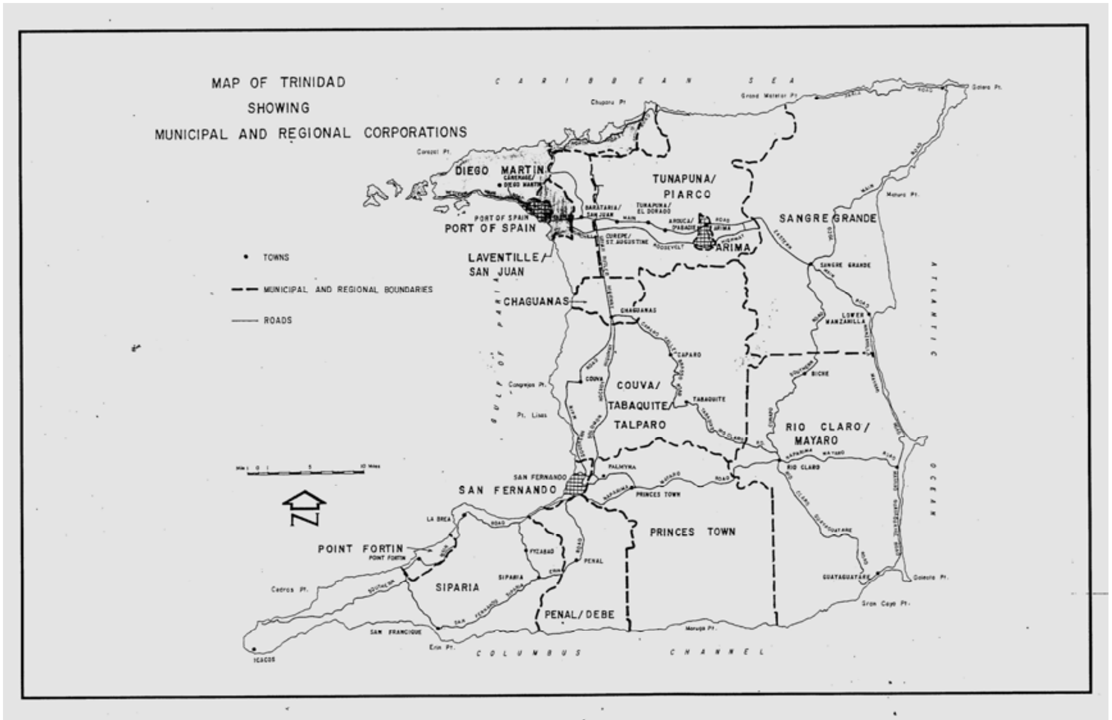
Regional Office	Planning Region
North Regional Office	T1, T5
East Regional Office	T2, T3, T4
South Regional Office	T6, T7, T8
Tobago Regional Office	T9

Source: T&T National Physical Plan-: Designation of Regional Settlement and Local Physical Planning Areas. Ministry of Planning and Development, Town & Country Planning Division, November 1968

T - Refers to Trinidad & Tobago.

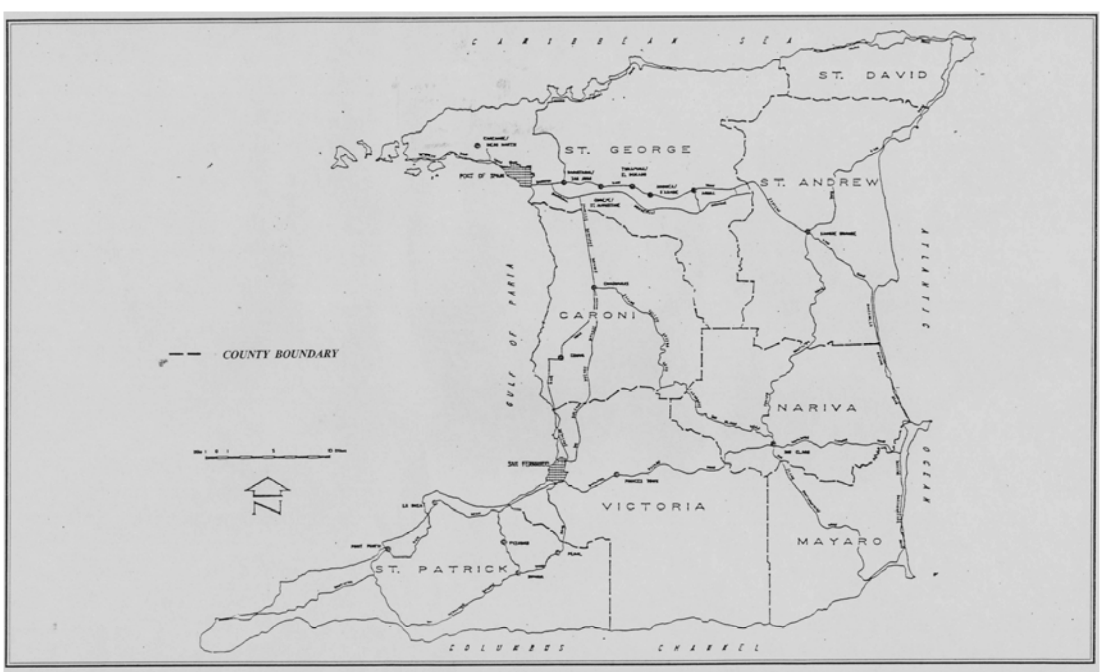
[6] **T&T National Physical Plan-: Designation of Regional Settlement and Local Physical Planning Areas. Ministry of Planning and Development, Town & Country Planning Division, November 1968.**

MAP 4.1: MUNICIPAL AND REGIONAL CORPORATIONS- TRINIDAD



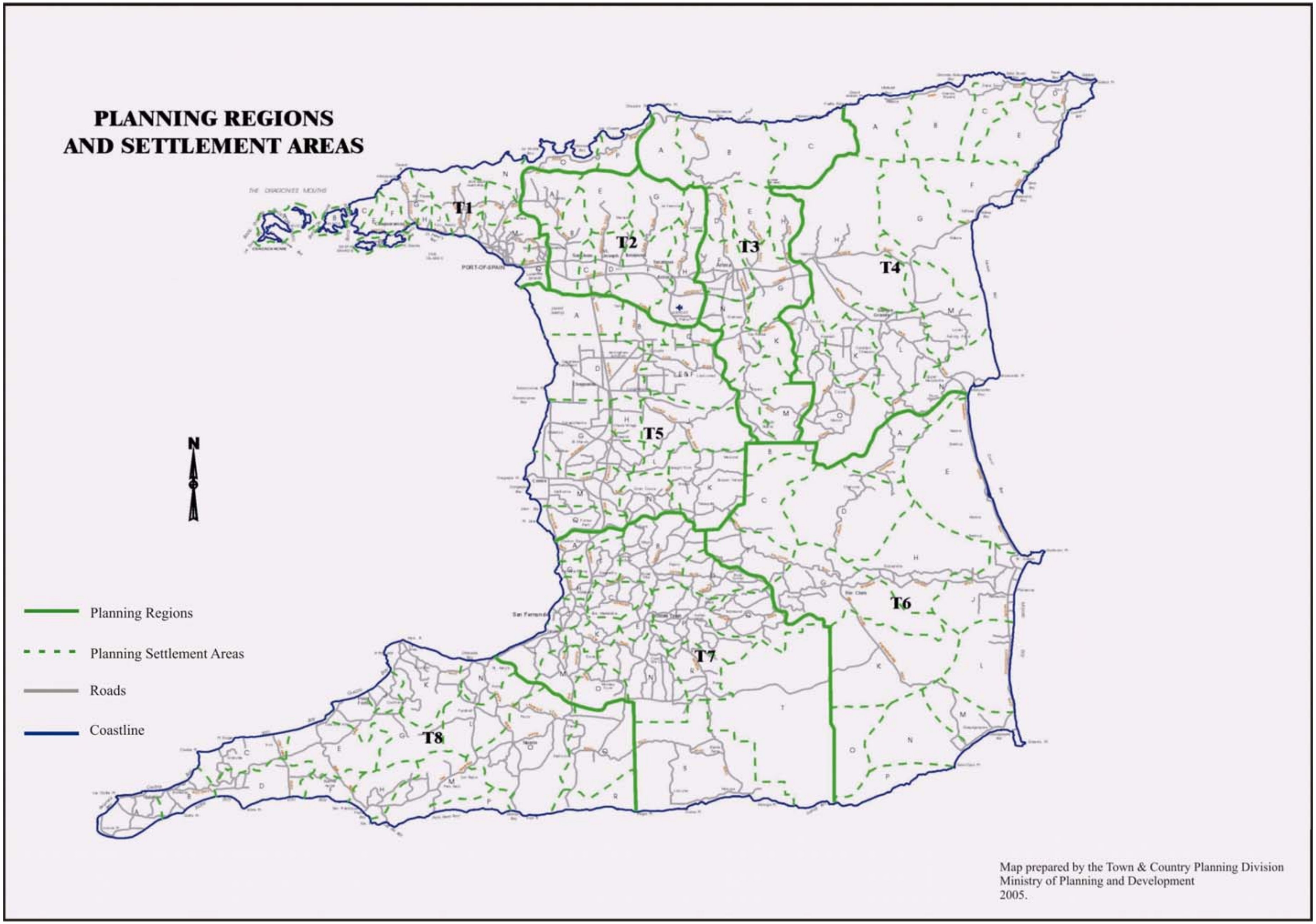
Source: Town and Country Planning Division

MAP 4.2: COUNTY BOUNDARIES- TRINIDAD

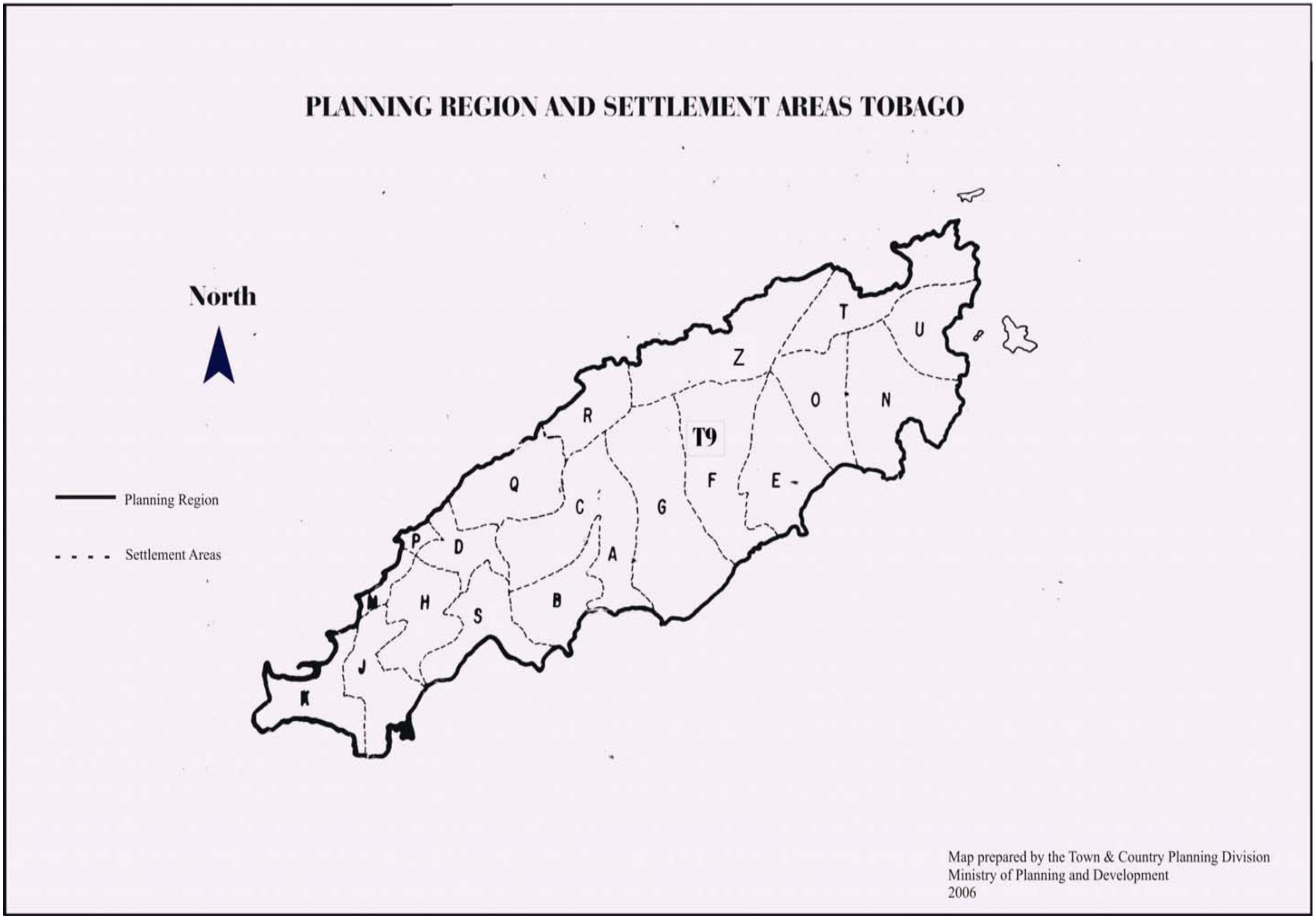


Source: Town and Country Planning Division

MAP 4.3 PLANNING REGIONS AND SETTLEMENT AREAS- TRINIDAD



Source: Town and Country Planning Division



Source: Town and Country Planning Division

4.6 Land Use

The following data sets were extracted from the National Physical Development Plan (NPDP) and describe existing and proposed land use, on the level of the national territory of Trinidad and Tobago in 1980, with a twenty (20) year horizon period in 2000. While in general, the intensity of development has increased, the areas allocated to different uses today have been in keeping to what were identified twenty (20) years ago.

Generalised land use for the national territory in 1980

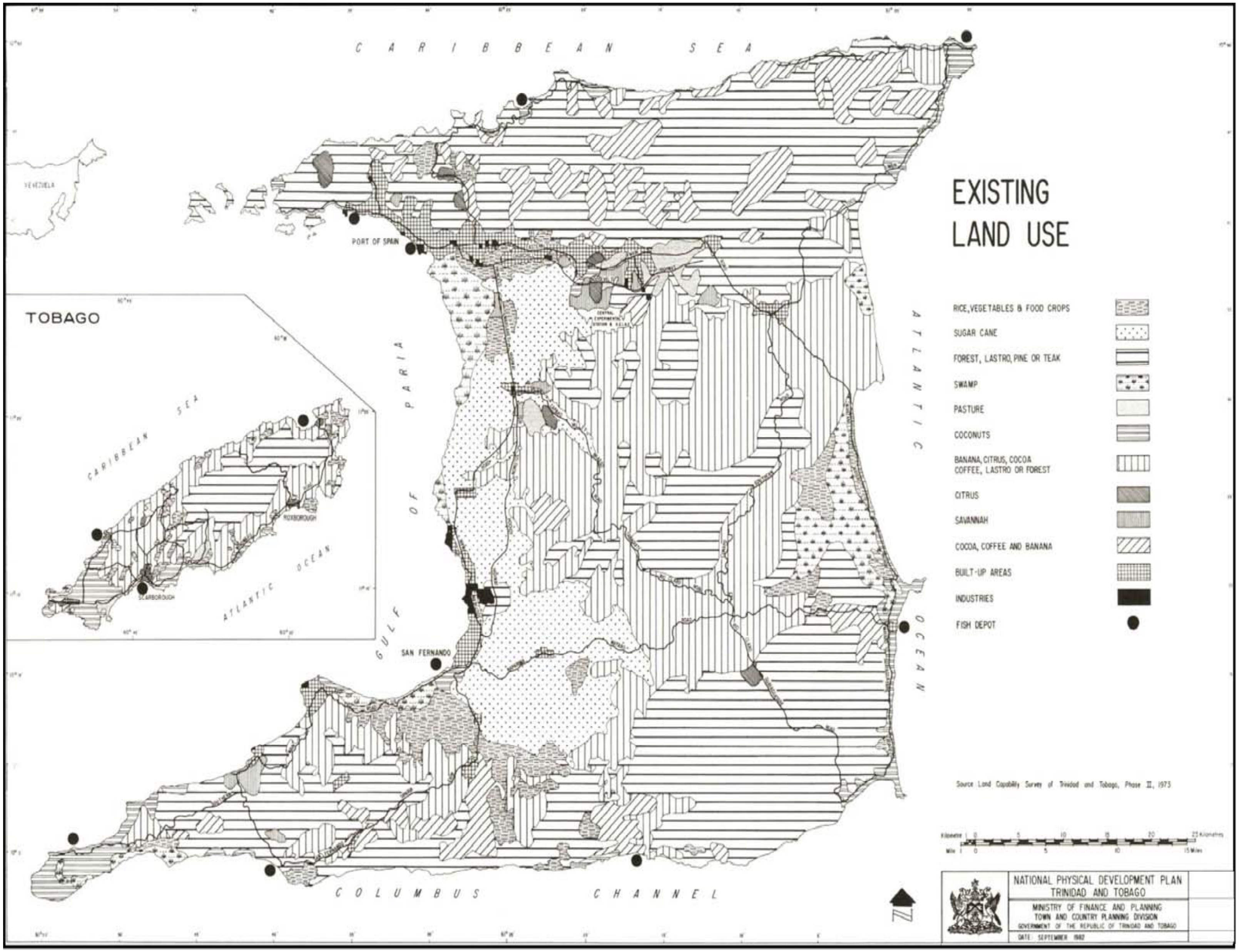
Undeveloped or under Conservation	Agricultural Use	Developed or under mining Operations
57%	**35%**	**8%**

- 57% of total land area was considered undeveloped with primary and secondary forest areas as well as swamplands (approximately 283,290 ha.). These areas are "concentrated in the Northern, Central and Southern Ranges and within the Eastern Counties, St Patrick, Victoria and Tobago"[1]
- 35% cultivated
- 8% is developed (built) or under mining operations.
- At the time it was noted that the settlement (housing) aspect of land use was the one that was the "most susceptible to change and expansion especially at the expense of agricultural land uses (and it was determined that) these land use conflicts will have to be resolved on the criteria of efficiency and compatibility and their implications for the overall economic, social and physical environment."[2]

[1] **The National Physical Development Plan Trinidad and Tobago. Volume I – Survey & Analysis. 1980 – Town and Country Planning Division**

[2] **Ibid. pg 35**

MAP 4.5 EXISTING LAND USE 1980 FOR TRINIDAD AND TOBAGO



Source: Ministry of Finance and Planning; Town and Country Planning Division

4.7 Settlement Planning

The NPDP remains the only statutory physical planning document with jurisdiction over the national territory. Of significance is the identification of settlement types; settlements that are predominantly urban or developing urban generally require increased management of the environment resources since the environmental impact, through pollution and waste generation, is greater. Infrastructural provisions for the development of existing and new settlements also carry environmental costs. Settlement planning can therefore be used to the economic advantage of the country and at the same time used to mitigate environmental impacts.

(see Tables 4.4 and 4.5 and Maps 4.6 and 4.7)

TABLE 4.4 SETTLEMENTS BY TYPE IN TRINIDAD AND TOBAGO

Urban	Developing	Special Case Centres	Rural
Carenage – Diego Martin	Greater Sangre Grande	Arouca – D'Abadie	Princes Town
Greater Port of Spain	Greater Chaguanas	Fyzabad	Rio Claro
Barataria – San Juan	Couva	Penal	..
Curepe – St Augustine	..	La Brea	..
Tunapuna – El Dorado	..	Scarborough	..
Greater Arima	..	..	..
Greater San Fernando/Siparia	..	..	..
Point Fortin	..	..	..

Source: The National Physical Development Plan Trinidad and Tobago. Volume I – Survey & Analysis. 1980 – Town and Country Planning Division

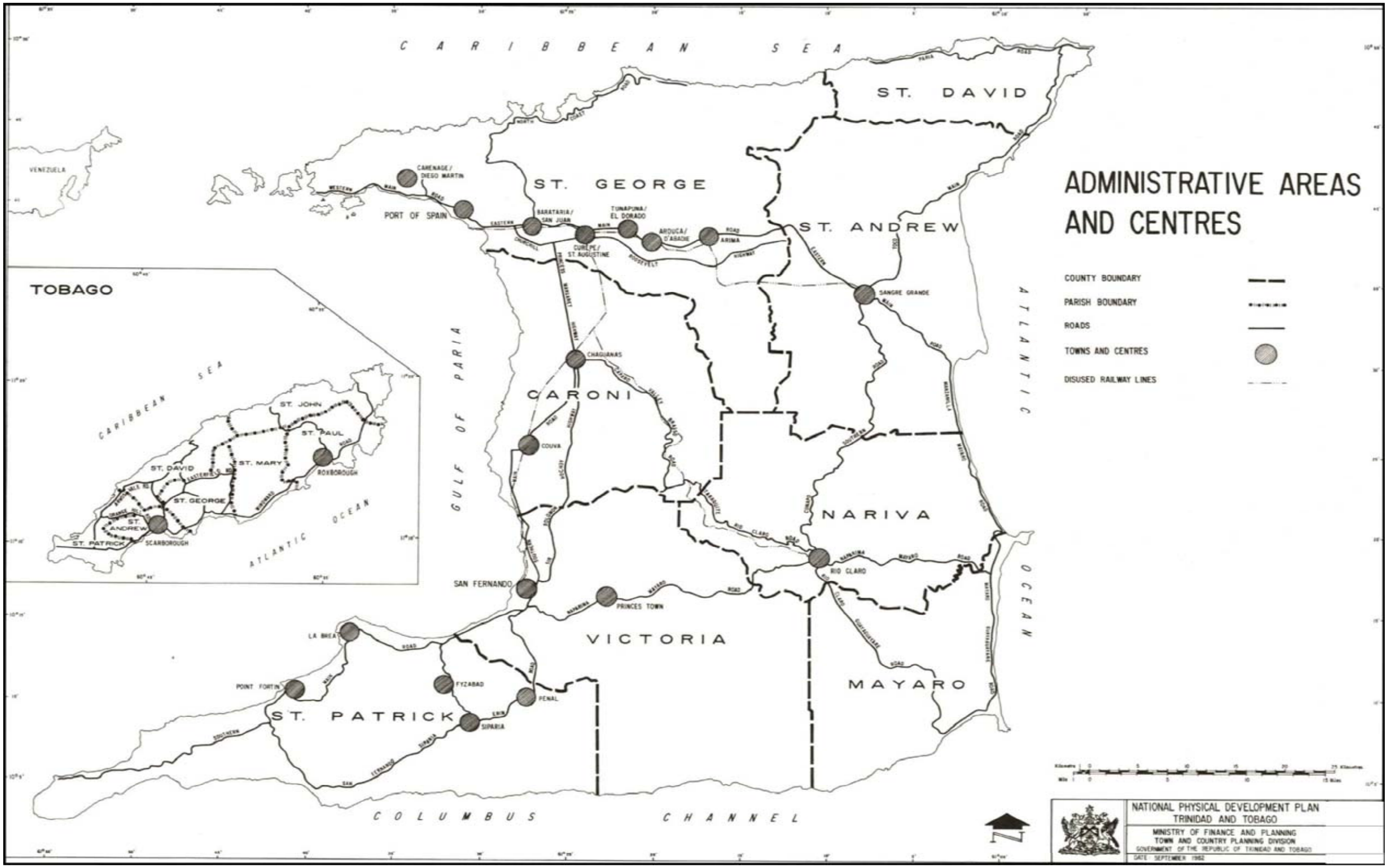
Urban – Settlements that are completely urban in character

Developing – Settlements that are developing into urban but still have rural occupation structures

Special Case Centres – Settlements with urban occupational structures but rural characteristics

Rural settlements – Settlements that have rural occupational structures and characteristics.

MAP 4.6 LOCATION OF SETTLEMENTS IN TRINIDAD AND TOBAGO



Source: Ministry of Finance and Planning; Town and Country Planning Division

TABLE 4.5 DEVELOPMENT ZONES DEFINED IN THE NPDP

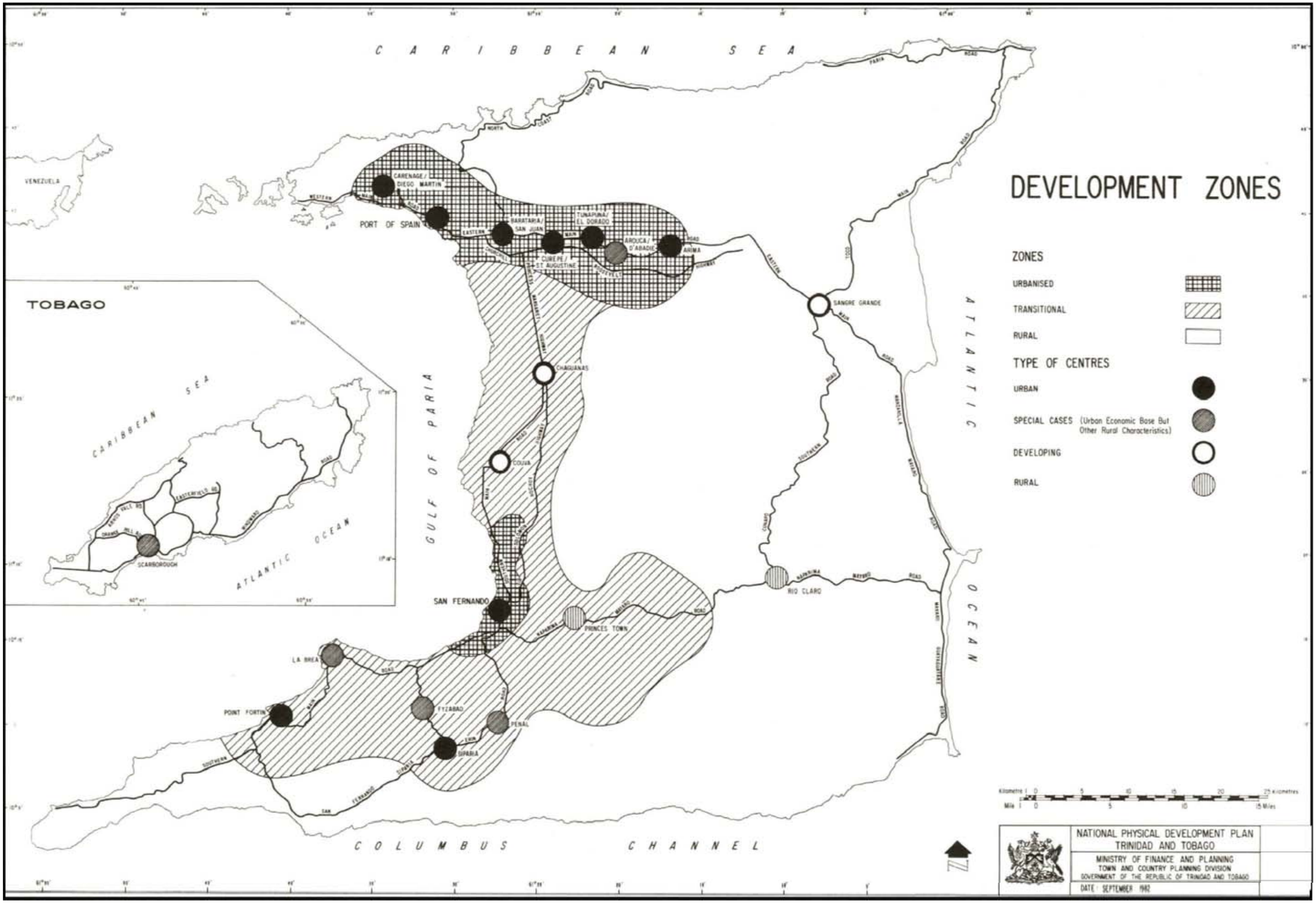
Area	Type of Zone
Capital Region **San Fernando Region**	**Urban.** Characteristics: • Urban with the highest level of development. • Contain a high proportion of national population, in 1980, 54.6% of the total population. • Land area approximately 12.5% of the total land area. • Lower than average incidence of poverty. • Higher social/health and educational facilities access. • Higher quality of housing and available infrastructure. Problems: • Shortage of land/congestion built up areas • Congested transportation networks • Optimal pressure on existing infrastructure, often exceeding capacity. Deteriorating prime class agricultural lands to built development.
Caroni **Princes Town** **Siparia** **Point Fortin Sub-regions**	**Developing/Transitional** Characteristics: • Upward & downward transitional, mixed development pattern with both urban and rural zone characteristics. Upward for areas outside of the urban core areas and downward for other areas, particularly in the south west with the decline of the oil industry in the oil 'bust' years. • 29% of population lived in this zone. • Intensive agriculture is a mainstay in this type of zone.
Tobago	**Special Case** (urban economic base but rural characteristics).
All other areas	**Rural**[3]

Source: The National Physical Development Plan Trinidad and Tobago. Volume I – Survey & Analysis. 1980 – Town and Country Planning Division

[3] NPDP Vol I- Town & Country Planning Division Unpublished Research Data 1976:

- **Population Size: Settlements with a nucleated population of 5000 were classified as Urban and those with less, Rural.**
- **Population Density: Settlements with 10 persons/acre or more were classified as Urban and less Rural.**
- **Occupational Structure: Settlements with a low percentage of the working population in primary economic activity (e.g. agriculture) were classified as Urban and a high percentage in primary economic activity, Rural.**

MAP 4.7 DEVELOPMENT ZONES IN TRINIDAD AND TOBAGO



Source: Ministry of Finance and Planning; Town and Country Planning Division

4.8 Land Use Proposals 1980-2000

In projecting land use proposals (see Maps 4.8 and 4.9) for the entire country, the National Physical Development Plan identified the following policy objectives as being critical:

- Protection of water resources and soil conservation,
- Retention of high capability agricultural lands,
- Identification and development of Resort/Recreational uses areas, incorporating a balance of conservation, built environment, agricultural retention, recreational use and high amenity value,
- Allocating lands for built development based largely on their physical and infrastructural potential. These are to be strategically located within the identified growth centres and development zones,
- Allocate lands for infrastructural development,
- All other lands to be designated either agricultural or conservation.

Land Use for Leisure Activity – Cricket Match in Trinidad

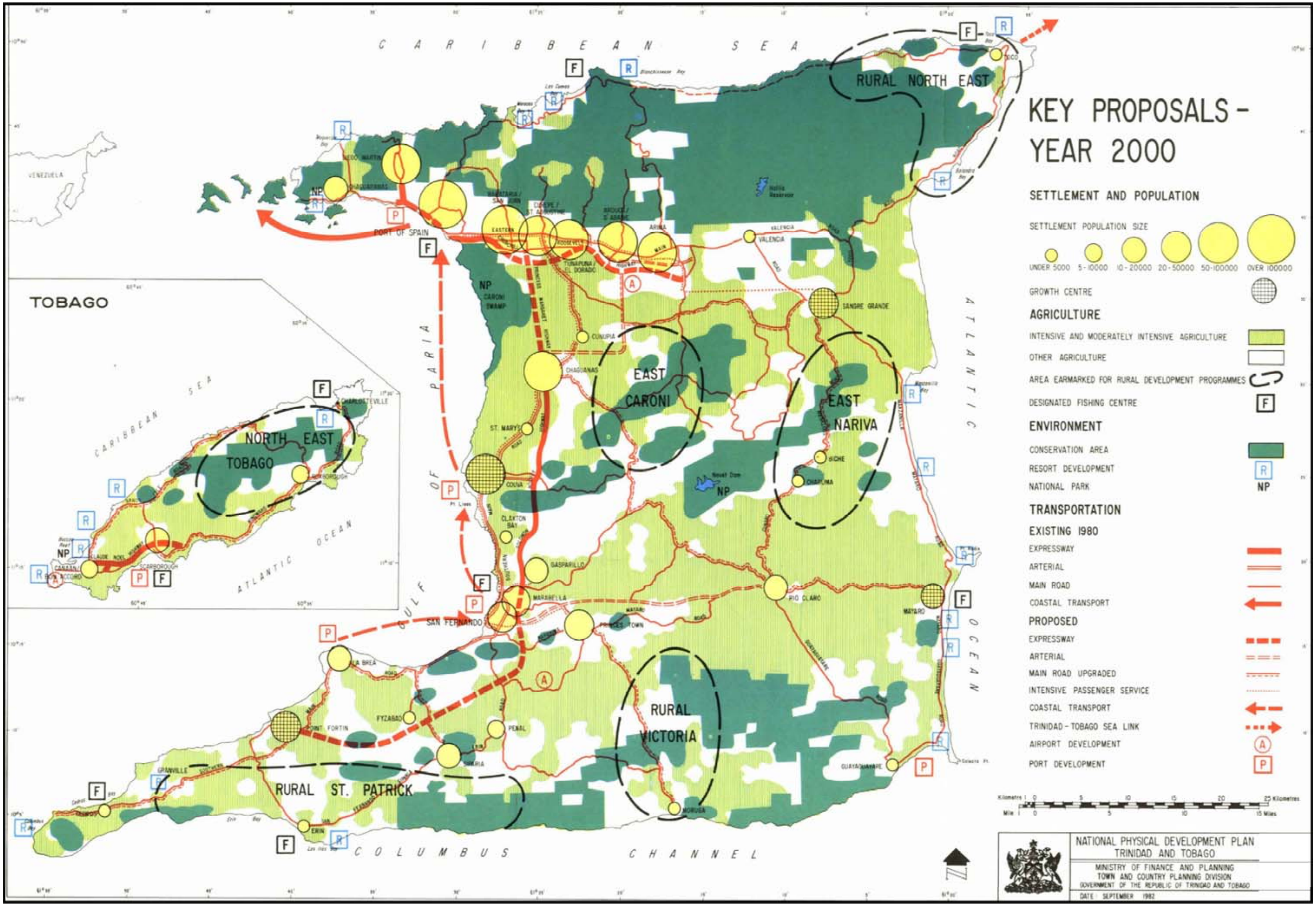
The following are areas that are broadly defined and are allocated to different uses:[4]

- The Northern, Central and Southern Ranges, Tobago Main Ridge and the Caroni Swamp are to have areas designated as **Critical Conservation Areas** to be preserved and kept under natural vegetative cover.

[4] **It should be noted that the National Physical Development Plan treats spatial development at a very broad level. Regional and Local Area Plans would allocate land uses to more specific locations.**

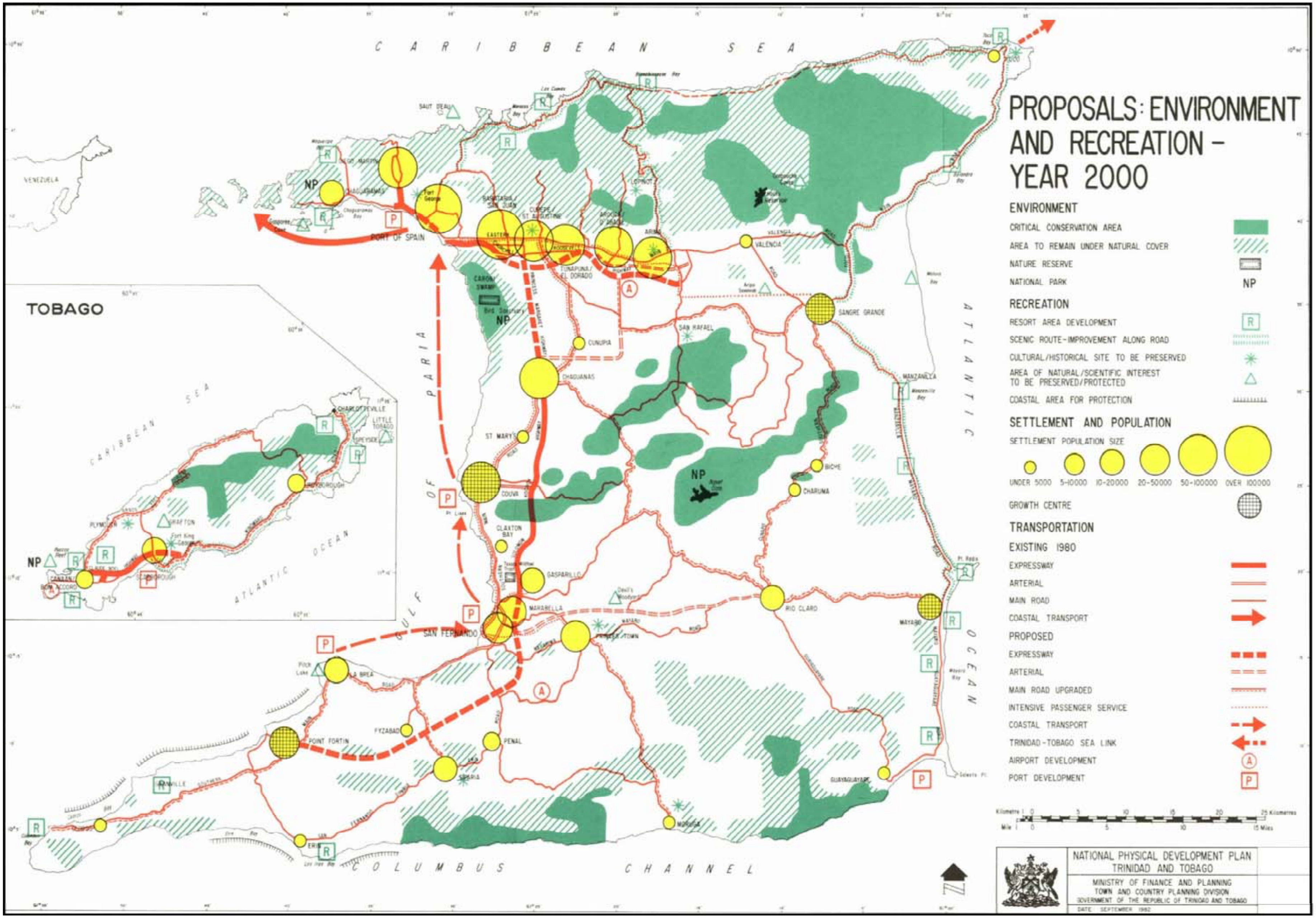
- Lands allocated for moderate to intensive agriculture use have been identified within the Counties of Caroni, Victoria and the Oropouche Lagoon, Naparima/Mayaro and South-West Tobago.
- Built development to be concentrated within the Capital Region (Port of Spain in the West to Arima in the East) and other areas identified in South-West Tobago, Nariva, Valencia and North Caroni.
- Resort/Recreational uses identified for areas within the South-West Tobago, Chaguaramas and the North Coast of Trinidad as well as inland areas as National Parks & Scenic routes.

MAP 4.8 1980 PROPOSALS FOR THE YEAR 2000-LAND USE; TRINIDAD AND TOBAGO



Source: Ministry of Finance and Planning; Town and Country Planning Division

MAP 4.9 1980 PROPOSALS FOR THE YEAR 2000- ENVIRONMENT AND RECREATION; TRINIDAD AND TOBAGO



Source: Ministry of Finance and Planning; Town and Country Planning Division

4.9 Present Land Use

Since the National Physical Development Plan of 1984, there have been attempts but no official follow up final draft to assess land use in the present context. A Technical Report commissioned by the Town and Country Planning Division, for its review of its Hillside Development Policy in 2004, commissioned the Centre for Caribbean Land and Environmental Appraisal Research (CLEAR), based at the University of the West Indies St Augustine,[1] to conduct an assessment of land use in order to identify areas which would have been suitable for built development. The results of this study highlights aspects of existing land use which require immediate attention particularly as it relates to the halting of environmental degradation (specifically here on Hillsides and on wider Watershed catchment areas) and to locate built development in such a way that it would minimise future environmental threats. The CLEAR report raises concerns about the rapid economic and industrial development. This is resulting in land use development that is outpacing the regulatory bodies' abilities to properly ascertain and control it, leading to certain environmental degradation. The report notes that this situation is made worse by

> "illegal settlement of prime lands, inappropriate national land policies, urbanization, agriculture and population growth as well as the lack of objective implementation of available regulations (Kenny et al., 1997; EMA, 2001; Baban 2004) … a series of environmental problems including the destruction of forests, floods and landslides, a reduction in biological diversity, high rates of erosion and water quality degradation (Baban, 2001) … if not managed effectively within a reasonable timeframe, (built development) could eventually lead to further environmental degradation as lack of government's land policies could result in the sterilization of prime lands, illegal use of land such as slash and burn agriculture or squatting leading to the degradation of significant expanses of land (Baban 2004). These consequences could eventually slow down and threaten the pace of economic development (Baban, 2001; Baban, 2004). This is of critical importance to Trinidad and Tobago, which is aiming feverishly to achieve developed nation status by 2020."[2]

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[1] The Centre for Caribbean Land and Environmental Appraisal Research (CLEAR) The Office of Research, The University of the West Indies, St. Augustine, Trinidad, West Indies May 2006. By Professor Serwan M J Baban, Dr. Francis Canisius, Mr. Amarnath Chinchamee.

[2] Ibid.

Based on the findings of CLEAR the following existing land use has been determined.

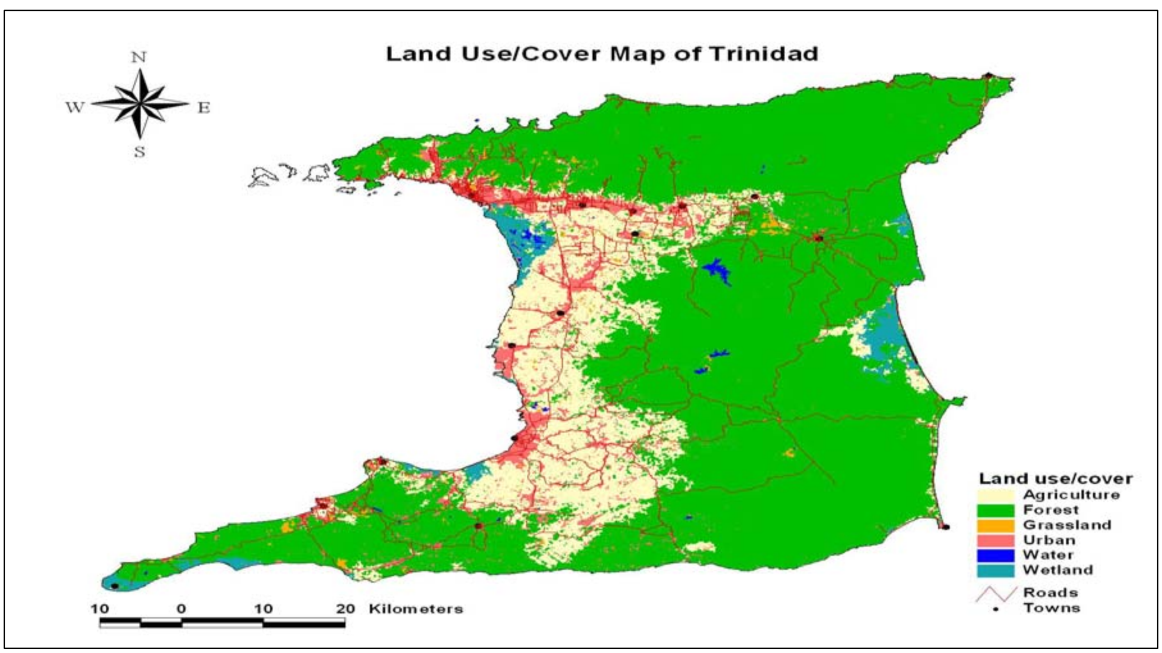
TABLE 4.6 TRINIDAD LAND USE / COVER STATISTICS

Land use/cover		Total Area (Acres)	Total Area (%)	Suitable area for built development		Suitable area for Agriculture	
				Area (Acres)	%	Area (Acres)	%
1	Urban	77,900	6.2	22,110	28	35,642	46
2	Agriculture	273,211	21.6	54,380	20	54,380	43
3	Forest	869,363	68.8	79,065	9	176,178	20
4	Grassland	10,277	0.8	2,555	25	2,555	25
5	Wetland	28,366	2.2	..	..	..	..
6	Water	3,593	0.3	..	..	..	..

Source: CLEAR Report, 2006

Table 4.6 shows 46 % (35,642 acres) of suitable lands for agriculture already under settlements in Trinidad with 28% (22,110 acres) of present developments located on suitable areas. Approximately 79,065 acres of suitable areas for built development and 176,178 acres of suitable areas for agriculture are presently under forest or approximately 29% of the total forest cover. The remaining forest cover approximates half of Trinidad at 614,120 acres. (see Map 4.10)

MAP 4.10 LAND USE / COVER MAP OF TRINIDAD



Source: CLEAR Report 2006

TABLE 4.7 TOBAGO LAND USE / COVER STATISTICS

Land use/cover		Total Area (Acres)	Total Area (%)	Suitable area for built development		Suitable area for Agriculture	
				Area (Acres)	%	Area (Acres)	%
1	Urban	7,444	10	429	6	6,330	85
2	Agriculture	792	1	26	3	696	88
3	Forest	55,089	74	2,675	5	22,010	40
4	Grassland	10,198	14	644	6	7,812	77
5	Wetland	484	1	..	..	..	..
6	Water	58	< 1	..	..	..	..

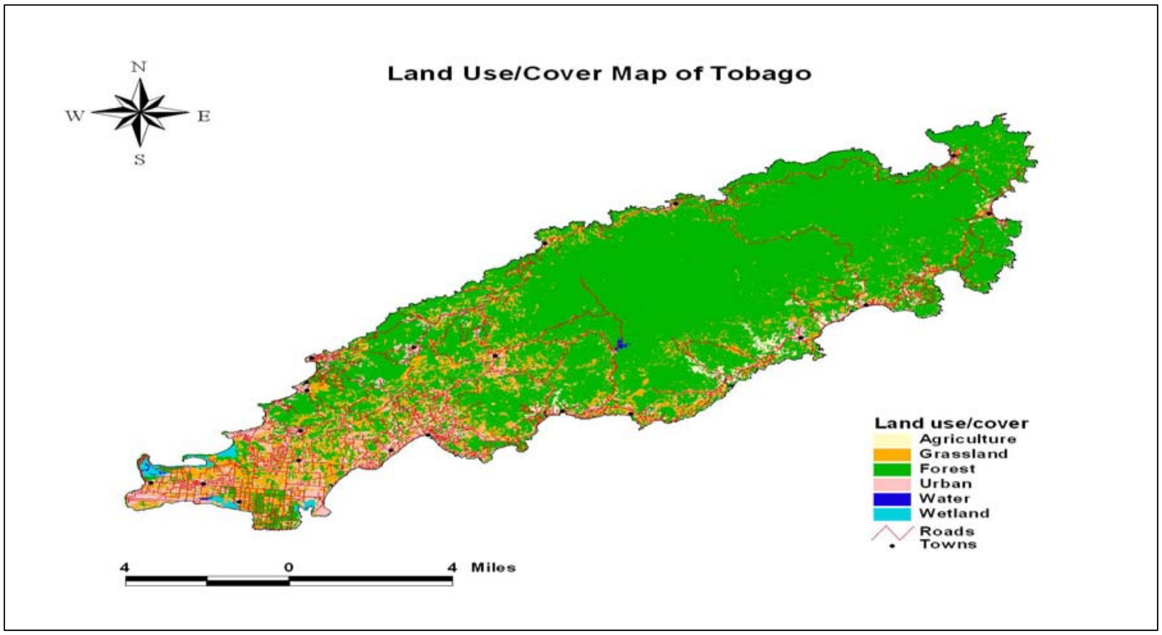
Source: CLEAR Report 2006

Table 4.7 shows that in Tobago, approximately:

> "6% (429 acres) of the suitable land for development are already developed. The remaining areas suitable for built development are estimated to be about 3,345 acres or almost half of the present urban area or settlements. It is estimated that some 94% of present developments (7,015 acres) are located on unsuitable land where the land is capable for agriculture (6,330 acres) or the physical conditions are not suitable for built development (685 acres). Approximately 2,675 acres of suitable areas for development and 22,010 acres of suitable areas for agriculture are presently under forest or 45 % of the present forest cover. The remaining forest cover is 30,404 acres or about 41 % of Tobago."[3] (see Map 4.11)

[3] **CLEAR 2006**

MAP 4.11 LAND USE / COVER MAP OF TOBAGO



Source: CLEAR 2006

4.10 Watersheds

Watersheds are environmental areas that need effective management in order to properly locate built development. The CLEAR investigations revealed that there were "watersheds showing a great potential (more than 6000 Acres) for development in south Trinidad. These include; South Oropouche, Cedros Peninsula 3, Ortoire 1, Central West Coast 2 and Ortoire 2. Watersheds presenting a high potential (more than 3000 Acres) for built development in north Trinidad include; Western Peninsula 20, North Oropouche 6, North Coast 1, Western Peninsula 12, Western Peninsula 9, Western Peninsula 19, Western Peninsula 22 and North Oropouche 7. In terms of percentage, the small watersheds tend to show higher percentage for suitable development. The area statistics shows the total area of 54 watersheds in Trinidad is around 1,189,340 Acres and total suitable area for built development is 144,252 Acres or 12 % of the total area."

TABLE 4.8 WATERSHED SUITABILITY FOR DEVELOPMENT IN TRINIDAD AND ASSOCIATED AREA STATISTICS [4]

Watershed	Total Area (Acre)	Suitable Area (Acre)	Percentage[1]
Cedros Peninsula 1	45,034	4,969	11
Cedros Peninsula 2	13,100	3,509	27
Cedros Peninsula 3	42,301	9,568	23
Central West Coast 1	12,311	5,199	42
Central West Coast 2	30,007	6,916	23
Central West Coast 3	13,134	2,238	17
Central West Coast 4	47,724	4,684	10
Central West Coast 5	24,132	1,144	5
Nariva 1	96,542	5,209	5
Nariva 2	11,811	550	5
Nariva 3	4,358	-	-
Nariva 4	2,053	-	-
North Coast 1	50,137	4,094	8
North Coast 2	20,505	-	-
North Coast 3	11699	5,19	4
North Coast 4	10,240	4,64	5
North Coast 5	11,402	2,41	2
North Oropouche 1	14926	1085	7
North Oropouche 2	13,016	450	3
North Oropouche 3	18,172	1,279	7
North Oropouche 4	16,331	1,422	9
North Oropouche 5	3,508	-	-
North Oropouche 6	22,754	4,087	18
North Oropouche 7	32,396	3,010	9
North Oropouche 8	12,431	812	7
Ortoire 1	46,518	7,021	15
Ortoire 2	69,813	62,34	9
South Oropouche	108,500	18,038	17
Southern Range 1	47,949	3,280	7
Southern Range 2	58,524	4,341	7

[4] **All statistics represent the percentage of suitable area for built development over the corresponding total area of that watershed, some watersheds contain incomplete datasets.**

Southern Range 3	7,664	1,436	19
Southern Range 4	19,724	647	3
Western Peninsula 1	8,019	312	4
Western Peninsula 10	5,540	2,749	50
Western Peninsula 11	12,229	2,486	20
Western Peninsula 12	10,907	3,728	34
Western Peninsula 13	5,252	2,056	39
Western Peninsula 14	4,949	1,410	28
Western Peninsula 15	14,694	2,531	17
Western Peninsula 16	12,070	749	6
Western Peninsula 17	12,074	1,667	14
Western Peninsula 18	4,382	641	15
Western Peninsula 19	16,420	3,265	20
Western Peninsula 2	4,767	14	-
Western Peninsula 20	9,590	4,439	46
Western Peninsula 21	6,352	1,697	27
Western Peninsula 22	25,066	3,167	13
Western Peninsula 3	12,077	1,696	14
Western Peninsula 4	21,396	2,017	9
Western Peninsula 5	22,166	1,707	8
Western Peninsula 6	9,862	1,737	18
Western Peninsula 7	6,653	395	6
Western Peninsula 8	13,192	19	-
Western Peninsula 9	12,967	3,325	26
Total	**1,189,340**	**144,252**	

Source: CLEAR

[1]The total percentage in the above table is not available due to the missing data for some areas

With respect to Tobago, the CLEAR report indicates that "the total area of Tobago is around 74,054 Acres and total suitable area for built development is 3,780 Acres or 5 % of the total area. The watersheds such as Tobago North and Courland watersheds have a high potential for built development."

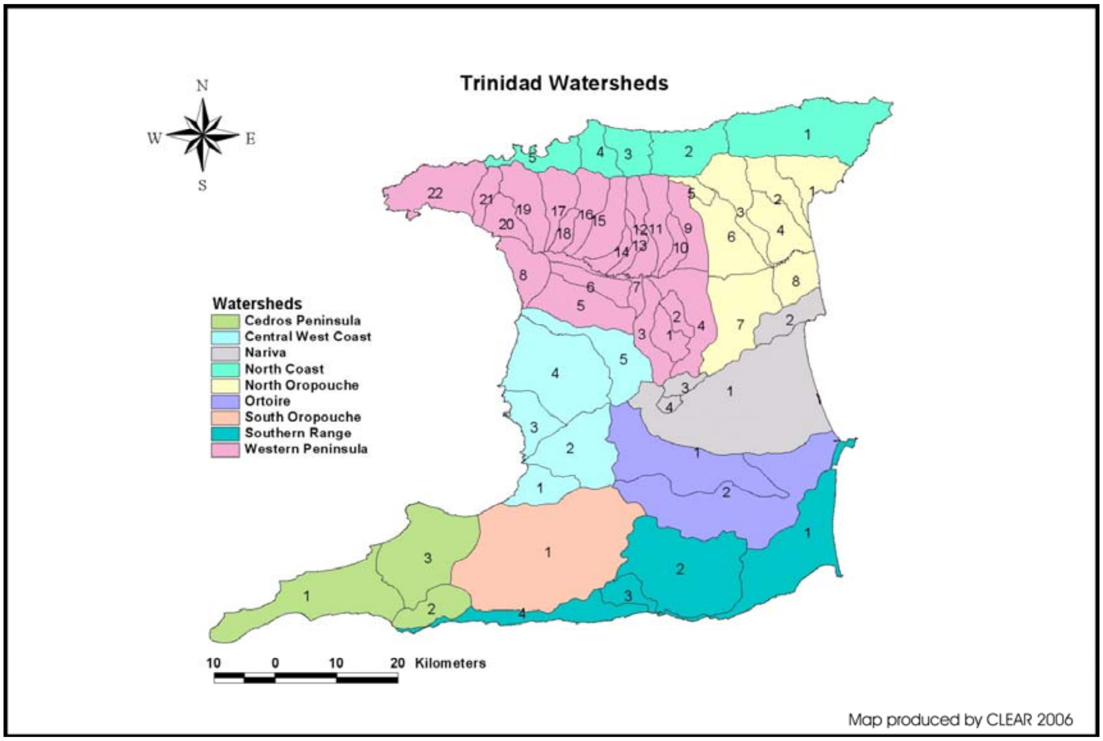
TABLE 4.9
WATERSHED SUITABILITY FOR DEVELOPMENT IN TOBAGO AND ASSOCIATED AREA STATISTICS

Watershed	Total Area (Acres)	Suitable Area (Acres)	Percentage[1]
Tobago East	9,627	67	1
Bloody Bay	3,611	110	3
Louis D'Or	3,513	256	7
Tobago North	7,745	1,303	17
Roxborough	4,970	160	3
Richmond	4,932	50	1
Goldsborough	6,495	-	-
Hillsborough Dam	1,247	13	1
Courland	7,556	1,318	17
Hillsborough West	3,188	58	2
Tobago South2	739	-	-
Sandy River	3,787	394	10
Hillsborough East	1,758	50	3
Tobago South1	1,828	-	-
Tobago West	13,058	-	-
Total	**74,054**	**3,779**	

Source: CLEAR

[1]The total percentage is not available in the above table due to the missing data for some areas.

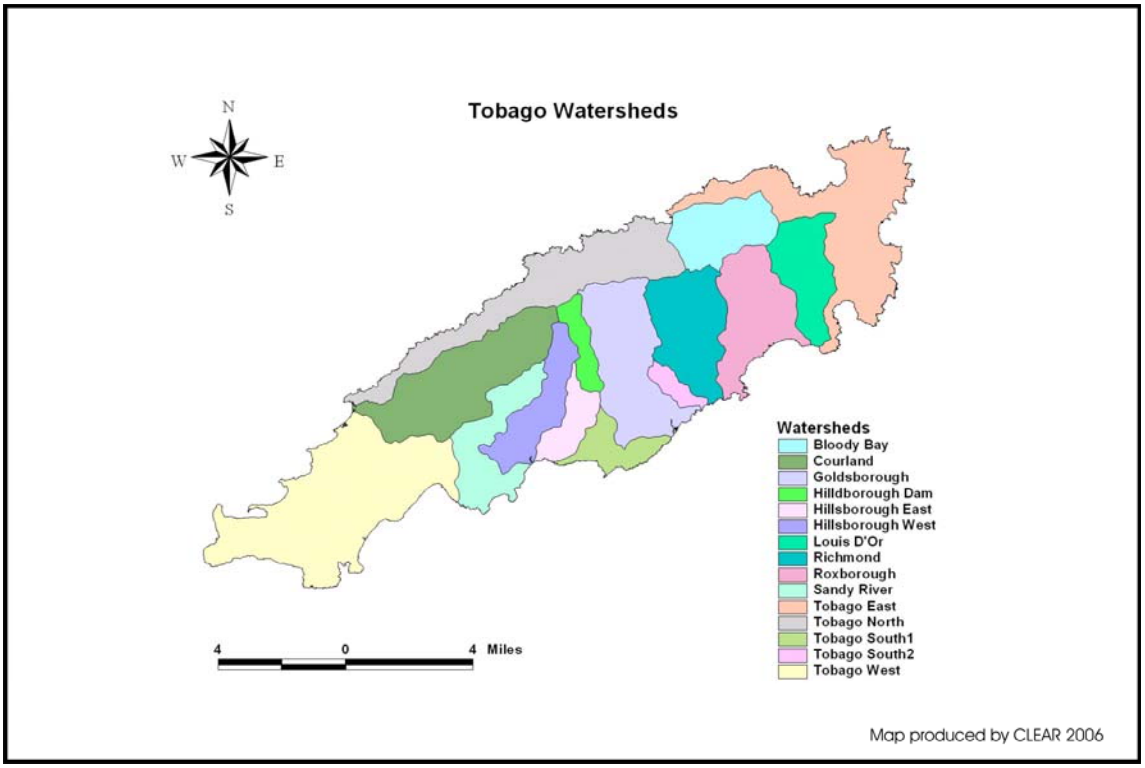
MAP 4.12 TRINIDAD WATERSHEDS



Source: CLEAR 2006

The watersheds in Trinidad and Tobago have been subdivided into smaller catchments based on topography, in order to make the areas more manageable from a planning perspective. This criterion was used in all of the main hydrological catchments and is reflected in all of these being subdivided and numbered accordingly as seen in Map 4.12.

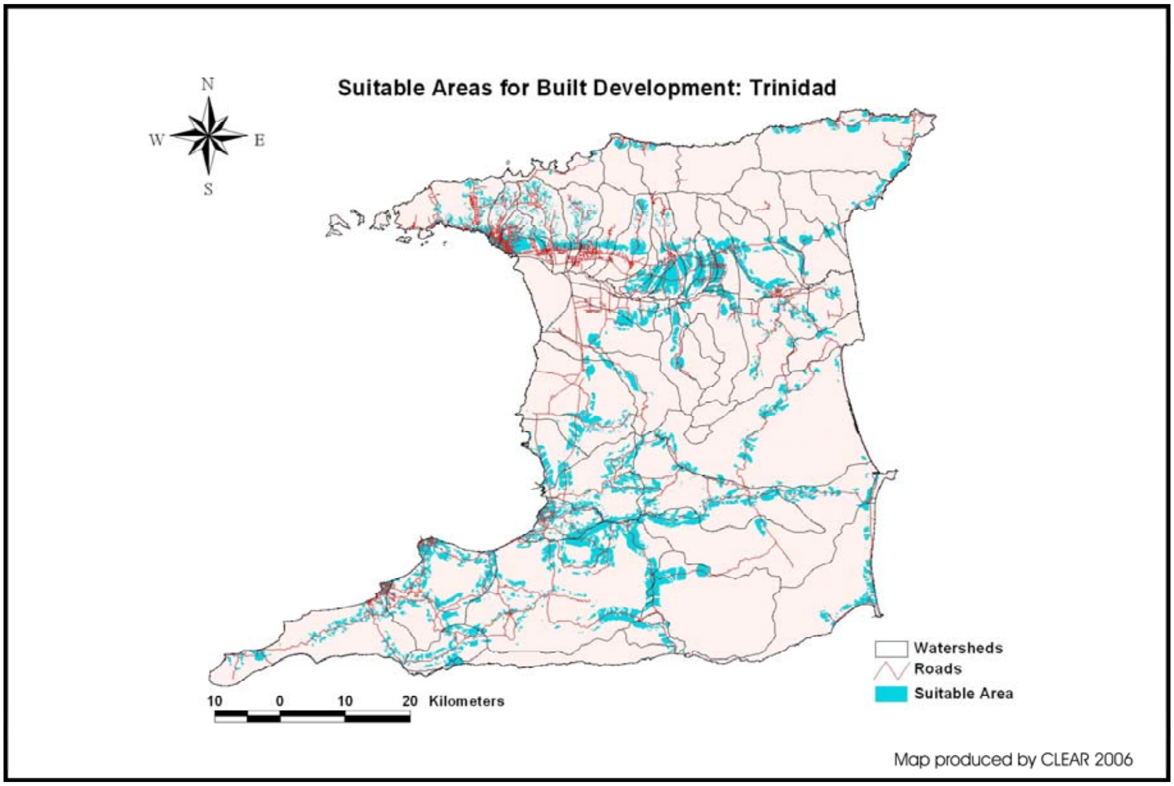
MAP 4.13 TOBAGO WATERSHEDS



Source: CLEAR 2006

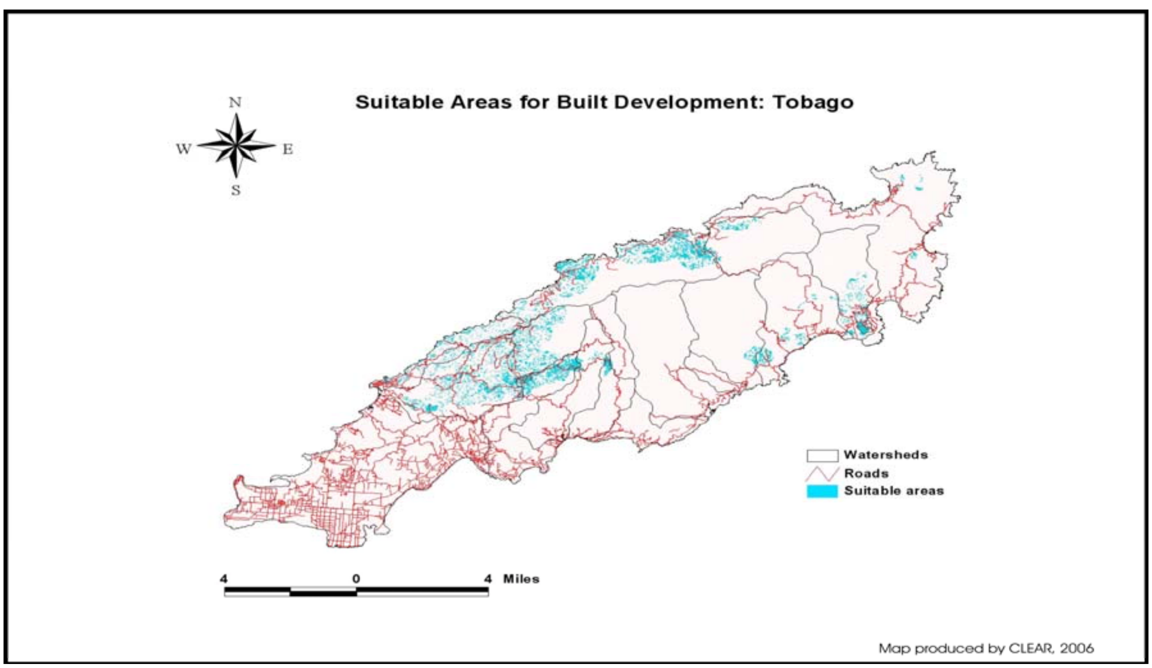
The following locations were identified as being suitable for built development within watersheds. (see Maps 4.14 and 4.15)

MAP 4.14: SUITABLE AREAS FOR BUILT DEVELOPMENT IN TRINIDAD



Source: CLEAR 2006

MAP 4.15 SUITABLE AREAS FOR BUILT DEVELOPMENT IN TOBAGO



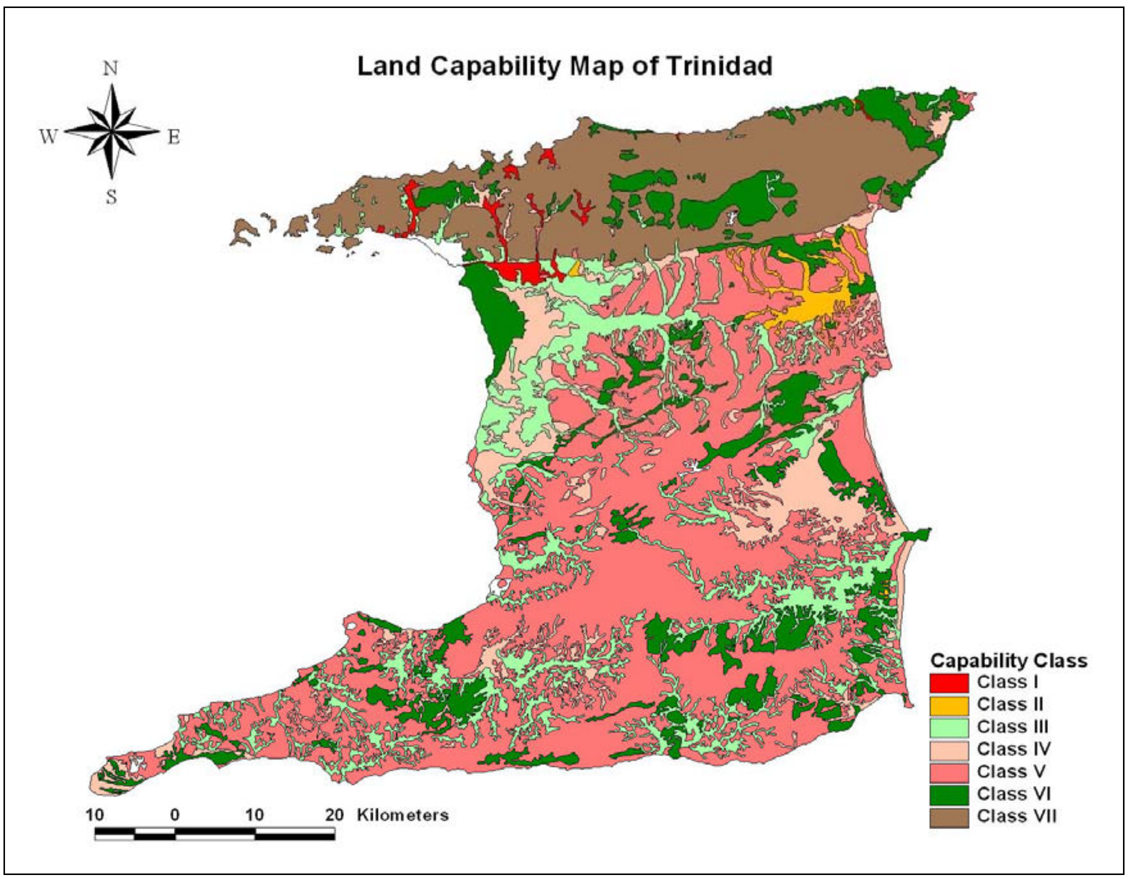
Source: CLEAR 2006

4.11 Land Capability

4.11.1 Land Capability in Trinidad

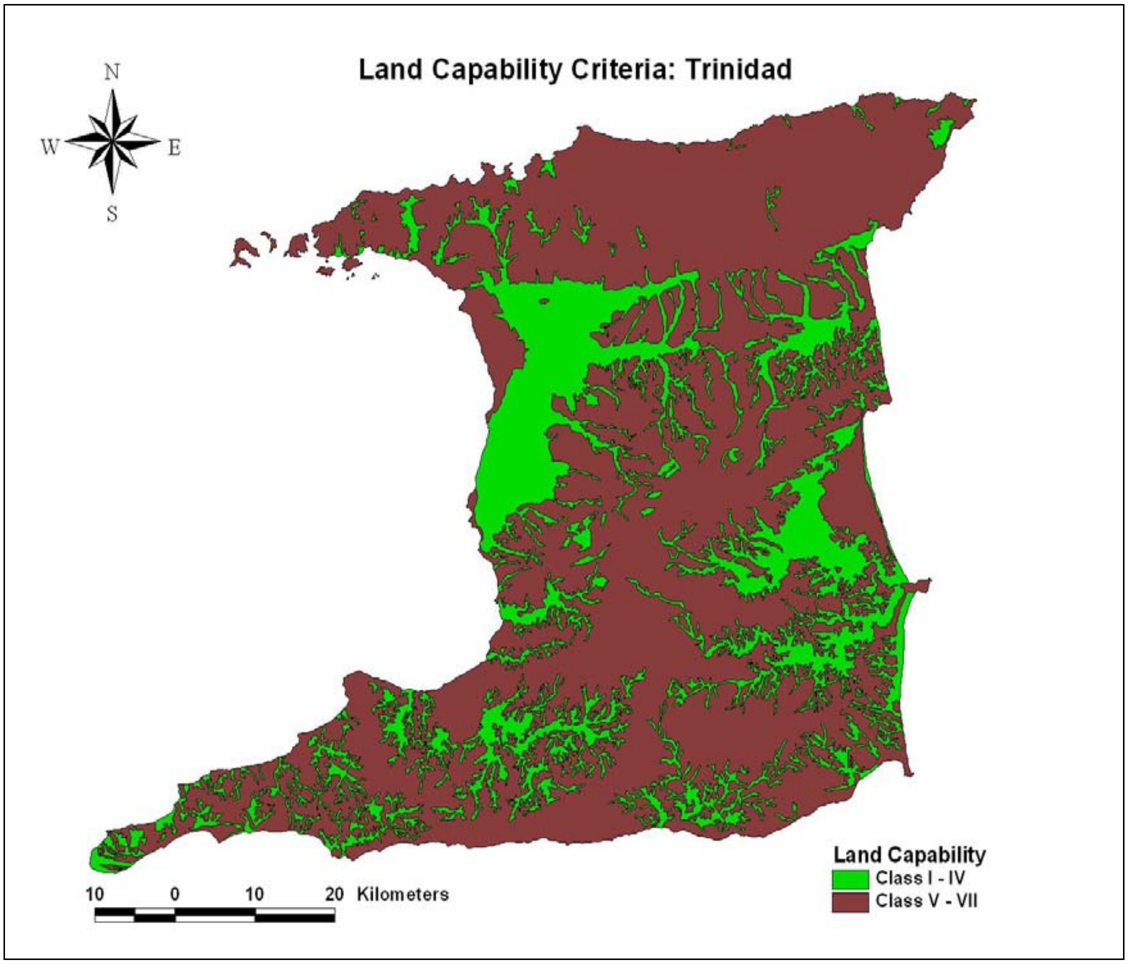
The land capability map identifies areas in Trinidad that contain good soils (Classes I-IV) and should be retained as far as possible as agricultural lands with the remaining soils (Classes V-VII) utilised as much as possible for built development. (see Maps 4.16 and 4.17). It should be noted however, that significant areas of extremely good agricultural soils particularly at the foothills of the Northern Range have been long converted to built development with increasing pressure for land close to the urban strip known as the “East-West Corridor”. Housing demand in particular, is leading to more loss of fertile agricultural lands in these areas.

MAP 4.16 LAND CAPABILITY MAP OF TRINIDAD



Source: Ministry of Agriculture, 1972

MAP 4.17 LAND CAPABILITY CRITERIA IN TRINIDAD

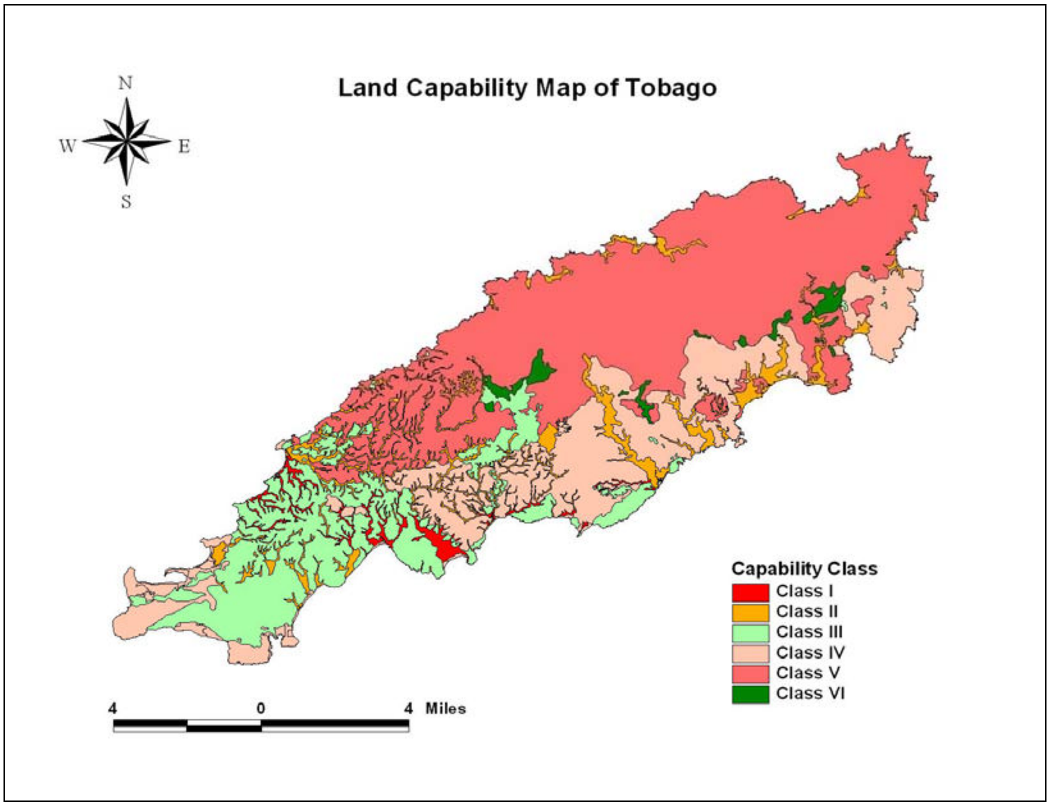


Source: CLEAR 2006

4.11.2 Land Capability in Tobago

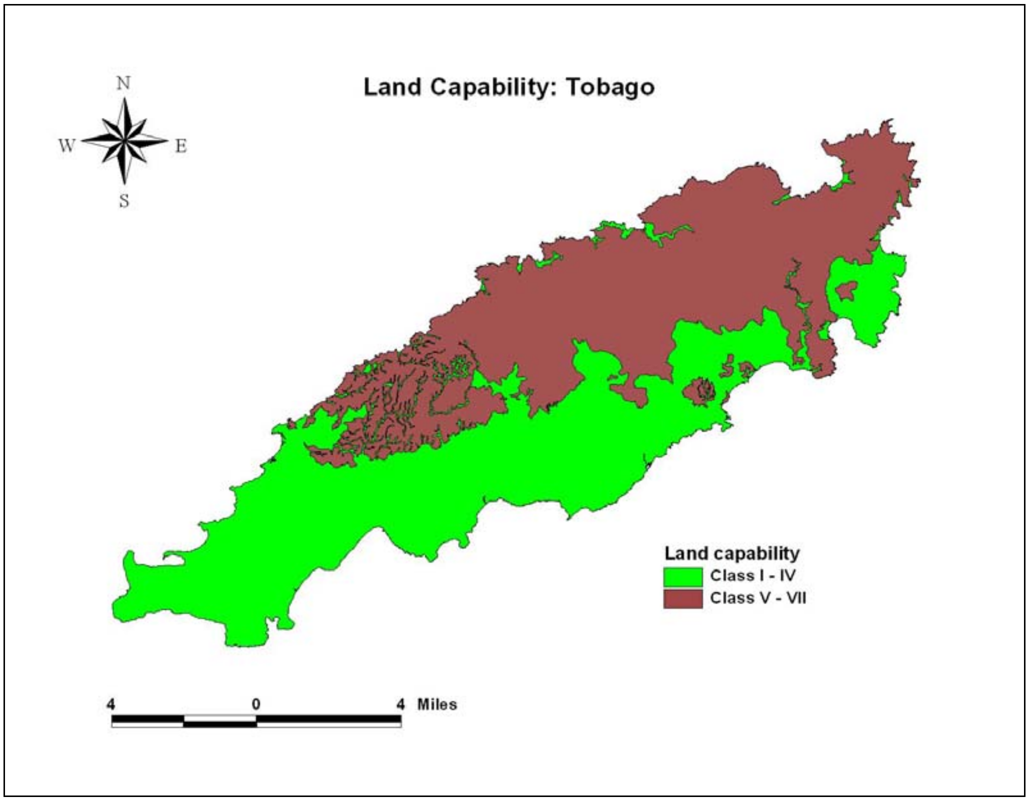
Similarly, it should be noted that in Tobago, some of the best agricultural lands are located in and around the urban centre of Scarborough and much of south west Tobago and are thus subjected to significant built development when compared to the rest of the island. (see Maps 4.18 and 4.19) Development planning therefore, has to play a critical part in allocating and controlling land use to mitigate against potential environmental degradation that may occur in this area, since Tobago's vulnerability is enhanced by its dependency on natural coastal resources.

MAP 4.18 LAND CAPABILITY MAP OF TOBAGO



Source: CLEAR 2006

MAP 4.19 LAND CAPABILITY IN TOBAGO



Source: CLEAR 2006

The generalised land use/cover map (see Maps 4.20 and 4.21) and was developed by combining information from the following sources;

1. The developed land use/over map
2. The land capability for agriculture map
3. The suitability for built development map
4. The recently proposed/approved projects map.

The following tables (Table 4.10 and 4.11) are a list of existing datasets and associated datum available through different agencies, which were used in the development of the generalised land use/cover maps for Trinidad and Tobago.

TABLE 4.10 DIGITAL DATA SETS DEVELOPED FOR TRINIDAD

Data Layer	Source	Scale	Metadata
Coastline	Paper map	1:25,000	Available
Watershed	Vector data	-	Available
Land use/cover	Satellite image	30m resolution	Available
Land capability	Paper map	1:150,000	Available
Settlement	Satellite image	30m resolution	Available
Road	Paper map	1:25,000	Available
Landslide	Vector data	-	Available
Flood	Paper map	1:150,000	Available
Contour	Paper map	1:25,000	Available

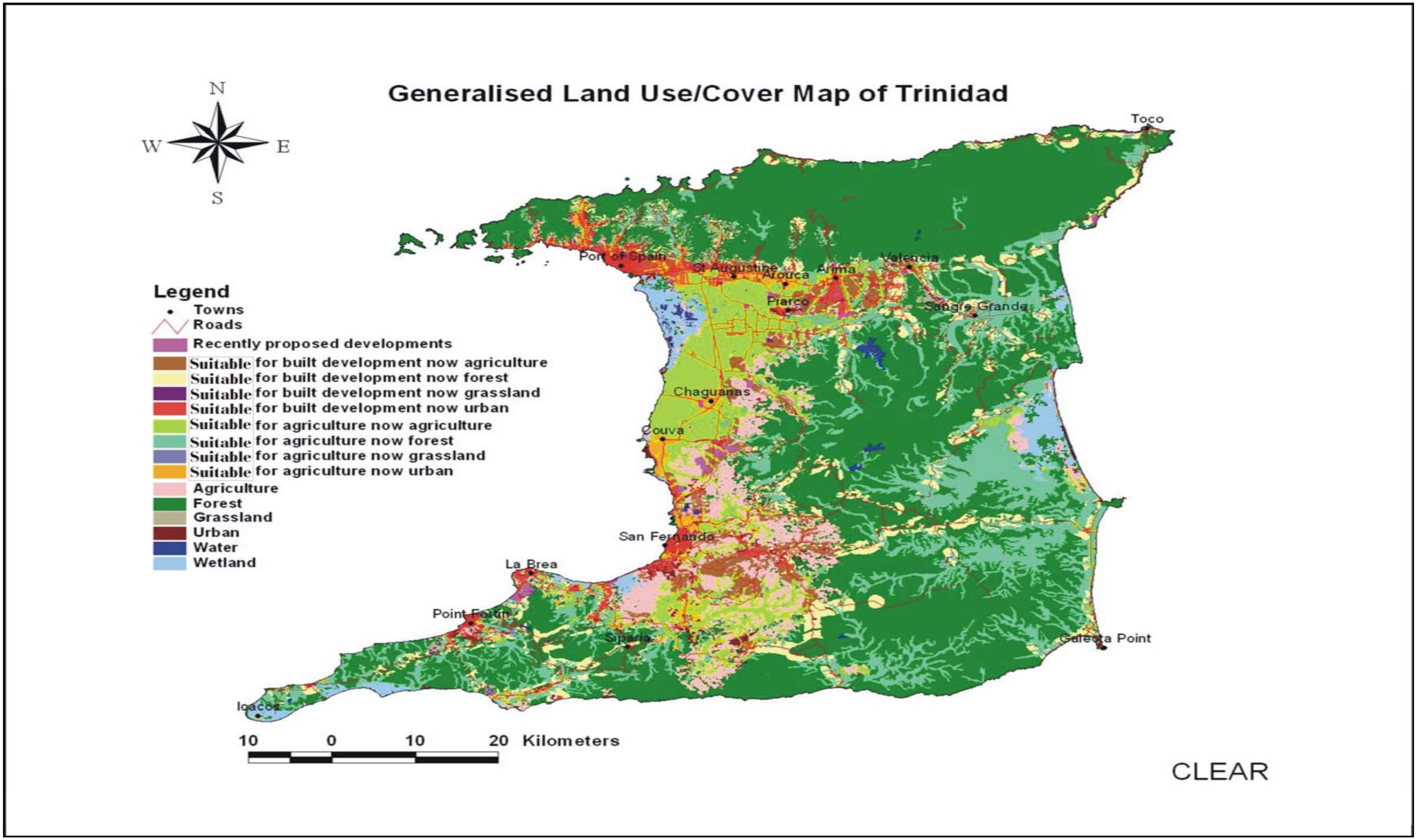
Source: CLEAR

TABLE 4.11 DIGITAL DATA SETS DEVELOPED FOR TOBAGO

Data Layer	Source	Scale	Metadata
Coastline	Paper map	1:10,000	Available
Watershed	Vector data	-	Available
Land use/cover	Satellite image	30m resolution	Available
Protected area	Paper map	1:100,000	Available
Land capability	Paper map	1:25,000	Available
Settlement	Satellite image	1m resolution	Available
Road	Paper map	1:10,000	Available
Landslide	Vector data	-	Available
Contour	Paper map	1:10,000	Available

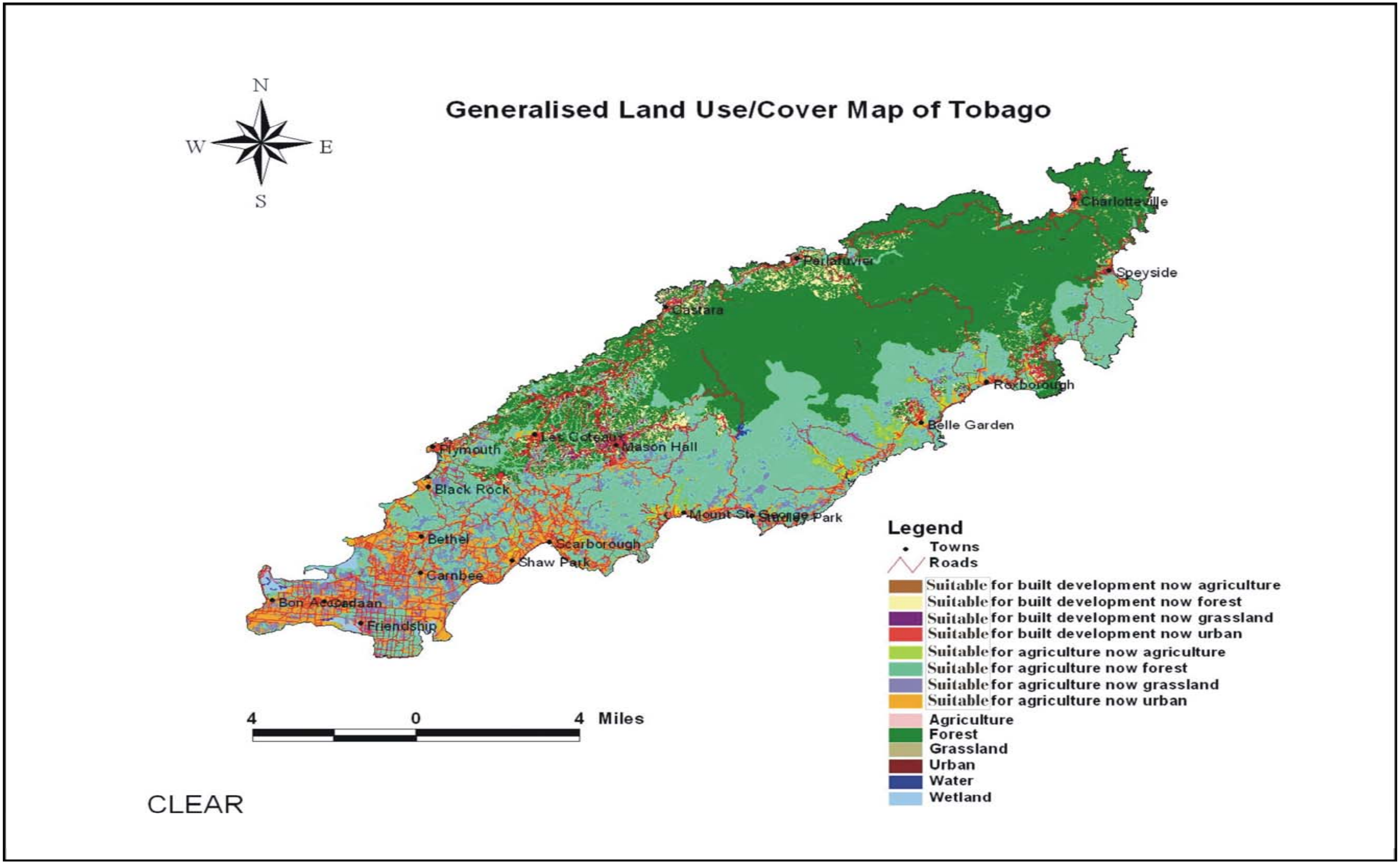
Source: CLEAR

MAP 4.20 GENERALISED LAND USE COVER MAP OF TRINIDAD



Source: CLEAR 2006

MAP 4.21 GENERALISED LAND USE COVER OF TOBAGO FOR 2006



Source: CLEAR 2006

4.12 Land Use in the Urban Context

The historical growth of the capital city of Port of Spain (see Map 4.22) gives an indication of the urban sprawl that is now being experienced in the main urban areas of Trinidad & Tobago. There are physical constraints to land use development for most of the existing urban areas within the country and the capital city itself is constrained in its growth by the presence of the Northern Range to the north and the gulf of Paria to the south. Physical planning concerns for the capital city which can be extrapolated to the main urban centres include the following: [1]

- Topographical constraints
- Flooding problems where drainage channel capacity is undermined through the presence of high sedimentation and large amounts of debris. This is compounded by the areas of informal and formal developments on steep slopes.
- Inadequate infrastructural support for communities, particularly those that had their genesis through informal development. These place additional pressures on the existing infrastructural systems to perform their functions effectively. For example, "Some residences not connected to the sewage system are situated on steep slopes where the use of septic tanks, pit latrines and cesspits can create a nuisance and health hazard for downhill residents. In areas not served by sewers, grey water is generally discharged to open drains, presenting a health nuisance and odour and mosquito hazards."[2]
- Traffic congestion, which has economic and social implications, leads to environmental degradation which includes traffic-related noise and air pollution.
- Within the main urban centres there are few easily developable sights for new housing outside of prime agricultural lands in the peri-urban areas.

The map below demonstrates the expansion of the Capital City, Port of Spain from around 1760 to 1985. If such expansions are not been fully supported by adequate infrastructural provisions, the environmental impacts can be significant and oftentimes insidious.

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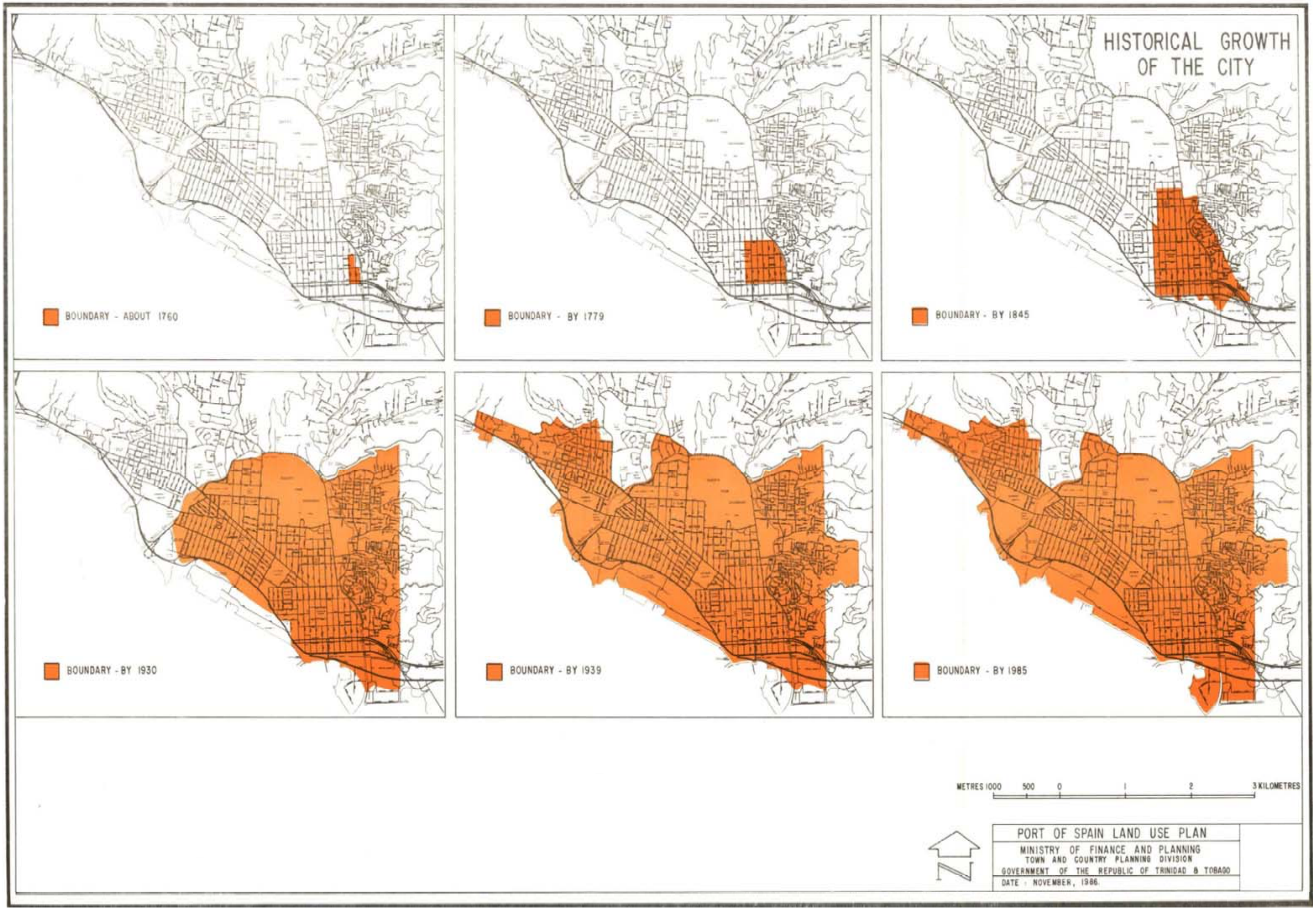
[1] Adapted from the Greater Port of Spain Local Area Plan Greater Port of Spain Master Plan, Technical Report. December 2000 Halcrow Group (Trinidad & Tobago) Ltd. In association with the Joint Consultative Council for the Construction Industry.

[2] Ibid.

MAP 4.22 PORT OF SPAIN: HISTORICAL MAPPING OF DEVELOPMENT



Source: Ministry of Finance and Planning; Town and Country Planning Division

4.13 Land Use Planning for the Preservation of Historical / Archaeological Areas[1]

"Hidden in Trinidad's forest, east of the Maracas Valley lies a rare haven of archaeological finds. The rock drawings of Caurita. They are of unknown age and their meanings are equally mysterious…the reason for our prehistoric forebearers engraving these petroglyphs remains a well chiselled mystery, but these artefacts also remain to be one of Trinidad's most revered and oldest monuments". [3]

Museum - Trinidad

Cathedral of The Immaculate Conception, Trinidad

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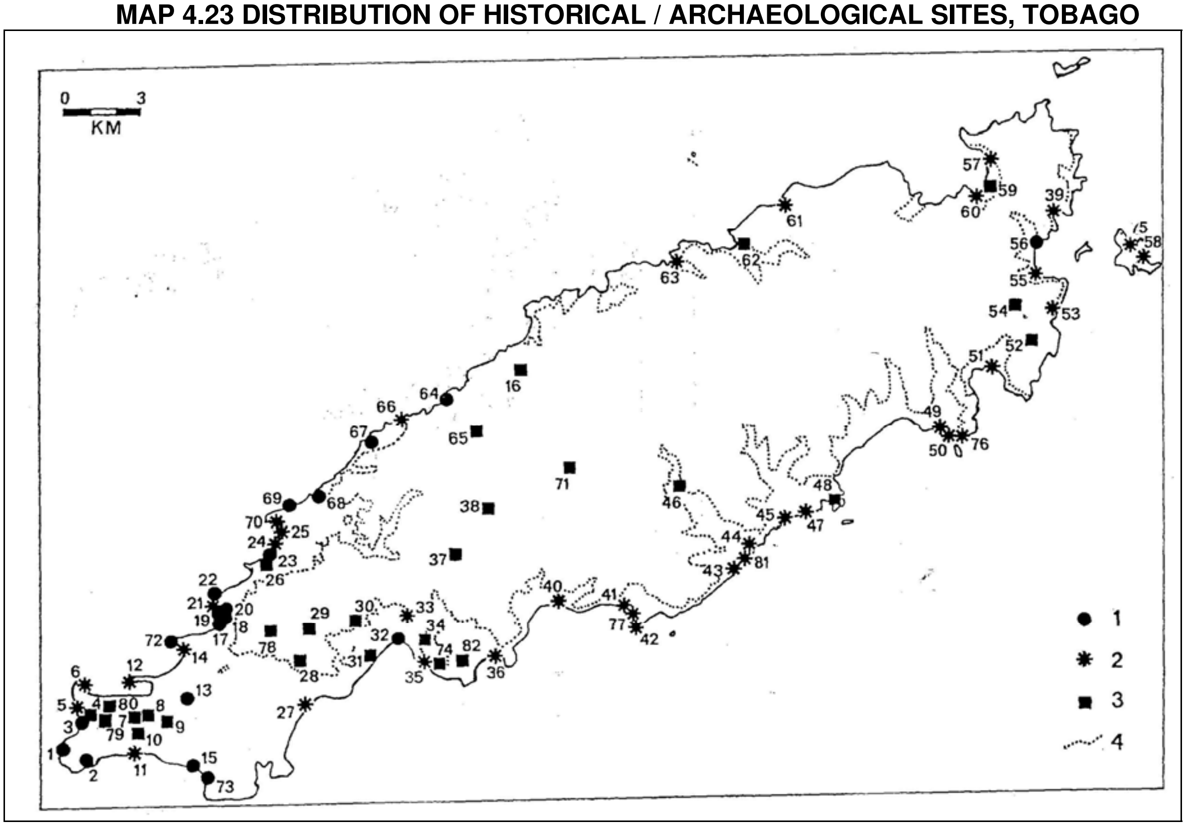
[1] **See appendix 4.1 for Listing of Archaeological Sites in Trinidad andTobago**

[3] **Besson, Gérard & Brereton, Bridget. 1992. *The Book of Trinidad*. 2nd ed. Port of Spain: Paria Publishing Co. Ltd. ISBN 976-8054-36-0.**

Land use planning in Trinidad and Tobago takes into account the existence of sites that are of archaeological or historical significance (see Map 4.23). Planning regulations provides a caveat to protecting such sites where it is stated that "developers will be expected to conserve these by preservation, restoration, reconstruction, reconstitution and/or rehabilitation processes. Where redevelopment is permitted in conservation areas, new construction is to be in sympathy with the character of the building and/or area. Whatever the form of conservation there should be integrity of style, scale, setting, building form, materials, colour and careful consideration given to adaptive use of sites and buildings"[4] There have been over 71 historical/archaeological sites identified in Tobago[5] and more than 186 identified in Trinidad, the following is a tabular and graphic representation of some of these sites. [6] This list it should be noted is not exhaustive and it is always being updated as new information is 'discovered'.

MAP 4.23 DISTRIBUTION OF HISTORICAL / ARCHAEOLOGICAL SITES, TOBAGO



Source: Archaeological Committee, 1987.

1- Midden sites; 2- Pottery deposits; 3- Individual Find; 4- 200 feet Contour line

[4] Guide to Developers and Applicants for Planning Permission. Ministry of Planning and Mobilization, Town & Country Planning Division. Government of the Republic of Trinidad & Tobago. November 1989.
[5] The Prehistoric sites of Tobago-Arie Boomert 1986
[6] Report on the 1987 Archaeological-Historical Survey of Tobago. Arie Boomert

1. ***Midden sites*** defined as "the layer of soil which contains the by-products of human activity as the result of the accumulation of these materials on their living surface For prehistoric sites, a layer of soil that was stained to a dark colour by the decomposition of organic refuse which also contained food bones, fragments of stone tools, charcoal, pieces of pottery, or other discarded materials. For historic sites, a similar layer of soil but with appropriate historic material remains often in a much thinner deposit…"[7] Or simply, "an area used for trash disposal."[8]

2. ***Pottery Deposits***- These are sub categorised according to the age.

3. ***Individual Find***- these can be find "spots" or find "scatters" of various artifacts from specific periods, essentially objects located at a particular site.

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[7] The National Park Service U.S. Department of the Interior. Available on the internet - http://www.cr.nps.gov/seac/terms.htm

[8] West Virginia Division of Culture and History, Glossary of Archaeological Terms available on the Internet- http://www.wvculture.org/shpo/glossary.html

4.14 A Historical Glance at the Submission of Planning Applications for Development, 1969 – 2005

Since the proclamation of the Town and Country Planning Act of 1969, the country appears to be undergoing a similar pattern of development in relation to the amount of physical development that is currently being undertaken and what had occurred during the 'oil-boom' years of the 1970's. The economic situations were similar with significant increases in oil revenue spurring development forward resulting in the tangible data of applications for development planning approval. As the graph in Figure 4.1 indicates, there were sharp increases in development planning applications in the 1970's which tapered off during the depression period of the late 1980's – early 1990's.

Land use activity in Trinidad and Tobago continues to play the paramount role in the economic and social development of the country and is directly linked to the environmental health and well being of its people and of the ecosystems which are impacted upon. Future physical development must be cognizant of this role which should be reflected in the continuous monitoring and control of land use activity, in order to ensure that the development which ensues is compatible. A balance must be struck between the conservation and exploitation of natural resources to be able to operationalise the concept of sustainable development for the present and future generations.

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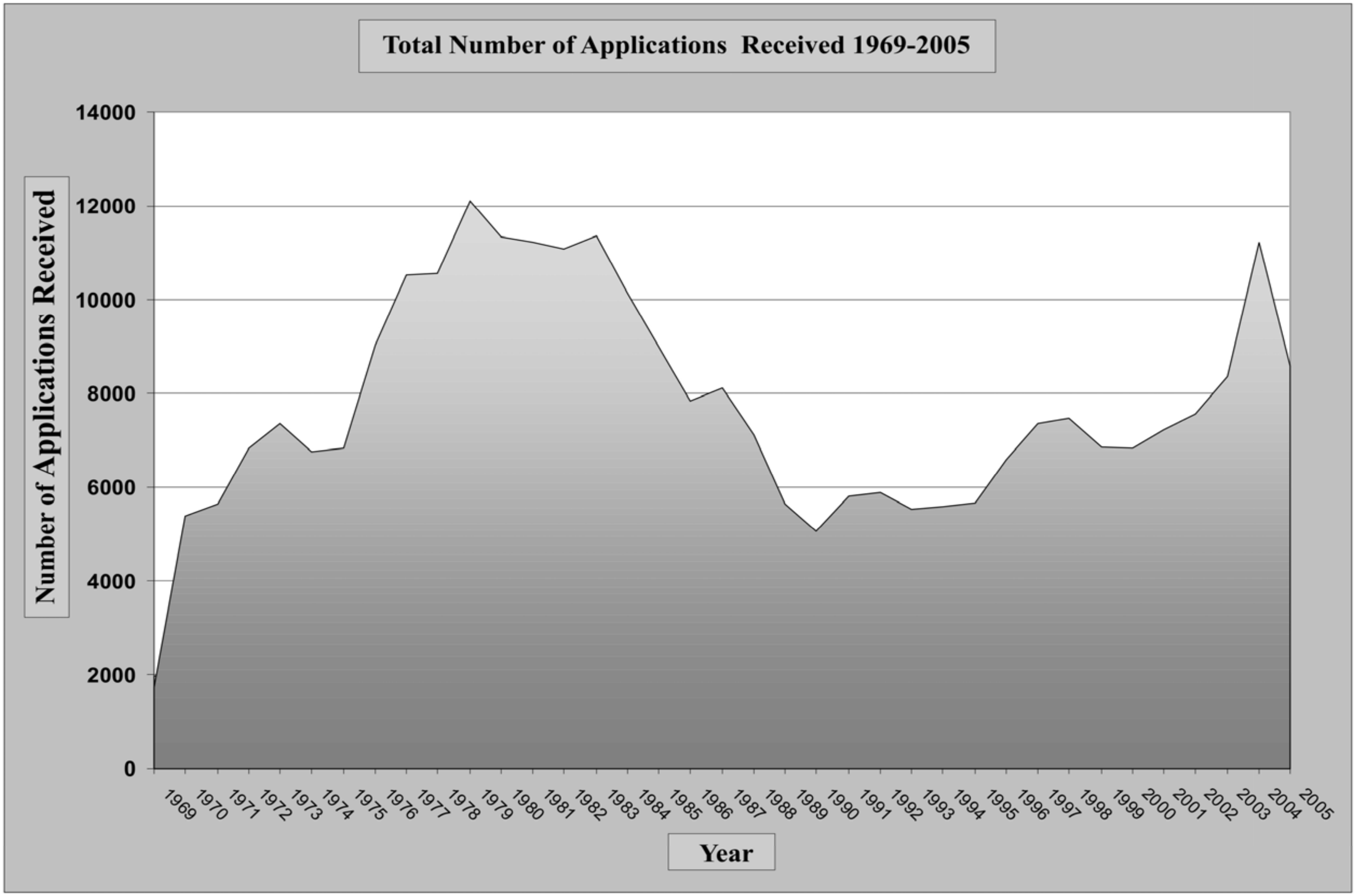
[23]"Petroglyphs are a form of prehistoric rock art found in many cultures around the world and at many times. They are made by carving, etching, incising, rubbing, and pounding the rock surface to create images. Petroglyphs are among the oldest form of art known to humans…" http://archaeology.about.com/od/pterms/g/petroglyphs.htm

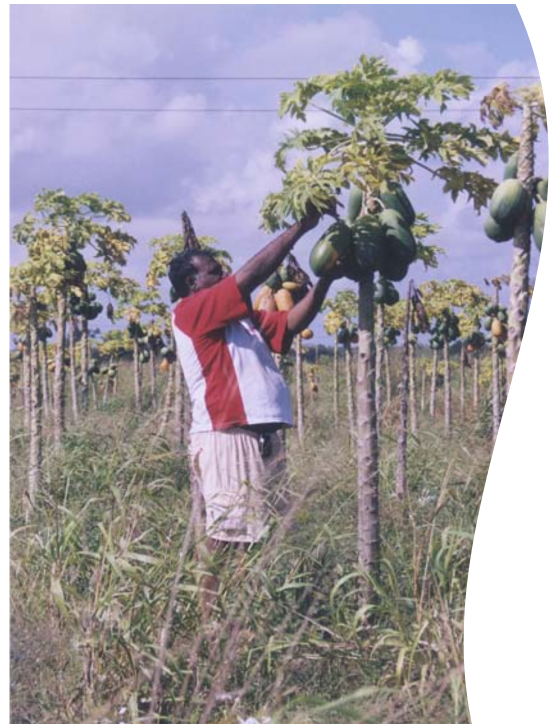
[24]Flint has been described as "a microcrystalline silicate rock similar to chert, used for the manufacture of flaked stone tools. Colour most commonly gray, honey-brown, or black..." http://www.webref.org/archaeology/f/flint.htm

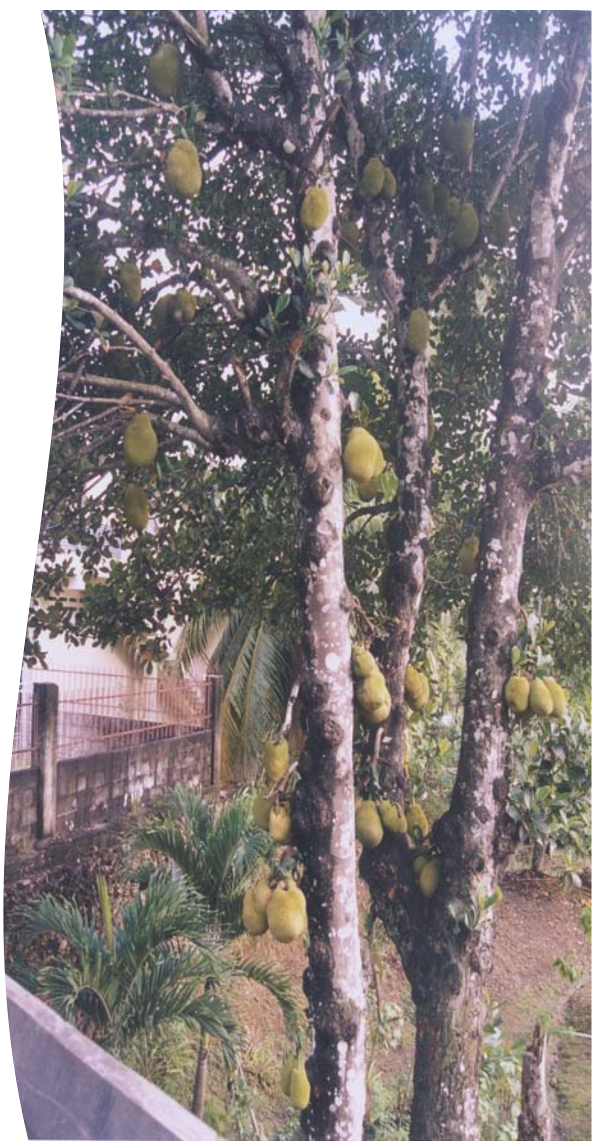
FIGURE 4.1 TOTAL NUMBER OF PLANNING APPLICATIONS RECEIVED FOR DEVELOPMENT APPROVAL RECEIVED, 1969-2005



CHAPTER 5

AGRICULTURE





Photographs courtesy Satee Boodoo

5 AGRICULTURE

Introduction

Agricultural economic activity provides food in order to service consumer demand. As food is so important to the nutritional welfare of any country's citizenry, the continuation of such activity must be encouraged. Several tree crops and vegetable food crops are cultivated throughout both islands and the proper crop cultivation used on arable land is important for soil conservation. This sector though is not sufficiently developed to provide for the total requirements of the country, hence the high food import bill.

Most holdings throughout the country dispose of waste water into ravines or rivers which leads to polluted water sources. The drainage system in many holdings during the rainy season becomes clogged with debris and this leads to flooding and loss of livestock and food crops. The improper use or overuse of fertilizers and pesticides contaminates the soil and enters into water courses as agricultural chemical run-off. This affects the water quality of the underground water table. Machinery and equipment used on the holdings eventually has to be disposed off and this solid waste is very often left on the holdings as old derelicts which pollute the natural environment.

5.1 Agricultural Land in Trinidad and Tobago

Trinidad and Tobago has an area of 512,838 hectare[1] of which 84,990 (16.6%) hectares, according to the 2004 Agricultural Census Report, are used as cultivated croplands (tree, non-tree, ornamental plants etc), cultivated pasture, natural pasture, resting lands (fallow), new lands being prepared for crops, abandoned and semi abandoned crop and pasture, forest and lastrajo, built on and service areas and all other land (including swamps) - see Table 5.1.

State lands (other than constituted forests) cover 179,288 hectares in Trinidad and 3,665 hectares in Tobago. State lands therefore constitute a significant portion of the land mass in Trinidad and Tobago.

This section shows all holdings in Trinidad and Tobago by type and land use for 2004 and compares it with the 1982 Census data. The data reveals that there was an overall 35.4% decline in land used for agriculture over the period in Trinidad and Tobago.

Access road to agricultural holding in Trinidad

TABLE 5.1: ALL HOLDINGS IN TRINIDAD & TOBAGO BY TYPE OF LAND USE, 1982 AND 2004

Location	Year	Number of Holders by Location	Total Land Use	Land Use in Hectares								
				Arable Land								
				Cultivated Crop-lands (tree, non-tree, orna-mental plants etc.)	Culti-vated Pasture	Natural Pasture	Resting Lands (fallow)	New Lands being prepared for crops	Aban-doned and Semi abandon-ed crop and pasture	Forest and Last-rajo	Built on and Service Area	All Other lands
Trinidad and Tobago	2004	19,111	84,990.00	47, 902.8	2,869.40	3,331.70	3,617.30	1, 794.4	6, 256.6	4,262.00	1,840.40	13,115.30
	1982	30,566	131,572.00	81, 760.8	4,503.80	-	8,663.60	4, 476.3	12, 509.7	8,469.30	5,679.80	5, 519.7
Trinidad	2004	18,142	82, 947.8	47 ,460.4	2,678.10	2,807.80	3,554.70	1, 744.3	6, 050.5	3,789.90	1,774.80	13,087.30
	1982	28,600	125,700.00	79, 233.0	3,537.10	-	8,385.40	4, 290.4	11, 857.1	7,596.10	5,446.60	5, 365.3
Tobago	2004	969	2, 042.1	442.5	191.3	523.9	62.7	50.1	206.1	472.1	65.6	28.0
	1982	1,966	5, 872.0	2, 527.8	966.7	-	278.2	185.9	652.6	873.2	233.2	154.4

Source: CSO Agricultural Census 1982, 2004

5.2 Land Use and Food Crops under Cultivation

This section refers to the area of land utilized in the cultivation of green vegetables, root crops, other pulses (such as green corn, pigeon peas) and rice. Food crops has experienced an overall decline in acreage cultivated over the period 1993-2004, with significant declines especially in the categories of green vegetables, other pulses and rice. Table 5.2 shows the data and Fig 5.1 illustrates the data graphically.

Land under Cultivation

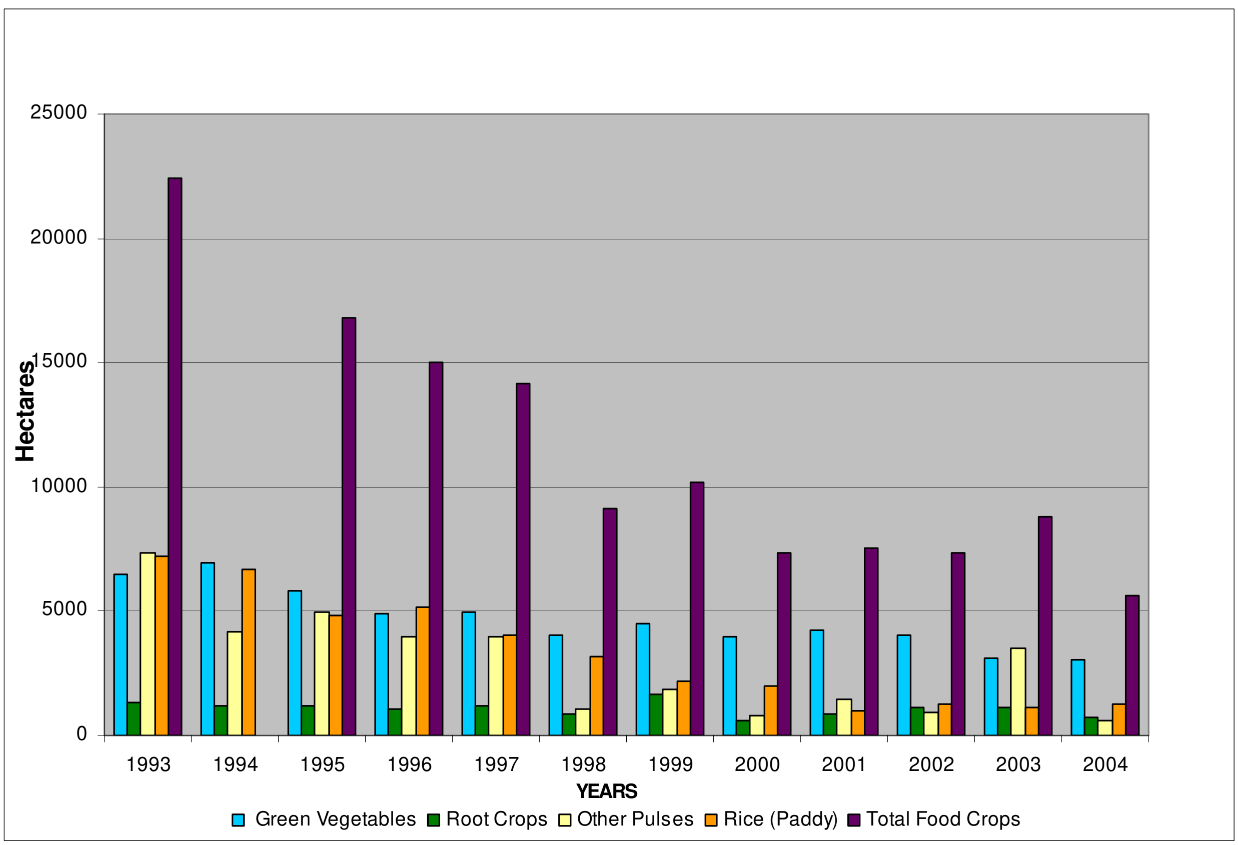
Roadside Vendor selling fruits,
Sugar Cane "arrow" shown to the left

TABLE 5.2 ESTIMATED AREA (HECTARES) OF FOOD CROPS PLANTED UNDER TRADITIONAL CULTIVATION, 1993-2004

Years	Food Crops				
	Green Vege-tables	Root Crops	Other Pulses	Rice (Paddy)	Total Food Crops
1993	6,495.1	1,313.6	7,358.1	7,226.1	22,392.9
1994	6,930.5	1,185.5	4,178.1	6,669.6	18,963.7
1995	5,805.8	1,222.2	4,970.5	4,796.4	16,794.9
1996	4,875.9	1,029.6	3,936.4	5,144.6	14,986.5
1997	4,946.4	1,198.1	3,983.5	4,025.0	14,153.0
1998	4,015.7	877.6	1,043.1	3,192.5	9,128.9
1999	4,508.3	1,666.9	1,824.2	2,198.9	10,198.3
2000	3,997.0	599.3	773.1	1,973.7	7,343.1
2001	4,260.2	841.6	1,464.7	987.6	7,554.1
2002	4,029.5	1,129.6	949.9	1,265.3	7,374.3
2003	3,080.8	1,104.7	3,520.7	1,106.2	8,812.4
2004	3,053.8	739.7	594.2	1,233.4	5,621.1

Source: CSO Agriculture Division

FIGURE 5.1 ESTIMATED AREA (HECTARES) OF FOOD CROP PLANTED UNDER TRADITIONAL CULTIVATION, 1993-2004



Source: CSO Agriculture Division

The cultivation of tree crops whether pure stand or interplanted enhances the 'green' environment. More essential, is the produce of tree crops. In Table 5.3 the quantity of non orchard treecrops harvested were primarily dry coconuts, bananas and plantain / moko. The main orchard crops harvested were oranges, Portugal /mandarin/tangerine and grapefruits.

TABLE 5.3 TREE CROPS HARVESTED AND SOLD ON ALL HOLDINGS BY TYPE OF CROP, 2003

Type of Tree Crop	Unit	Area Harvested in 2003 (Hectares)	Quantity Harvested 2003
Non Orchard	kg		
Banana	kg	6,180	5,417,884
Breadfruit	kg	708	196,016
Bread Nut (Chataigne)	kg	326	91,522
Cocoa	kg	7,729	1,719,461
Coconuts- Copra	kg	-	-
Coconuts- Dry	Number	1,820	10,536,469
Coconuts- Green	Number	1,631	2,221,478
Coffee	kg	3,815	489,505
Green Fig	kg	1,481	1,120,785
Nutmeg	kg	32	5,055
Peewah	kg	604	126,777
Plantain/Moko	kg	1,755	2,515,795
Rubber	kg	-	-
Tonca Bean	kg	5	518
Other Non Orchard Crops	kg	86	98,565
Orchard			
Avocado	kg	718	453,354
Carambolo	kg	30	8,892
Cashew Nut	kg	81	96,120
Cherry	kg	65	21,486
Grapefruit	kg	1,954	1,363,665
Guava	kg	18	11,599
Lime	kg	736	364,761
Mango	kg	1,061	1,048,077
Orange	kg	4,847	48,118,453
Paw Paw	kg	184	1,201,831
Pineapple	kg	205	924,393
Plums	kg	147	55,523
Pommecythere	kg	342	145,065
Pommerac	kg	139	87,066
Portugal/Mandarin/Tangerine	kg	2,290	1,981,293
Sapodilla	kg	66	14,895
Soursop	kg	23	3,957
Other Citrus	kg	414	234,577
Other Orchard Crops	kg	94	31,970
Mixed Tree Crop and Non Orchard	kg	90	62,163

Source: CSO Agricultural Report 2004

The cultivation of tree crops whether pure stand or interplanted enhances the environment not only aesthetically but also by the quality of harvests from one tree. In the 2004 Agricultural Census conducted by the Central Statistical Office, data on the area harvested, quantity harvested and sold from tree crops in 2003 was obtained. Cocoa and banana occupied 7,729 and 6,180 hectares of land respectively. The quantity harvested was then sold in the wholesale market. (9.4 % of the cocoa and 82.5% of bananas). (see Table 5.3)

5.3 Livestock

The livestock industry is not as developed as the food crop areas of agriculture in Trinidad and Tobago. Although livestock had been targeted with subsidies and government programs, the beef and dairy industry did not expand as did the poultry and pork industries which have become well developed. Livestock however, is a key facet of the agricultural sector as it not only supports agricultural production, but it also provides the necessary food for human consumption. This section gives an inventory of livestock on holdings as at 31 May 1982 and 31 July 2004. Tables 5.4 and 5.5 show the number of animals slaughtered in the various counties in Trinidad and in Tobago.

TABLE 5.4: INVENTORY OF LIVESTOCK ON HOLDINGS AS AT 31ST MAY 1982 AND 31ST JULY 2004

Livestock	May 31st 1982	July 31st 2004
Cattle	42, 340	19, 088
Pigs	79, 366	54, 855
Poultry	9, 160, 171	5, 740, 783
Sheep	11, 921	20, 726
Goats	30, 273	12, 500
Total Livestock	**9, 324, 071**	**5, 847, 952**

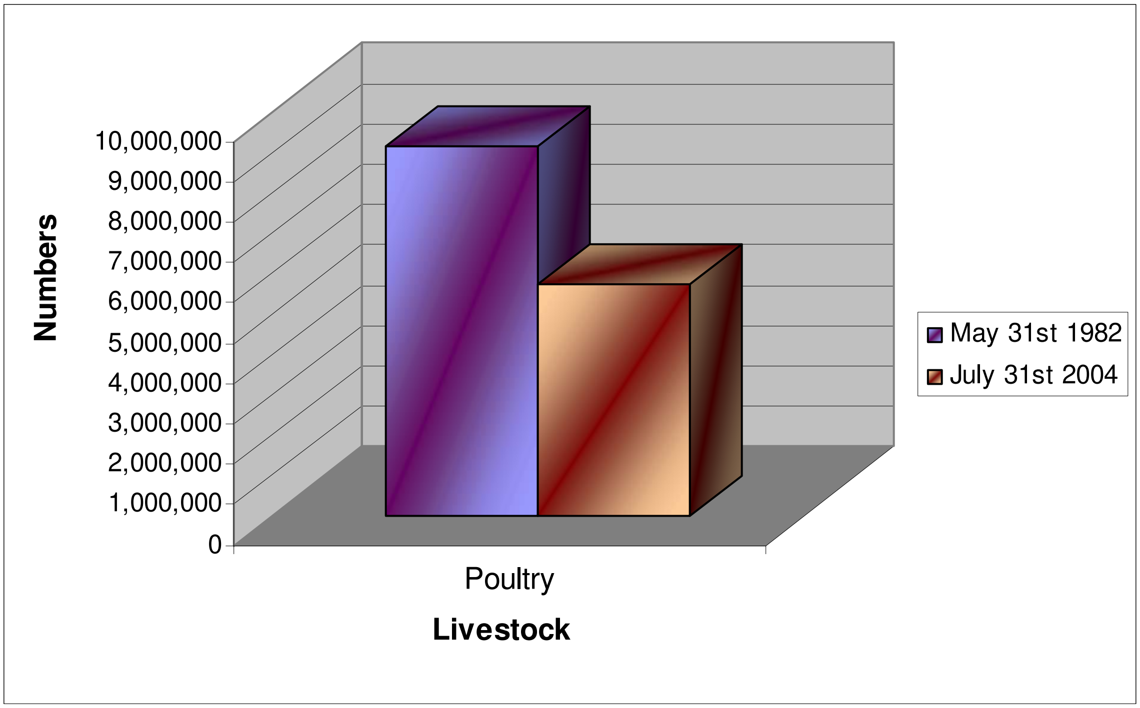
Source: 1982 Agricultural Census Report; 2004 Agricultural Census Report

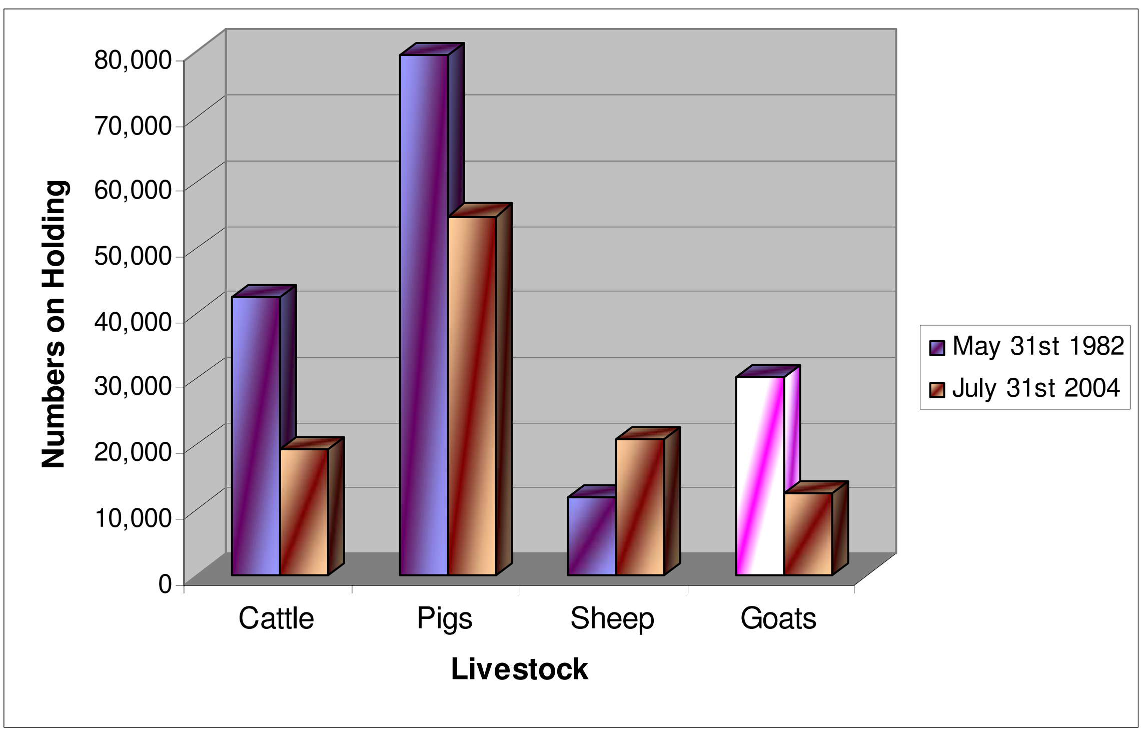
Cow grazing

Figure 5.2 below, graphically presents the inventory of livestock on holdings.

FIGURE 5.2:

INVENTORY OF LIVESTOCK ON HOLDINGS AS AT 31st MAY 1982 AND 31st JULY 2004





Source: CSO- Agriculture Section

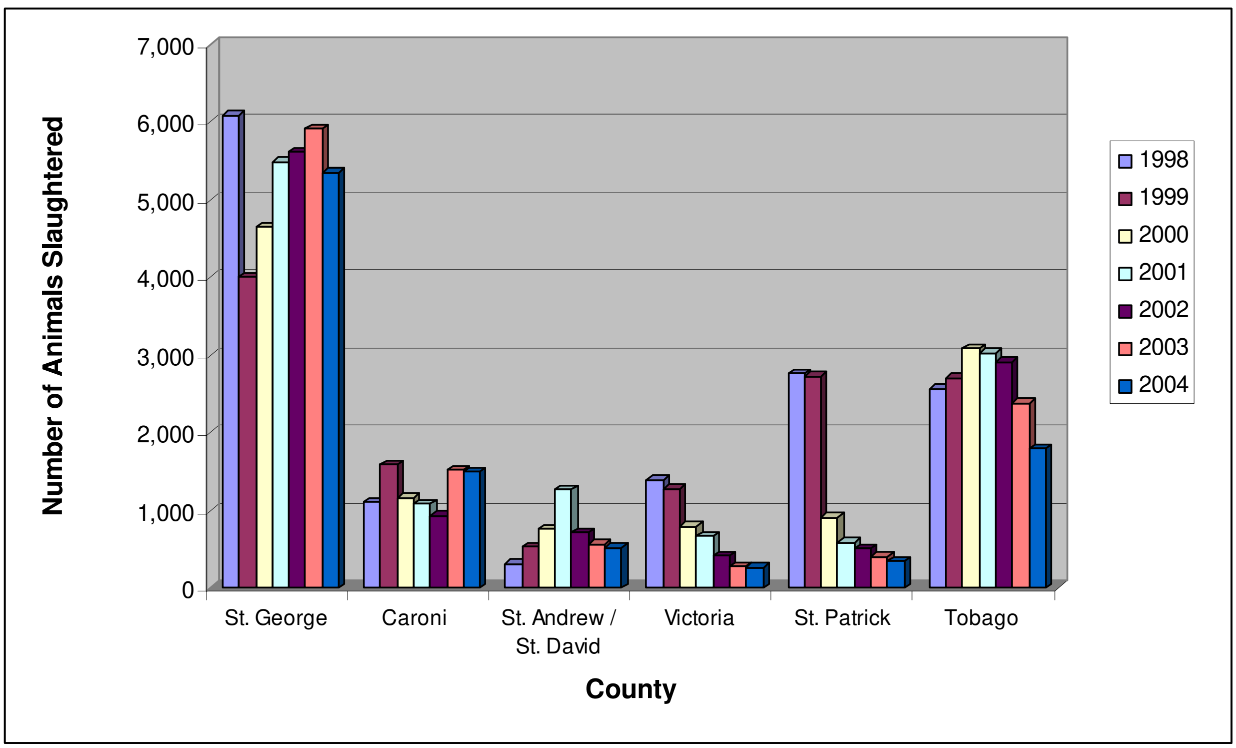
TABLE 5.5: NUMBER OF ANIMALS SLAUGHTERED BY GOVERNMENT CONTROLLED ABBATOIRS BY ADMINISTRATIVE AREAS 1998-2004

Country	Number of Animals Slaughtered						
	1998	1999	2000	2001	2002	2003	2004
St. George	6,095	4,004	4,654	5,493	5,623	5,917	5,355
Caroni	1,111	1,582	1,165	1,084	931	1,513	1,493
St. Andrew / St. David	315	529	765	1,267	712	565	520
Victoria	1,394	1,282	793	674	420	270	269
St. Patrick	2,760	2,732	914	589	500	401	348
Tobago	2,563	2,702	3,092	3,028	2,915	2,387	1,798
Total	**14, 238**	**12, 831**	**11,383**	**12,135**	**11,101**	**11,053**	**9,783**

Source: CSO Agriculture Section

The number of animals slaughtered was highest for 1998 and least in 2002. The numbers slaughtered in 1998 was 14,238 and 11,101 in 2002. A graphical presentation is shown in Figure 5.3.

FIGURE 5.3: NUMBER OF ANIMALS SLAUGHTERED BY ADMINISTRATIVE AREA, 1998-2004



Source: CSO Agriculture Section

TABLE 5.6 NUMBER OF HOLDINGS SHOWING METHODS OF DISPOSAL OF WASTE WATER[1] BY LOCATION AND AGRICULTURAL ACTIVITY, 2004

Characteristics of Holding	Method of Disposal						
	Flow into River/Ravine/Sea	Flow into Recycling System	Ground Percolation	Flow into WASA System	Pumping into Open/Covered Drains	Other	Not Applicable
Trinidad and Tobago	12,881	140	6,232	191	980	536	1,869
Trinidad	12,421	133	5,723	157	940	501	1,801
City of Port of Spain	2	-	-	-	-	-	-
City of San Fernando	9	-	4	-	1	3	-
Borough of Arima	14	-	12	6	8	1	-
Borough of Chaguanas	301	5	111	7	37	21	3
Borough of Point Fortin	51	1	24	-	-	-	-
Diego Martin	384	3	256	1	2	5	2
San Jaun/Laventille	490	5	188	11	80	26	4
Tunapuna/Piarco	1,512	31	742	50	254	76	43
Couva/Tabaquite/Talparo	2,508	31	734	38	164	114	89
Mayaro/Rio Claro	1,740	11	805	10	61	31	114
Sangre Grande	1,627	16	763	15	72	82	414
Princess Town	1,426	7	830	4	71	74	851
Penal/Debe	1,537	15	554	12	80	37	227
Siparia	820	8	700	3	110	31	54
Tobago	460	-	509	34	40	35	68
Agricultural Activity							
Total All Types	**12,881**	**140**	**6,232**	**191**	**980**	**536**	**1,869**
Crop	9,398	77	4,525	100	548	290	1,611
Livestock	1,197	35	597	44	209	126	108
Mixed	2,223	28	1,067	42	213	113	126
Other	63	-	43	5	10	7	24

Source: CSO Agricultural Report 2004

[1]Most of the wastewater on holdings in 2004 for Trinidad and Tobago was disposed of by flowing into rivers/ ravines/sea, followed by ground percolation and thirdly by pumping into open/covered drains. Holdings using any of these three methods were engaged in crop cultivation as the main agricultural activity.

TABLE 5.7
NUMBER AND AREA OF HOLDINGS SUBJECT TO FLOODING BY LOCATION OF HOLDING AND FREQUENCY OF HOLDING, 2004

Location of Holding	Frequency of Flooding							
	Total		Once		Twice		Three or More Times	
	No. of Holdings	Hectares	No. of Holdings	Hectares	No. of Holdings	Hectares	No. of Holdings	Hectares
Trinidad and Tobago	**6,928**	**28,599**	**1,054**	**2,603**	**1,498**	**5,099**	**4,376**	**20,899**
Trinidad	**6,776**	**28,404**	**996**	**2,496**	**1,464**	**5,063**	**4,316**	**20,844**
City of Port of Spain	-	-	-	-	-	-	-	-
City of San Fernando	6	5	-	-	1	0.1	5	5.1
Borough of Arima	11	13	3	2	4	7	4	3.2
Borough of Chaguanas	241	555	20	36	62	127	159	391
Borough of Point Fortin	15	16	1	0.5	3	8	11	8
Diego Martin	44	60	20	22	11	19	13	20
San Juan/Laventille	295	460	170	262	33	44.7	92	153
Tunapuna/Piarco	961	2,881	195	531	286	904	480	1,446
Couva/Tabaquite/Talparo	921	7,955	107	224	213	859	601	6,874
Mayaro/Rio Claro	947	3,523	111	332	202	779	634	2,411
Sangre Grande	913	3,929	126	535	249	1,247	538	2,148
Princess Town	829	2,987	59	192	106	376	664	2,419
Penal/Debe	1,152	3,014	130	261	208	452	814	2,301
Siparia	441	3,007	54	98	86	244	301	2,665
Tobago	**152**	**195**	**58**	**107**	**34**	**36**	**60**	**52**

Source: CSO Agricultural Report 2004

Flooding caused by heavy rainfall and improper drainage has been the cause of loss of livestock and crops in Trinidad. During 2004, 6,928 holdings with acreage of 28,403.6 hectares were affected by flood water. In Tobago, the problem was not as significant as in Trinidad as 152 holdings were affected. The area affected was 195 hectares – see Table 5.7.

5.4 Fertilizer and Insecticide Use

5.4.1 Fertilizer Use

In the year 2004 (see Table 5.8), approximately 1.4 tonnes per hectare of fertilizer was used compared with 15.0 tonnes per hectare in 1993. The highest use of fertilizer per hectare was in 2000 (17.2 tonnes/ha) followed by 16.7 tonnes/ha in 1994 and 15.0 tonnes/ha in 1993. Domestic sales of fertilizer was the highest in 1995 (352,127 tonnes). In descending order, local sales in 1993 were 335,519 tonnes/ha which was the next highest sale values following 1995, then 315,955 tonnes/ha in 1994 and finally 126,495 tonnes/ha in 2000. Over the period 1993-2004, the lowest sale was in 2004 with 7,770 tonnes/ha. (see Figure 5.4 for graphical presentation of the data and Appendix 5.1 for details on type of fertilizers and quantities used. Refer to Appendix 5.2 for the production, disposal and use per hectare of anhydrous ammonia and urea. Refer to Appendix 5.3 for the production and disposals of urea. Appendix 5.4 gives a detailed listing of area treated by chemicals in 2004.

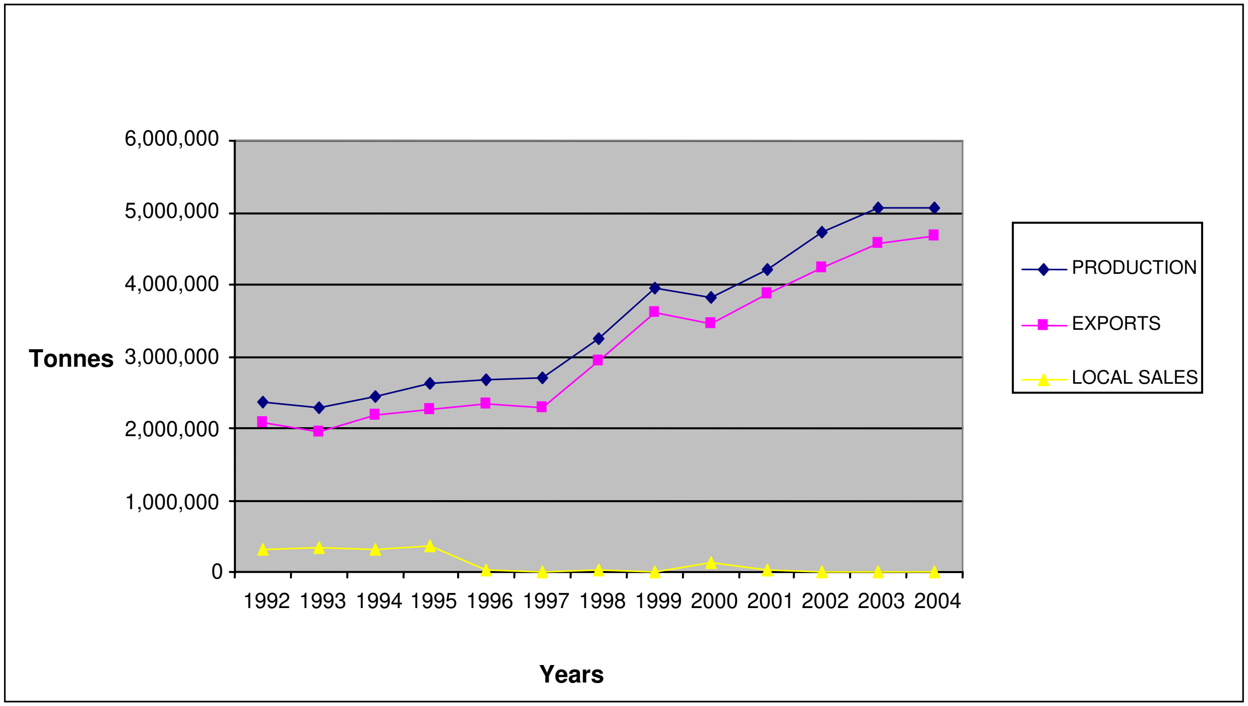
TABLE 5.8: PRODUCTION, UTILIZATION AND EXPORTS OF FERTILIZER 1993-2004 (TONNES)

Year	Production	Exports	Local sales	Fertilizer use per Hectare[1]
1993	2,291,841	1,946,022	335,519	15.0
1994	2,452,582	2,185,233	315,955	16.7
1995	2,624,820	2,268,424	352,127	21.0
1996	2,674,248	2,336,274	16,840	1.1
1997	2,690,654	2,291,729	12,194	0.9
1998	3,246,723	2,924,130	13,603	1.5
1999	3,946,752	3,610,366	12,162	1.2
2000	3,827,563	3,449,734	126,495	17.2
2001	4,209,600	3,883,100	13,200	1.7
2002	4,720,506	4,226,213	12,045	1.6
2003	5,060,463	4,584,345	10,620	1.2
2004	5,057,681	4,674,551	7,770	1.4

Source: Central Bank of Trinidad and Tobago

[1] Estimated area of food crops (Hectares) under traditional cultivation

FIGURE 5.4: PRODUCTION, UTILIZATION AND EXPORTS OF FERTILIZER, 1992-2004



Source: Central Bank of Trinidad and Tobago

5.4.2 INSECTICIDE USE

TABLE 5.9: IMPORTS AND EXPORTS OF INSECTICIDES[1], 1992-2004

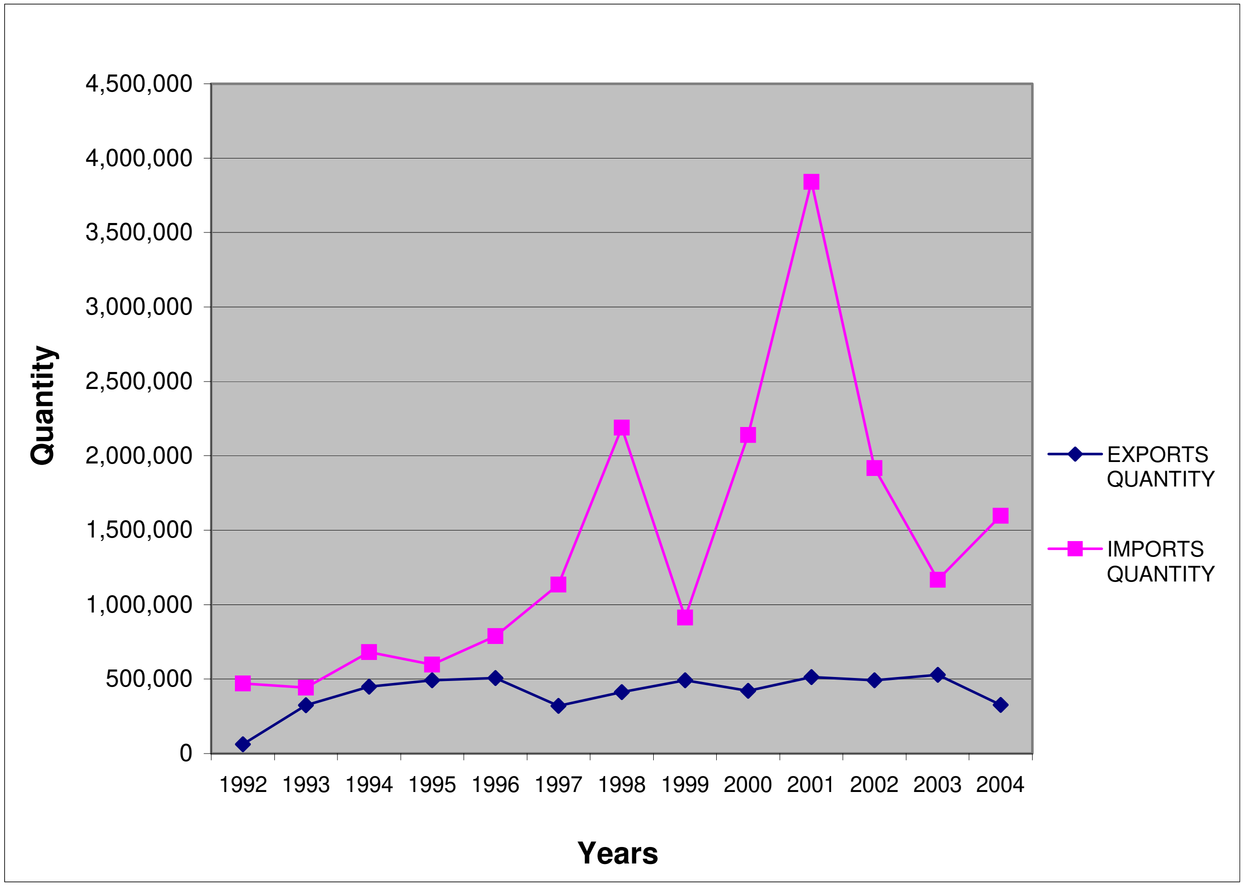
Year	Quantity (kg)		Net Import
	Imports	Exports	
1992	469,792	63,276	406,516
1993	441,769	323,690	118,079
1994	680,681	450,103	230,578
1995	596,521	493,082	103,439
1996	788,502	506,867	281,635
1997	1,133,883	319,215	814,668
1998	2,189,576	412,344	1,777,232
1999	913,285	493,114	420,171
2000	2,141,048	421,183	1,719,865
2001	3,841,132	513,383	3,327,749
2002	1,917,106	492,480	1,424,626
2003	1,166,256	527,797	638,459
2004	1,596,528	327,472	1,269,056
Total	**17,876,079**	**5,344,042**	**12,532,073**

Source: Central Statistical Office Trade Division

[1]These insecticides include all those approved by the Chief Technical Officer, Ministry of Agriculture; whether or not in retail packages. This figure does not include mosquito coils, fungicides, herbicides, anti-sprouting products and plant-growth regulators

Insecticides are used in an effort to control pests and diseases to prevent the loss of crop yield. The negligent use of pesticides however, can result in incremental damages to animals as well as humans. Table 5.9 indicates that Trinidad and Tobago is a net importer of insecticides. The highest quantities of insecticide were imported in 1998, 2000 and 2001. Fig 5.5 presents the data in a graph. Appendix 5.5 highlights area treated by location and type of chemical for Trinidad and Tobago in 2004.

FIGURE 5.5: IMPORTS AND EXPORTS OF INSECTICIDES, 1992-2004



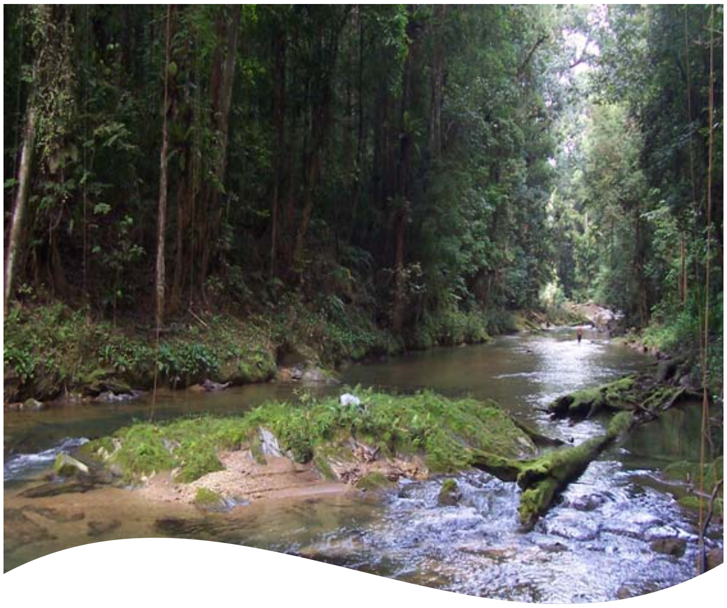
Source: Central Bank of Trinidad and Tobago

TABLE 5.10
NUMBER OF MACHINERY AND EQUIPMENT USED FOR AGRICULTURAL PURPOSES ON ALL HOLDINGS BY TYPE OF EQUIPMENT, OWNERSHIP AND USAGE, 2004

Type of Machinery and Equipment	Type of Ownership											
		Total				Used Wholly for Agriculture				Used Partly for Agriculture		
	Total	Owned	Rented	Other	**Total**	Owned	Rented	Other	**Total**	Owned	Rented	Other
Land Clearing and Land Preparation Equipment												
Cutlass/Brushing Cutlass	**59,346**	57,859	776	711	**50,938**	49,592	741	605	**8,408**	8,267	35	106
Rake	**11,611**	11,408	146	57	**9,909**	9,733	132	44	**1,702**	1,675	14	13
Hoe	**27,684**	27,097	348	239	**24,361**	23,814	336	211	**3,323**	3,283	12	28
Fork	**21,528**	21,009	269	250	**18,834**	18,380	247	207	**2,694**	2,629	22	43
Spade/Shovel	**22,320**	21,921	238	161	**19,262**	18,918	218	126	**3,058**	3,003	20	35
Hand Held Brush Cutter	**6,741**	6,285	312	144	**5,507**	5,167	240	100	**1,234**	1,118	72	44
Hand Held Power Equipment	**1,711**	1,556	98	57	**1,449**	1,335	68	46	**262**	221	30	11
Tractor Operated Brush Cutter	**944**	450	413	81	**820**	413	337	70	**124**	37	76	11
Bulldozer	**77**	25	45	7	**61**	21	34	6	**16**	4	11	1
Motor Grader and Land Leveller	**71**	55	11	5	**59**	46	8	5	**12**	9	3	-
Ditcher/Terracer	**127**	80	43	4	**117**	74	40	3	**10**	6	3	1
Ridger/Banker	**618**	257	310	51	**568**	247	272	49	**50**	10	38	2
Plough	**2,408**	776	1,468	164	**2,069**	719	1,201	149	**339**	57	267	15
Rotary Hoe	**1,079**	449	562	68	**957**	428	464	65	**122**	21	98	3
Harrow	**157**	105	50	2	**147**	100	45	2	**10**	5	5	-
Interrow Cultivator	**100**	55	38	7	**90**	52	31	7	**10**	3	7	-
Tractor	**5,129**	1,915	2,848	366	**4,352**	1,769	2,267	316	**777**	146	581	50
Other Land Clearing/Preparation Equipment	**4,687**	4,425	190	72	**4,146**	3,945	156	45	**541**	480	34	27

Source: CSO Agricultural Report 2004

Machinery and Equipment used in any economic activity eventually must be discarded after the duration of its usefulness. Table 5.10 shows machinery and equipment used wholly and partly for agricultural purposes. In Trinidad and Tobago, the Agricultural Census 2004 indicated that most of the equipment used wholly for agricultural purposes were tools such as cutlasses, forks, spades/shovels and hand held brush cutters. The type of machinery used on agricultural holdings for agricultural production was tractors and ploughs.



CHAPTER 6

FORESTRY, WILDLIFE AND BIODIVERSITY

Photographs courtesy Tyrone Gopaul

6 FORESTRY, WILDLIFE AND BIODIVERSITY

Introduction

Forestry has been practiced in Trinidad and Tobago (T&T) since the eighteenth century, when in 1765, the first forest reserve (see Appendix 6.1 for Demarcated Forest Reserve) in the western hemisphere, the Main Ridge of Tobago, was created by the Young Commission through its setting aside of two thousand, four hundred and seventy five (2,475) hectares of land for the "protection of the rains".

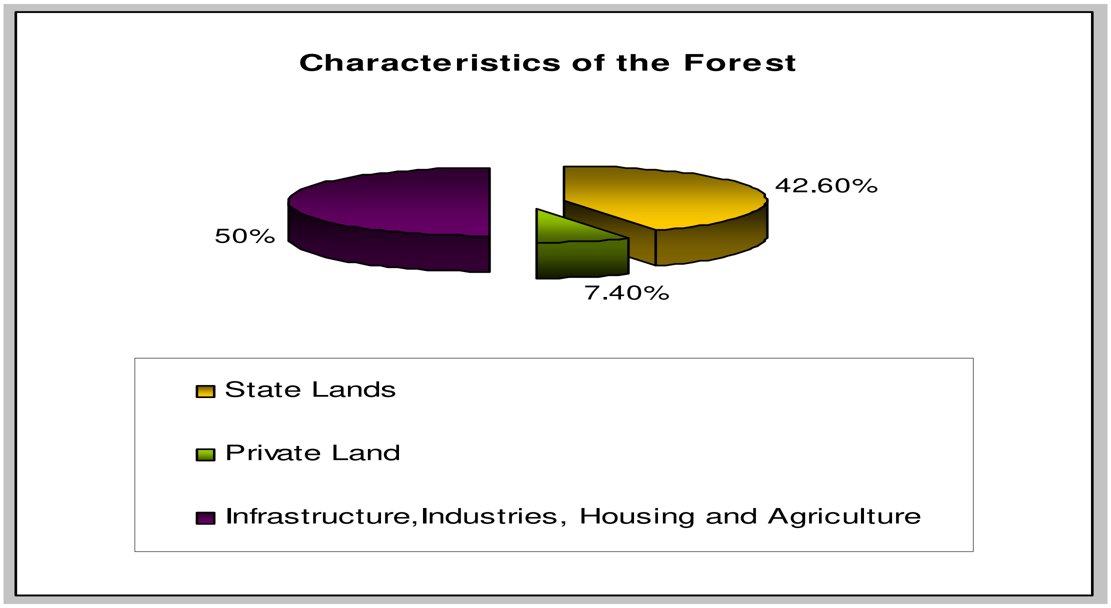
Forest Reserve, South Trinidad

The first forestry unit was created in 1901 through the formation of a one person branch of the Crown Lands Department. The unit evolved into a separate governmental agency in 1918 called the Forest Department, and later in 1960, became the Forestry Division. To date, the Forestry Division is located within the Ministry of Public Utilities and the Environment.

The first official policy was formulated in 1942 at which time Trinidad and Tobago was a British colony. Its function was to enable the forestry department to manage the forest of the colony in the best interest of the community.

The forest policy continued in effect for almost four decades and in 1979, the then Conservator of Forest commissioned a review and update of it on the basis of the significant social, economic, political and technical changes which has taken place in the country since 1942. As a result, a new draft Forest Resources Policy was prepared in 1981. This new policy takes into account the recognition of the forestry sector's continuously increasing contribution to national development. The Forestry Division acts as both a provider of goods and services, and also as a facilitator to its stakeholders (Forest Policy of T&T, 1998).

FIGURE 6.1 CHARACTERISTICS OF THE FOREST



Source: Forestry Division

6.1 Characteristics of the Forests

The forest types of Trinidad and Tobago are quite diverse as can be seen in Figure 6.1. In Trinidad, there are nine different forest types, the major forest type being the Evergreen seasonal forest which occupies 40 % or 98,180 hectares of land. In Tobago, there are three forest types. The major forest type is Swamp forest which occupies 60.5 % or 6,019 hectares of the land mass. Within recent times, the forestry division has opted to encourage private forestry via an incentive programme in an effort to allow for sustainable forest cover and use of the resource.

TABLE 6.1 FOREST TYPES IN TRINIDAD AND TOBAGO

Indigenous Forest Types	Trinidad Percentage Cover	Tobago Percentage Cover	Trinidad Area (Hectares)	Tobago Area (Hectares)	Tobago Location	Trinidad Location
Evergreen Seasonal	40.0	-	98,180	-	-	North-East and South-East
Semi–evergreen seasonal	5.7	-	13,928	-	-	Southern extremes
Deciduous seasonal	1.5	-	3,617	-	-	Western Northern Range
Dry evergreen	0.2	-	495	-	-	East Coast
Seasonal Montane	0.4	-	926	-	-	Northern Range
Montane	8.8	0.6	21,619	58	Main Ridge	Northern Range
Swamp	6.8	60.5	16,731	6,019	Coastal	Coastal
Secondary	6.8	6.5	16,631	646	Main Ridge	Widely distributed
Plantation (Teak, Pines, Mixed Hardwoods)	8.4	-	20,735	-	-	Widely distributed
Other Areas	21.5	32.4	52,859	3,226	-	-
Total	**100**	**100**	**245,721**	**9,949**	-	-

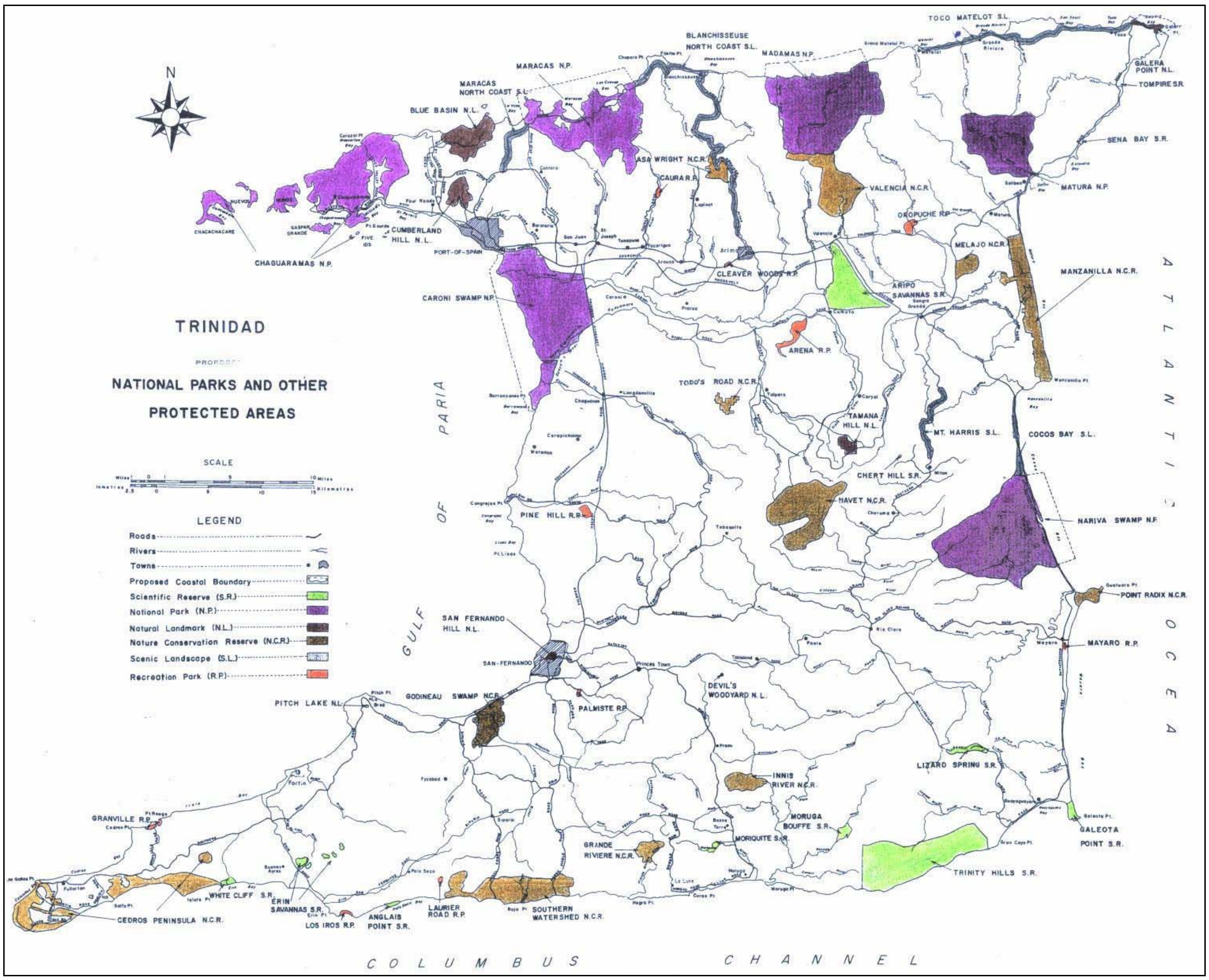
Source: Forestry Division

Section of Caura River, Trinidad

6.2 The National Parks

This section is in operation to provide service to the public through recreation and education via recreation sites and scientific reserves. National parks have been established throughout Trinidad and Tobago as seen in Map 6.1.

MAP 6.1 NATIONAL PARKS AND OTHER PROTECTED AREAS IN TRINIDAD



Source: Forestry Division; 1998

There are nine (9) sites that are managed by the National Parks section, thirteen (13) sites that are managed by the Conservancies and sixteen (16) sites managed by the Wildlife section as seen in Table 6.2

TABLE 6.2 NUMBER OF PROTECTED AREAS MANAGED BY FORESTRY DIVISION

Section of Forestry Division	Number of Sites
National Park Section	9
Conservancies	13
Wildlife Section	16

Source: Forestry Division

This area is further broken down into sixty-one (61) areas as seen in Table 6.3 where the Organization of American State survey in collaboration with the Forestry Division has proposed protected areas for Scientific Reserves, National Parks, Natural Landmarks, Scenic Landscapes, Recreation Parks and Natural Conservation Reserves.

TABLE 6.3 NUMBER OF CATEGORIES PROTECTED AREAS PROPOSED BY THE ORGANIZATION OF AMERICAN STATES AND FORESTRY DIVISION

Category of Area	Number of Sites Identified
Scientific Reserves	13
National Parks	8
Natural Landmarks	8
Scenic Landscapes	6
Recreational Parks	13
Natural Conservation Reserves	13

Source: Forestry Division

The visitors to the national parks have been on a constant increase as seen in Table 6.4. This is as a result of the leisure requirements of nationals as well as to encourage tourists to the land of Trinidad and Tobago to visit these sites. Visitor totals showed a steady increase from 310,307 to 545,294 visitors, whilst in 2003 there was a drastic reduction to 321,539 visitors.

In 2002 there was the highest amount of visitors totalling 545,294 visitors, whilst in 1998 there was the least amount of visitors totalling 310,307.The mean amount of visitors for the period was 404,793 visitors.

TABLE 6.4 SUMMARY OF VISITORS TO NATIONAL PARK AREAS, 1998- 2004

Site	Years						
	1998	1999	2000	2001	2002	2003	2004
Cleaver Woods Recreation Park	12,100	12,000	4,009	7,598	30,000	40,000	30,000
Quinam Bay Recreation Park	65,000	100,000	75,939	63,000	150,000	100,000	172,000
Matura Nature Park (Proposed)	10,800	13,705	14,600	14,100	17,000	14,000	12,000
Palmiste Recreation Park	-	5,000	15,000	42,000	48,000	-	-
Siparia Nature Reserve (Proposed)	-	100	-	100	150	-	-
Aripo Savannas Scientific Reserve	80	373	500	216	291	467	3000
River Estate Museum and Waterwheel	45,000	36,737	29,014	19,524	20,000	11,000	9000
Lopinot Historical Complex	85,000	77,760	138,258	126,000	130,000	62,000	60,000
Fort George	40,000	51,000	41,649	61,752	50,000	55,000	40,000
Fort Picton	10,000	5,078	8,558	3,600	4,200	2,000	1800
Caroni Swamp	-	-	-	-	-	25,000	30,000
San Fernando Hill	42,327	47,800	74,342	94,305	95,653	112,072	115,000
TOTAL	**310,307**	**349,553**	**401,869**	**432,195**	**545,294**	**321,539**	**472,800**

Source: Forestry Division

6.3 Forest Production

The Forestry Division collects revenue from various sectors within the Division via royalties. This is collected via payments to the government of Trinidad and Tobago.

Some of the avenues through which monies are collected from are: Sale of Forest Outturn, Sawmill Licences, and State Game Licences (Licences are sold to the public on a seasonal basis from October 1 to February 28. (see Table 6.6)

Sale of Forest Outturn

This is the sale of forest trees to the public. The sale of these trees comprises both trees from plantation forests and also trees from natural forests. The forest outturn is reflected by the sawn log production from sawmills (see Table 6.5). Table 6.7 indicates the sawn log outturn from the Natural Forest by Species and Class from Forest Reserve, State Lands and Private Lands.

Cutting of Forest Logs

Forest outturn from the Plantations was divided into two groups, those sold by the Conservancy and those sold by Tanteak.Firstly, outturn from plantations sold via Conservancy dealt with two species – Teak (*Tectona grandis*) and Pine (*Pinus caribe*). From the period 1993 - 2004 the outturn of sawn logs was recorded in Both Plantations (Conservancy Tanteak) and the Natural Forest (refer to Table 6.5).

The highest outturn for teak (sold by Conservancy) was recorded in 1999 (8,617 m^3) whilst the lowest outturn was recorded in 1993 (257 m^3). The mean outturn over the period was recorded as 3,960.2 m^3. Pine showed its highest outturn is 1997 (16,217 m^3) and its lowest outturn in 1994 (20 m^3), its mean outturn for the period was 5,275m^3 (see Table 6.5)

Secondly, outturn from Plantations sold by Tanteak indicated the following in Teak; the highest outturn was in 1997 (24,658 m^3) and the lowest was in 1999 (7,124 m^3). The mean outturn however, was 15,860 m^3 (see Table 6.5)
The sale of Pine however indicated that the highest outturn was in 1993 (16,548 m^3) whilst the lowest outturn was recorded in 2000 (1,898 m^3), the mean outturn for Pine for the period was 8,502 m^3 (see Table 6.5)

It should be noted that outturn from Tanteak was reported over an eight (8) year period due to its closure in 2001. Outturn from Conservancy and the Natural Forest were compiled over a ten (10) year period as seen in Table 6.5.

Teak logs for sale, La Romain, Trinidad

TABLE 6.5 FOREST OUTTURN, 1993 – 2004

Year	Sawn Logs						Poles
	Total	Natural Forests	Plantations				Teak
			Sold by Conservancy		Sold by Tanteak		
			Teak	Pine	Teak	Pine	
	Cubic Metres						
1993	42,959	13,713	257	49	10,896	16,548	1,496
1994	49,247	11,122	419	20	23,774	11,974	1,956
1995	66,443	24,295	2,243	82	22,178	15,304	2,350
1996	58,809	25,742	2,636	1,804	20,044	8,583	-
1997	71,302	24,133	3,466	16,217	24,658	2,376	452
1998	50,289	17,355	3,356	11,798	9,705	7,167	906
1999	47,531	16,222	8,617	11,204	7,124	4,167	197
2000	71,956	46,336	6,915	8,160	8,502	1,898	145
2001	63,151	58,503	4,558	90	-	-	-
2002	60,344	48,699	3,818	4,194	-	-	-
2003	70,028	54,550	6,706	5,005	-	-	-
2004	50,208	38,868	4,525	4,679	-	-	-

Source: Forestry Division; Forest Reserve and Inventory Management Section

Note: From the year 2000, the sawnlog outturn (Natural Forests) included 66 species from Private Lands.

TABLE 6.6 REVENUE OF FORESTRY DIVISION, 1995 - 2003

Item	1995	1996	1997	1999	2000	2001	2002	2003	Total
Sale of Seeds	-	-	225,858	-	-	87,500	43,750	-	**357,108**
Sale of Timber	335,814	406,357	3,231,399	3,821,487	5,788,596	672,094	14,244,250	5,023,310	**33,887,883**
Log haulage Permits[1]	-	-	-	33,500	286,700	26,400	28,500	30,000	**405,100**
Sawmills/ Furniture Shops[4]	32,500	32,000	32,500	-	-	201,000	247,000	228,500	**805,500**
Private Removal Permit[2]	-	-	-	-	-	189,540	169,668	238,170	**597,378**
Minor Forest Produce[3]	5,210	3,458	4,186	-	-	-	19,985	39,350	**74,099**
San Fernando Hill/Caroni Swamp and Compounding Fee	15,000	36,925	38,720	112,212	30,117	212,165	98,727	582,090	**582,090**
Seedlings[5]	13,272	11,581	21,678	**-**	**-**	**-**	**-**	**-**	**53,863**
State Game Licences/Permits	149,100	158,272	184,284	248,528	166,399	272,139	272,225	342,114	**1,957,268**
Hillside Stations	-	1,402	4,104	6,721	3,341	4,895	1,420	542	**42,673**
Vat	84,606	46,809	108,777	570,442	912,969	123,942	2,136,851	786,888	**5,152,454**
Total	**635,503**	**696,808**	**3,851,507**	**4,792,892**	**7,188,123**	**1,789,675**	**17,262,376**	**7,270,964**	**43,915,419**

Source: Forestry Division

[1]Log haulage permits were introduced in 1999.
[2]Minor Forest Produce sales were suspended for the period 1999-2001.
[3]Private Removal Permits (P.R.P) were introduced in 2001.
[4]Furniture shops/sawmills –permits were suspended for 1999-2000 due to a court injunction.
[5]Seedlings were utilized departmentally for the period 1993-2003

Revenue is collected as royalties that is paid to the government of Trinidad and Tobago from the various sector of the forestry division as seen in the Table 6.6.

The sale of timber to the saw-millers and licenses is the greatest contributor of royalty to the treasury whilst the sale of produce from the hillside station is the least contributor of royalty to the forestry division. The reason for the highest royalty being collected from the sale of timber is due to the well managed plantation forest that allows for the sale of trees to the sawmilling industry on an annual basis by the forestry division thereby creating sustainable employment not only in the public sector but in the private sector as well.

6.3.1 OUTTURN OF FOREST BY SPECIES AND CLASS 1994-2004

For the period 1994-2004 (see Table 6.7.1 & 6.7.2), sawn logs data was recorded. It should be noted that from 1994 to 1999, the Outturn from Natural Forests consisted of a few species of sawnlogs. In 2000, this was increased to 66 species of sawn logs. The lowest outturn for the ten year period (sawn logs from the Natural Forest) was in 1994, 7,796 m³ and the highest was 2003, 54,246 m³.

TABLE 6.7.1 SAWNLOG OUTTURN FROM NATURAL FOREST BY SPECIES AND CLASS FROM FOREST RESERVE, STATE LANDS AND PRIVATE LANDS (CLASS I, II AND III), 1994-2004

Class I Species- From Private Lands													
		Cubic Metres											
Local Name	**Botanical Name**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
Balata (I)	*Manikara bidentata*	44	153	127	296	159	142	161	168	150	92	76	**1,568**
Cedar (I)	*Cedrela odorata*	975	13,981	12,025	8,886	8,743	7,497	6,964	9,004	5,835	6,433	3,620	**83,963**
Total		**1,019**	**14,134**	**12,152**	**9,182**	**8,902**	**7,639**	**7,125**	**9,172**	**5,985**	**6,525**	**3,696**	**85,531**
Class II Species- From Forest Reserve and State Lands													
Crappo (II)	*Carapa guianensis*	2,463	2,460	2,289	1,662	712	645	1,759	1,871	1,028	1,481	788	**17,158**
Galba (II)	*Calophyllum lucidum*	2	32	30	24	42	21	76	62	53	51	27	**420**
Guatecare (II)	*Escweilera subglandulosa*	71	101	194	199	65	35	95	77	68	155	69	**1,129**
Laurier (II)	*Ocotea and nectandara spp.*	89	127	89	138	38	97	333	317	406	230	147	**2,011**
Mora (II)	*Mora excelsa*	1,692	842	1,747	4,170	1,624	851	974	2,083	62	1,666	1,395	**17,106**
Olivier (II)	*Terminalia & buchenavia spp.*	621	730	756	1,005	475	1,454	2,834	1,554	1,726	2,214	1,880	**15,249**
Serrette (II)	*Byrsonma coriacea*	67	133	111	108	60	61	623	460	796	564	260	**3243**
Tapana (II)	*Hyeronima caribaea*	96	147	130	212	75	89	669	491	718	438	247	**3312**
Toprite (II)	*Hernandia sonora*	224	313	258	460	166	206	839	967	87	830	396	**4746**
Total		**5,325**	**4,885**	**5,604**	**7,978**	**3,257**	**3,459**	**8,202**	**7,882**	**4,944**	**7,629**	**5,209**	**64,374**
Class III Species-From Forest Reserve and State Lands													

Local Name	Botanical Name	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Cajuca (III)	*Virola Surinamensis*	229	387	420	587	292	583	2,079	2,847	2,381	2,820	1,833	**14,458**
Chenet (III)	*Melicocuss bijugatus*	32	5	8	-	-	-	4	3	5	3	-	**60**
Gommier (III)	*Protium insigne*	15	40	16	42	36	34	157	230	129	203	43	**945**
Jiggerwood (III)	*Bravaisia integerima*	54	31	103	90	75	36	1,086	2,024	410	1,443	994	**6,346**
Jereton (III)	*Diymopanax morotoni*	43	37	56	70	29	42	366	340	1,527	404	314	**3,228**
L'Epinet (III)	*Fagara martinicensis*	144	145	162	153	159	50	727	901	864	852	607	**4,764**
Mahoe (III)	*Sterculia caribaea*	158	197	262	301	313	316	1,564	1,438	1,363	1,666	835	**8,413**
Mangue (III)	*Symphonia and other spp.*	34	44	24	29	22	33	113	111	1,155	56	33	**1,654**
Moussara (III)	*Borsimum alicastrum*	134	58	72	41	45	24	63	103	1,692	117	50	**2,399**
Purpleheart (III)	*Peltogyne porphyrocardia*	134	130	161	63	30	7	31	35	2,101	13	2	**2,707**
Sandbox (III)	*Hura crepitans*	381	161	446	49	121	48	1,729	3,818	537	1,391	961	**9,642**
Silk Cotton (III)	*Ceiba pentandra*	94	99	72	234	53	116	951	1,351	1,351	1,191	903	**6,415**
Total		**1,452**	**1,334**	**1,802**	**1,659**	**1,175**	**1,289**	**8,870**	**13,201**	**13,515**	**10,159**	**6,575**	**61,031**

TABLE 6.7.2 SAWNLOG OUTTURN FROM NATURAL FOREST BY SPECIES AND CLASS- FOREST RESERVE, STATE LANDS AND PRIVATE LANDS (CLASS IV), 1994 - 2004

Class IV Species - From Forest Reserve and State Lands													
Cubic Metres													
Local Name	**Botanical Name**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
Blackheart (IV)	*Clathrotropis brachypetala*	204	273	238	307	210	253	369	308	155	248	199	**2,764**
Bois D'ome (IV)	*Guazuma Ulmifolia*	193	239	344	441	96	191	426	723	700	538	247	**4,138**
Figuier (IV)	*Ficus tobagensis*	66	92	27	60	21	69	594	808	810	1,186	1,039	**4,772**
Hog Plum (IV)	*Spondias mombin*	1,556	1,084	2,287	1,409	1,449	881	6,649	7,993	8,319	10,703	8,363	**50,693**
Pois Doux (IV)	*Inga species*	319	420	624	621	362	669	1,498	1,892	31	1,693	1,044	**9,173**
All other between		915	1,731	1,857	1,429	1,857	1,674	12,448	16,235	14,970	15,565	12,324	**81,005**
Total		**3,253**	**3,839**	**5,377**	**4,267**	**3,995**	**3,737**	**21,984**	**27,959**	**24,985**	**29,933**	**23,216**	**15,2545**
GRAND TOTAL All Classes of Outturn		7,796	24,192	19,558	23,086	17,329	12,387	46,181	30,255	24,444	54,246	38,696	363,481

Source: Forestry Division

6.4 Sawmills – Number of Licensed Operations by Counties of Trinidad and Tobago

For the period 1993 – 2004 the highest number of sawmills which were granted licenses were during the period 2001 – 2004 (81 Sawmill Licences). Owners of sawmills are required to pay an annual fee for their Sawmill licences. The least amount of licensed sawmill was recorded in 1994 which totalled 65 operations. In 2004, the county of St. George had the highest number of licensed sawmills (21) whilst St. David had the least (0) operations. Tobago over the period had one sawmill respectively as seen in Table 6.8 below.

TABLE 6.8 NUMBER OF LICENSED SAWMILL OPERATIONS BY COUNTY, 1993-2004

	County									
Year	**Total**	**St. George**	**St. David**	**St. Andrew**	**Caroni**	**Nariva**	**Victoria**	**Mayaro**	**St. Patrick**	**Tobago**
1993	67	19	-	3	8	6	12	1	17	1
1994	65	18	-	3	8	6	12	1	16	1
1995	66	19	-	4	8	4	12	1	17	1
1996	66	19	-	4	8	4	12	1	17	1
1997	68	16	3	4	7	7	16	1	13	1
1998	68	16	3	4	7	7	16	1	13	1
1999	68	16	3	4	7	7	16	1	13	1
2000	74	16	1	8	10	8	13	1	16	1
2001	81	21	-	6	11	8	16	1	17	1
2002	81	21	-	6	11	8	16	1	17	1
2003	81	21	-	6	11	8	16	1	17	1
2004	84	21	-	6	11	8	17	2	18	1

Source: Forestry Division

6.5 Wildlife and Biodiversity

The Wildlife Policy Statements for Trinidad and Tobago are:

- The protection of wildlife species necessitates the protection of their natural habitat.
- Native wildlife species should not be allowed to reach extinction in Trinidad and Tobago and rare species that are declining towards extinction should be recovered to a secure status.
- Those wildlife species that are exploited should be harvested sustainably.
- Specified Development plans must include review of impact on wildlife and wildlife habitats.
- The government's wildlife conservation agency recognizes the need or involvement in overall conservation at the local, regional and international levels.
- The government's wildlife conservation agency must have the authority and resources necessary to effect policy.

The Main Guiding Principles are:

- Sustainability of resources
- Efficiency in providing goods and services
- Community involvement
- Integrity and pursuit of excellence

Wildlife is the term that covers all living forms, that is, plants, animals and micro-organisms living in uncultivated or undomesticated natural states. Trinidad and Tobago possess a rich variety of wildlife species due to the presence of many different ecosystems and the continental origin and proximity of the island to South America. A listing of endangered, vulnerable and rare species in Trinidad and Tobago can seen below.

Wildlife specie crosses North Coast Road, Trinidad

TABLE 6.9 TYPE AND NUMBER OF SPECIES IN TRINIDAD AND TOBAGO

TYPE OF SPECIES	NUMBER
Mammals	100
Bats	58
Birds	400
Reptiles	70 (inclusive of 40 snakes)
Amphibians	70
Butterflies	620
Flowering Plants	2500 (inclusive of 195 orchids and 300 trees)

Source: Forestry Division

6.5.1 List of Endangered (18), Vulnerable (11) Rare Species (20) and Orchids (40) in Trinidad and Tobago

ENDANGERED SPECIES

MAMMALS ***(5)***

Chironectes minimus	Water opossum
Felis pardalis	Ocelot, or Tiger cat
Lutra Longicaudis	Southern river otter
Trichechus manatus	West Indies manatee
All species in the order	Cetacea (whales and porpoises)

BIRDS ***(8)***

Ara ararauna	Blue and yellow macaw
Campylopterus ensipennis	White-tailed sabrewing
Oryzoborus angolensis	Lesser seed-finch
Oryzoborus crassirostris	Large-billed seed-Finch, or Twa-twa
Pipile pipile	Piping guan
Sporophilia intermedia	Gray seed-eater or Picoplat
Sporaphilia bouvronides	Lesson's seed-eater, or Chat
Sporaphilia nigricollis	Yellow-bellied seed-eater or Sliverbeak

REPTILES ***(5)***

Caretta	Loggerhead turtle
Chelonia mydas	Green turtle
Dermochelys coricea	Leatherback turtle
Eretmochelys imbricata	Hawksbill turtle
Lepidochelys olivacea	Olive ridley turtle

TOTAL ENDANGERED SPECIES: 18

VULNERABLE SPECIES

MAMMALS ***(5)***

Alouatta seniculus	Red howler monkey
Cycolpes didactylus	Silky anteater
Eira barbara	Tayra, or High-woods dog
Procyon cancrivorus	Crab-eating raccoon or Mangrove dog
Tamanadua tetradactyla	Three-toed anteater or Sloth

BIRDS *(5)*

Amazona ochrocephala	Yellow-headed parrot
Ara manilata	Red-bellied macaw
Eudocimus ruber	Scarlet ibis
Grallaria guatimalensis	Scaled antpitta
Steatornis caripensis	Oilbird

REPTILES *(1)*

Geochelone denticulata	Yellow-footed tortoise or Morocoy

TOTAL VULNERABLE SPECIES: 11

RARE SPECIES

MAMMALS *(2)*

Cebus albifrons	White-fronted capuchin monkey
Coendu prehensilis	Prehensile-tailed porcupine

BIRDS *(16)*

Anas Bahamensis	White-cheeked pintail
Aramides axillaris	Rufous-necked wood-rail
Asio clamator	Striped owl
Cairina moschata	Muscovy duck
Chaetocercus jourdanii	Rufous-shafted woodstar
Chondrohierax uncinatus	Hook-billed kite
Dendrocygna viduata	White-faced whistling duck
Euphonia cyanocephala	Golden-rumped euphonia
Icterus chrysocephalus	Moriche oriole
Paroaria gularis	Red- capped cardinal
Pseudocolopteryx sclateri	Crested doradito
Rallus maculatus	Spotted rail
Spinus cucullata	Red siskin
Tigrisoma lineatum	Rufescent tiger heron
Todirostrum maculatum	Spotted tody-flycatcher
Tyrannopsis sulphurea	Sulphury flycatcher

AMPHIBIANS *(2)*

Phyllodytes auratus	Golden tree frog (all stages)
Rana palmipes	

TOTAL RARE SPECIES: 20

LIST OF ORCHIDS IN TRINIDAD AND TOBAGO

<u>ORCHIDACEAE (ORCHIDS)</u> (40)	
Aganisia pulchella	
Bifrenaria aurantiaca	
Brassavola cucullata	
Cochleanthes flabelliformis	
Cochleanthes trinitatis	
Coryanthes speciosa	Monkey-throat orchid
Cryptarrhena lunata	
Cyrtopodium parviflorum	
Cyrtopodium punctatum	
Epidendrum bradfordii	
Epidendrum ibaguense var.schomburgkii	
Epidendrum imatophyllum	
Epidendrum schlechterianum	
Epidendrum secundum	
Habenaria alata	
Habenaria leprieurii	
Habenaria pauciflora	
Huntleya lucida	
Ionopsis satyrioides	
Kegeliella houtteana	
Maxillaria discolor	
Maxillaria guareimensis	
Oncidium ampliatum	Yellow bee orchid
Oncidium haematochilum	
Oncidium lanceanum	Cedros bee orchid
Oncidium papilio	Butterfly orchid
Otostylis branchystalix	
Palmorchis pubescens	
Paphinia cristata	
Peristeria cerina	
Peristeria pendula	
Plectrophora iridifolia	
Pogonia grandiflora	
Pogonia tenuis	
Liparis vexillifera	
Selenipedium palmifolium	
Stanhopea grandiflora	
Stenia pallida	
Xylobium colleyi	
Xylobium palmifolium	

Source: Forestry Division Wildlife Section.

Butterfly Orchid

Yellow Bee Orchid

Cedros Bee Orchid

The revenue generated from wildlife cannot always be measured in monetary terms due to the fact that a value cannot be placed on people's satisfaction of the aesthetic nature of the environment.

However, royalties are collected from the sale of permits to hunt certain wildlife species such as agouti, deer, lappe, cage birds, alligator, waterfowls, armadillo, and wildhog as seen in Table 6.10.

TABLE 6.10 STATE GAME LICENCES PERMITS[1] SOLD, 1991 – 2004

Season	Species Sold										
	Agouti	Cage Birds	Deer	Lappe	Alligator/ Lizard	Quenk/ Wildhog	Tattoo/ Armadillo	Water Fowl	Total Permits	Revenue Collected	Total Hunters
1990/1991	3,037	222	1,214	986	111	309	1,287	262	1,428	28,560	5,880
1991/1992	1,901	38	904	619	66	260	789	160	4,737	94,740	6,021
1992/1993	3,157	135	1,190	850	65	239	1,125	206	6,970	139,400	5,677
1993/1994	3,275	138	1,262	903	91	302	1,224	272	7,467	149,240	6,398
1994/1995	3,358	142	1,238	916	92	301	1,145	263	7,455	149,100	6,040
1995/1996	3,025	95	1,173	887	128	269	1,086	280	6,943	138,860	5,561
1996/1997	3,145	93	1,269	944	193	334	968	319	7,265	145,300	5,412
1997/1998	3,083	116	1,218	914	211	301	1,053	446	7,342	146,840	5,568
1998/1999	3,300	106	1,347	1,098	295	358	1,138	1,611	9,253	185,060	5,748
1999/2000	3,818	125	1,562	1,226	397	411	1,355	485	9,379	187,580	7,094
2000/2001	3,939	146	1,584	1,282	441	453	1,404	516	9,765	195,300	6,342
2001/2002	4,511	182	1,726	1,468	612	496	1,657	568	11,220	224,400	9,555
2002/2003	4,906	199	2,038	1,629	767	628	1,836	701	12,704	254,080	9,667
2003/2004	5,197	228	2,186	1,790	904	671	2,097	752	13,825	276,500	8,375
Total	**49,652**	**1,965**	**19,911**	**15,512**	**4,373**	**5,332**	**18,164**	**6,841**	**115,753**	**2,314,960**	**93,338**

Source: Forestry Division

[1]Cost of permit has not changed for the period above. ($30.00).

For the period 1990-1994, data recorded showed a minimal fluctuation in the number of hunters as well as in the number of wildlife caught as can be seen in Table 6.10. It is important to note that bag limits are customarily under reported by hunters in fear of the season being closed. During the period 1990 – 2003/04, State Game Licenses were sold for eight (8) species of wildlife as seen in Table 6.8. The highest number of permits was sold in 2003/04 (13,825 permits) whilst the lowest number sold was in 1990/91 (1,428 permits).

The highest amount of revenue collected was in 2003/04 ($276,500.00) whilst the lowest revenue collected was in 1990/91 ($28,560.00). The period with the highest number of hunters was in 2002/03 (9,667 hunters), whilst the least number of hunters was in 1996/97 (5,412 hunters).It should be noted that the sale of permits for games species showed a steady increase over the period with a minor decrease in 1995/96. Also revenue collected shows a steady increase, although the number of hunters over the period fluctuated from 1999-2004. Table 6.11 shows the number of wildlife species harvested.

TABLE 6.11 ANNUAL HARVESTS OF WILDLIFE SPECIES IN TRINIDAD, 1990 – 1994

Year	Number of Species								
	Agouti	Deer	Tattoo	Lappe	Wildhog	Cage-birds	Water-Fowl	Caiman/ Lizards	Total No. Hunters
1990/1991	7,536	850	1,337	699	173	99	1,943	185	5,880
1991/1992	14,363	1,299	2,238	1,058	325	29	2,419	378	6,021
1992/1993	11,161	967	1,767	986	183	80	1,055	88	5,677
1993/1994	16,741	1,230	2,620	1,052	239	75	2,076	252	6,398
Total	**49,801**	**4,346**	**7,962**	**3,795**	**920**	**283**	**7,493**	**903**	**23,976**

Source: Forestry Division

- *Data derived from sale of permits and mandatory forms, it should be noted that mandatory data forms are under reported.*
- *Data for the period 1995-2001 were unavailable*
- *N.B. In All Years Seventy-Five Percent (75%) Of Mandatory Forms Were Returned*

TABLE 6.12 PERCENTAGE OF MANDATORY FORMS RETURNED, 1996- 2004

Year	Percent (%) of Mandatory Forms Returned
1996-1997	63
1997-1998	26
1998-1999	28
1999-2000	40
2000-2001	65
2001-2002	23
2002-2003	73
2003-2004	41

Source: Forestry Division

6.5.2 Wildlife in Tobago

Tobago, although smaller than Trinidad, supports a healthy wildlife population that allows for the hunting of various species such as agouti, armadillo, caged birds and alligators. The increase of hunters over the period has shown that there is a keen interest in the sport of hunting in Tobago as seen in Table 6.13 below.

TABLE 6.13 NUMBER OF HUNTING PERMITS ISSUED IN TOBAGO, 1996-2004

Year	Number of Species				Total Number Registered Hunters
(Period) 1st October-28th February	Agouti	Armadillo/ Tattoo	Caged Birds	Alligator/ Lizard	
1996-1997	47	47	19	53	166
1997-1998	23	23	-	20	66
1998-1999	54	42	-	13	109
1999-2000	162	289	-	161	612
2000-2001	122	263	-	138	523
2001-2002	32	136	-	74	242
2002-2003	51	159	29	134	373
2003-2004	56	190	11	69	326

Source: Forestry Division

6.5.3 Number of Visitors to Turtle Viewing Sites and Revenue

For the period 2001-2004, the main areas visited for turtle watching were Matura Beach, Grande Riviere and Fishing Pond.

The highest number of visitors for the period was in 2001 (13,433 persons), while the least amount of visitors was in 2002 (9,041 persons).The least amount of permits issued was in 2002 (1,769) and most permits were issued in 2004 (2,693). As at 2004, there was a steady increase in visitors to turtle viewing sites.

The low number of group entry permits issued in 2002, was due to the fact that accessibility to the Fishing Pond Beach site was not permitted due to repairs to the boardwalk to the beach.

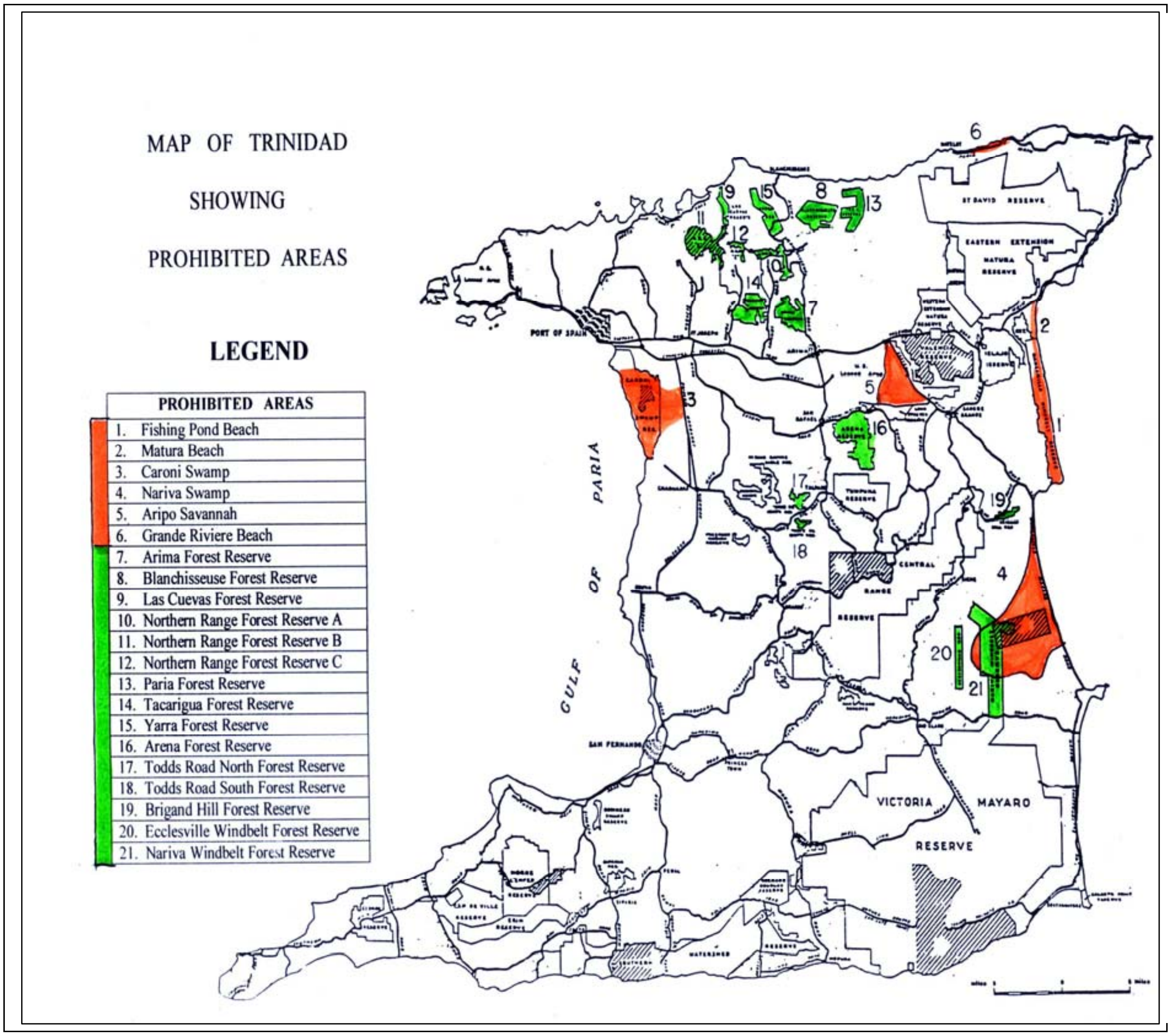
TABLE 6.14 NUMBER OF VISITORS AND REVENUE COLLECTED AT TURTLE VIEWING SITES, 2001 – 2004

Year	Number of visitors			Total Number of Visitors	Number of Group Entry Permits[1] Issued	Revenue Collected $
	Matura Beach	Grande Riviere	Fishing Pond Beach			
2001	8,932	3,824	677	13,433	2,419	61,719
2002	5,707	3,334	-	9,041	1,769	39,405
2003	5,430	3,207	1,051	9,688	2,397	42,411
2004	7,640	3,710	46	11,396	2,693	52,036
TOTAL	**27,709**	**14,075**	**1,774**	**43,558**	**9,278**	**195,571**

Source: Forestry Division

[1]Permits are issued to individuals and groups.

MAP 6.2 - PROHIBITED AREAS OF TRINIDAD AND TOBAGO



Source: Forestry Division

6.6 Agricultural Fires in Trinidad and Tobago

Fires are an integral threat to the forest and the land of Trinidad and Tobago. Over the years, the forestry division has embarked on a fire prevention campaign via public awareness to educate the population about the dangers of forest fires from an environmental as well as a human perspective. Each year, there are many fires which are reported during the fire season period that continues from December 01st to June 30th the following year. Tables 6.15 to 6.17 show the location and possible causes of fires in Tobago and Table 6.18 shows the number of fires and the size of burnt areas in Trinidad. The cause of fires over the years has been due to the irresponsible actions of people as seen in Table 6.17.

6.6.1 Fires in Tobago

During the period 2000-2004 (see Table 6.15), most fires in Tobago occurred in the geographical locations of Shirvan Road, Scarborough and Lowlands. Only one incident of fire was reported in five areas out of the thirty-four (34) listed in the table. St. Andrew, St. Patrick and St. David were the three parishes which experienced the highest number of fires. A total of 76% of the fires reported for 2000-2003 were as a result of deliberate ignition (13 % of total fires), while the remaining 63% or five hundred and seventy-one (571) agricultural fires is unknown as to the original cause of the fire.

TABLE 6.15 LOCATION OF AGRICULTURAL FIRES IN TOBAGO, 2000-2004

Geographical Location of fire	Year					Total
	2000	2001	2002	2003	2004	
Bagatelle	6	-	-	-	1	7
Bacolet	14	18	4	12	8	56
Belle Garden	1	-	-	-	-	1
Bethel/Patience Hill	4	7	2	5	4	22
Black Rock	-	6	-	6	-	12
Bon Accord/Canaan	8	27	5	14	6	60
Buccoo	-	2	-	-	-	2
Calder Hall	1	10	3	8	-	22
Carnbee	1	13	5	22	5	46
Charlotteville	1	-	-	-	-	1
Crown Point	2	5	5	9	4	25
Delaford	1	-	-	-	-	1
Goodwood	4	-	-	-	1	5
Government House Road	1	1	1	1	-	4
Hope	1	2	-	1	-	4
Idlewild	2	3	-	2	-	7
John Dial	1	3	-	3	1	8
Lambeau	4	15	4	5	1	29
Les Coteaux	1	1	-	5	1	8
Lowlands	19	32	11	14	14	90
Mason Hall	2	22	1	12	7	44
Moriah	4	14	-	14	-	32
Mt. Grace	-	7	-	1	1	9
Mt. Irvine	-	20	7	18	5	50
Mt. Pleasant	8	14	-	15	3	40
Mt. St. George	2	18	2	13	5	40
Orange Hill	4	6	-	1	1	12
Plymouth	20	32	10	34	6	102
Scarborough	29	42	8	44	9	132
Shirvan Road	3	8	-	1	-	12
Signal Hill	11	26	10	11	5	63
S.W.U.M (Spring Garden Trace)	7	14	3	23	3	50
Richmond	1	-	-	-	-	1
Roxborough/Argyle	-	-	-	1	-	1
Total	**163**	**368**	**81**	**295**	**91**	**998**

Source: Fire Services Department – Tobago House of Assembly

TABLE 6.16 AGRICULTURAL FIRES BY PARISHES IN TOBAGO, 2000- 2004

Parish	Year					
	2000	2001	2002	2003	2004	Total
St. Andrew	76	128	32	89	28	353
St. David	32	81	20	94	7	234
St. George	6	52	3	30	13	104
St. John	1	-	-	-	-	1
St. Mary	5	-	-	-	1	6
St. Patrick	41	107	26	81	42	297
St. Paul	2	-	-	1	-	3
Total	**163**	**368**	**81**	**295**	**91**	**998**

Source: Fire Services Department – Tobago House of Assembly

TABLE 6.17 AGRICULTURAL FIRES BY SUPPOSED CAUSE IN TOBAGO, 2000-2003

Supposed Cause of Fire	Year				Total
	2000	2001	2002	2003	
Agricultural Purposes	12	40	10	37	99
Deliberate Ignition	31	58	14	19	122
Smoking Materials	35	61	10	9	115
Unknown	85	209	47	230	571
Total	**163**	**368**	**81**	**295**	**907**

Source: Fire Services Department – Tobago House of Assembly

6.6.2 Fires in Trinidad

During the period 1995-2004, the greatest number of fires which burnt the natural environment occurred in 1998 and 1995 respectively. In 1998, a total of 10,284 hectares was burnt whilst in 1995, 7,232 hectares were burnt. In both years, the largest areas burnt were teak plantations followed by savannah/grasses. This pattern was also consistent with the fires for the entire period presented; since 47 % of the grand total area burnt was in the teak plantations, while 18% was the savannah/grasses area. A smaller percentage of area burnt consisted of shrub/secondary forest (9%) and another 9% consisted of pine plantations. This is an aggregated 83% of the total area burnt as a result of 2,275 incidents of fires.

TABLE 6.18 AREA BURNT BY LAND USE IN TRINIDAD, 1995 – 2004

Year	Natural Forest		Shrub/Sec. Forest		Teak Plantation		Pine Plantation		Savannah/ Grasses		Other		Agricultural Lands		Grand Total	
	No. of fires	Area of burnt (HA)	No. of fires	Area of burnt (HA)	No. of fires	Area of burnt (HA)	No. of fires	Area of burnt (HA)	No. of fires	Area of burnt (HA)	No. of fires	Area of burnt (HA)	No. of fires	Area of burnt (HA)	No. of fires	Area of burnt (HA)
1995	56	672	82	959	80	2,696	45	867	173	1,406	40	370	38	262	514	7,232
1996	6	55	12	46	44	1,580	19	213	81	344	7	106	9	92	178	2,435
1997	3	5	9	22	20	176	6	30	99	212	3	3	18	20	158	468
1998	21	248	96	845	100	5,467	51	584	327	1,732	49	182	118	1,225	762	10,284
1999	6	9	16	28	22	562	12	79	96	280	6	20	14	15	172	993
2000	-	-	8	18	19	717	8	23	39	136	3	9	15	24	92	927
2001	18	126	82	453	74	2,246	34	223	177	850	14	121	64	238	463	4,259
2002	-	-	7	15	4	9	2	10	41	85	4	10	4	5	62	134
2003	16	1,267	45	452	45	1,192	45	760	144	750	27	165	25	137	347	4,726
2004	-	-	13	175	19	968	3	18	76	276	17	32	8	16	136	1,487
Total	**126**	**2,383**	**370**	**3,014**	**427**	**15,615**	**225**	**2,807**	**1,253**	**6,071**	**170**	**1,017**	**313**	**2,034**	**2,884**	**32,941**

Source: Forestry Division

CHAPTER 7

FISHERIES AND AQUACULTURE

Photographs courtesy Fisheries Division

7 FISHERIES AND AQUACULTURE

A. Fisheries Resources

7.1.1 Marine

The marine fisheries of Trinidad and Tobago are characterized by a high diversity of species harvested by a multitude of gears and fishing fleets. A number of fish stocks are migratory and common with Northern South American countries and the Caribbean island chain.

Fishermen in Cedros

Studies on the coastal and marine fisheries resources present in the waters under the jurisdiction of Trinidad and Tobago have identified a total of 1,013 finfish species in 474 genera, 170 families and 36 orders (Ramjohn 1999). A summary of the number of species identified from Trinidad and Tobago by main groups namely Teleosts (bony fish) and Elasmobranchs (sharks and rays) is presented in Table 7.1. Only a small percentage of these species is caught and landed by commercial fisheries (see Table 7.2).

TABLE 7.1: NUMBER OF MARINE FISH SPECIES IN TRINIDAD AND TOBAGO, 1999

Category	Teleosts (bony fish)	Elasmobranchs (Sharks & Rays)	Combined Total
Orders	28	8	36
Families	148	22	170
Genera	437	37	474
Species	942	71	1,013

Source: Ramjohn 1999

Other coastal and marine resources include crustaceans (shrimps, lobsters, crabs), cephalopods (squid), cetaceans (marine mammals including whales, dolphins, and porpoises) and sea turtles. Fishery independent surveys and on-going research conducted on commercial fisheries by the Fisheries Division have identified thirteen (13) species of cephalopods in seven (7) families, and 85 species of crustaceans in 32 families (Fisheries Division, unpublished data). Shrimps are the most important crustacean resource with five (5) species being exploited commercially (see Table 7.2). Cephalopods currently do not contribute significantly to fisheries in Trinidad and Tobago. The cetaceans found in the waters around Trinidad and Tobago include some 28 species of whales and dolphins in five (5) families, and one (1) species of manatee (Carpenter 2002). Some of these species have been designated by the IUCN (International Union for the Conservation of Nature and Natural Resources) as threatened, vulnerable, or endangered, and there are currently no fisheries for these resources.

There are five (5) species of sea turtles in two (2) families occurring in waters around Trinidad and Tobago, all of which are considered endangered or critically endangered by the IUCN (Carpenter 2002). Sea turtles are exploited to a small degree in Tobago and Northeast Trinidad (mostly the green turtle, *Chelonia mydas*, and the hawksbill turtle, *Eretmochelys imbricata*) though many (particularly the leatherback turtle, *Dermochelys coriacea*) are captured incidentally in gillnets. Several beaches around Tobago and Northeast Trinidad are important nesting sites for sea turtles. Trinidad and Tobago in fact supports the largest nesting assemblage of leatherback sea turtles in the insular Caribbean, and perhaps the second largest in the Western Hemisphere and the third or fourth largest in the world (Fournillier and Eckert 1998).

TABLE 7.2:
MAJOR MARINE FISH AND SHRIMP SPECIES EXPLOITED COMMERCIALLY IN TRINIDAD AND TOBAGO

Family	Common Name(No. of Species Present)	Main species exploited
Ariidae	catfish (15)	*Arius spp., Bagre spp.*
Carangidae	cavalli (33)	*Caranx spp., Trachinotus spp., Seriola spp., Decapterus spp., Selene spp.*
Carcharhinidae	shark (19)	*Carcharhinus spp., Rhizoprionodon spp.*
Centropomidae	snook, brochet (6)	*Centropomus spp.*
Clupeidae	herring (18)	*Opisthonema oglinum, Harengula spp., Sardinella spp.*
Coryphaenidae	dolphinfish (2)	*Coryphaena hippurus*
Exocoetidae	flyingfish (7)	*Hirundichthys affinis, Cheilopogon spp., Cypselurus spp.*
Gerreidae	blinch (12)	*Diapterus spp.*
Haemulidae	grunt (27)	*Haemulon spp., Anisotremus spp., Genyatremus luteus*
Lutjanidae	snapper (19)	*Lutjanus spp., Rhomboplites aurorubens, Etelis oculatus*
Mugilidae	mullet (9)	*Mugil spp.*
Penaeidae	shrimp (13)	*Farfantepenaeus subtilis, F. notialis, Litopenaeus schmitti, F. brasiliensis, Xiphopenaeus kroyeri*
Pomatomidae	ancho (1)	*Pomatomus saltator*
Sciaenidae	salmon (45)	*Cynoscion spp., Macrodon ancylodon, Micropogonias furnieri*
Scombridae	mackerel, tuna (15)	*Thunnus spp., Scomberomorus brasiliensis, S. cavalla, Acanthocybium solandri, Euthynnus alletteratus*

Serranidae	grouper (57)	*Epinephelus spp., Mycteroperca spp., Cephalopholis spp.*
Sphyraenidae	barracuda (4)	*Sphyraena spp.*
Sphyrnidae	shark (5)	*Sphyrna spp.*
Trichiuridae	cutlassfish (3)	*Trichiurus lepturus*
Xiphiidae	swordfish (1)	*Xiphias gladius*

Source: Chan A Shing, 2002

7.1.2 Freshwater / Brackish Water

Some 48 species of freshwater finfish in 21 families have been recorded for Trinidad by Kenny (1995). A number of these species are utilised in aquaculture (inland fish farming, brackish water culture, mariculture, ornamental fish culture) and some are targeted on a small commercial scale by traditional fishing methods such as cast nets. Some important freshwater / brackish water fish and shellfish species are given in Table 7.3.

TABLE 7.3: MAJOR FRESHWATER / BRACKISH WATER FISH AND SHELLFISH SPECIES IN TRINIDAD AND TOBAGO

Scientific Name	Common Name
Indigenous Freshwater Food Fish	
Hoplosternum littorale	cascadura
Anguilla rostrata	eel
Hypostomus robinii	teta
Agonostomus monticola	mountain mullet
Cichlasoma taenia	brown coscarob
Indigenous Freshwater Shellfish	
Macrobrachium carcinus	prawn
Macrobrachium acanthurus	prawn
Macrobrachium crenulatum	prawn
Pomacea urceus	river conch
Indigenous Marine / Brackish Water Fish	
Mugil spp.	mullet
Epinephelus spp.	grouper
Mycteroperca spp.	grouper
Lutjanus griseus	grey snapper
Centropomus undecimalis	snook, brochet
Trachinotus spp.	pompano

Scientific Name	Common Name
Indigenous Marine / Brackish Water Shellfish	
Penaeus spp.	shrimp
Crassostrea rhizophorae	mangrove oyster
Strombus gigas	queen conch, lambi
Melongena melongena	black conch
Mytella guyanensis	mok
Mytella falcate	mok
Perna perna	mussel
Cardisoma guanhumi	blue crab
Ucides cordatus	mangrove crab
Indigenous Freshwater Ornamental Fish	
Hoplias malabaricus	guabine, wolf fish
Gasteropelecus sternicla	hatchet fish
Corynopoma riisei	swordtail tetra
Hemigrammus taeniurus	brand tail tetra
Aphyocharax axelrodi	red tail tetra
Gymnotus carapo	knife fish
Corydoras aeneus	goldfish, pui pui, souci
Ancistrus cirrhosus	jumbi teta
Hypostomus robinii	teta
Poecilia reticulata	guppy
Rivulus hartii	jumping guabine, killifish
Aequidens pulcher	blue acara, blue coscarob
Crenicichla alta	crenicichla, pike, matawal
Polycentrus schomburgkii	leaf fish, king coscarob
Introduced Species	
Oreochromis nilotica	silver or Nile tilapia
Oreochromis mossambicus	Mossambique (black) tilapia
Tilapia spp.	red hybrid tilapia
Macrobrachium rosenbergii	Malaysian prawn
Cherax quandricarinatus	Australian red claw crayfish
Perna viridis	green mussel
Cyprinus carpio	common carp
Ctenopharyngodon idella	grass carp

Source: Ramnarine *et al*. 1998

7.2 Fishing Vessels & Gears

The fishing industry has traditionally been an artisanal one, based on resources occurring in the coastal and territorial waters. There has however been a trend toward the development of larger, more industrial vessels targeting resources in areas inaccessible to the artisanal fleet. Fishing vessels can be categorized into fleets based on the characteristics of the vessels and the gears used (see Table 7.4). Descriptions of the various fishing gears / methods including the species groups caught by them are given in Appendix 7.1.

Artisanal pirogues with outboard engines

A total of 1,153 vessels were recorded during the 2003 fishing vessel census for Trinidad (conducted by the Fisheries Division), of which the vast majority (about 96%) were artisanal. The primary gear type used was indicated for 830 of the 1,153 vessels and this is illustrated in Table 7.5 and Figure 7.1. A 1993 survey of the recreational fishery of Trinidad's Northwest peninsula estimated a total of 307 vessels, a large proportion of which were registered as fishing vessels (Mike and Cowx 1996). In early 2006 it was estimated that Tobago had some 306 vessels of which about nine (9) were semi-industrial and the remainder pirogues (based on personal communication with staff of the Department of Marine Resources and Fisheries of the Tobago House of Assembly (THA).

Semi-industrial trawler off Orange Valley in the Gulf of Paria, Trinidad

Semi-industrial longliner

Industrial double-rigged trawler

TABLE 7.4:
CATEGORIES OF FISHING FLEETS IN TRINIDAD AND TOBAGO INCLUDING GEARS USED AND VESSEL CHARACTERISTICS

Fleet Category	Gear Used	Fishing Vessel Characteristics
Commercial		
Artisanal	Gillnets (monofilament & multifilament nets); Artisanal trawl net[1] (set and retrieved manually); Pelagic lines (a-la-vive, trolling, towing, switchering); Demersal lines (banking, palangue); Fishpot; Seines (beach, bait, Italian); Diving & Spearfishing.	Wooden, fibreglass or fibreglass-coated open vessels (pirogues); Length: 7-11.6 m; Two outboard engines usually 45-75 Hp each or (in the case of many artisanal trawlers) 90-150 Hp inboard diesel engine.
Semi-industrial Trawl[1]	Single semi-industrial trawl net operated from the stern with a hydraulic winch	Length: 9.3-12.2 m; 165-275 Hp inboard diesel engine.
Semi-industrial Multi-gear	Fishpot; Demersal lines (banking, palangue); Pelagic lines (a-la-vive).	Length: 14 m on average; 165-174 Hp inboard diesel engine.
	Gillnets (monofilament)[2]; FADs (Fish Attraction Devices); Pelagic lines (troll).	Length: 10-14 m; 75-335 Hp inboard diesel engine.
Semi-industrial Longline	Longlines	Length: 14-23 m; 160-400 Hp inboard diesel engine; Tonnage: 60 GRT.
Industrial Trawl[1]	Two industrial trawl nets operated with hydraulic double-drum winch	Length: 10.9-23.6 m; 325-425 Hp inboard diesel engine; Tonnage: 30-96 GRT. (Double-rigged Gulf of Mexico type vessel)
Recreational		
Recreational	Pelagic lines (a-la-vive, trolling, switchering); Demersal lines (banking, palangue); Fishpots; Spearfishing.	Pirogues: 9-11 m; Cabin Cruisers: 10-11 m; Power Boats: 6-8 m.

Source: Fisheries Division Records, Potts *et al.* 2002

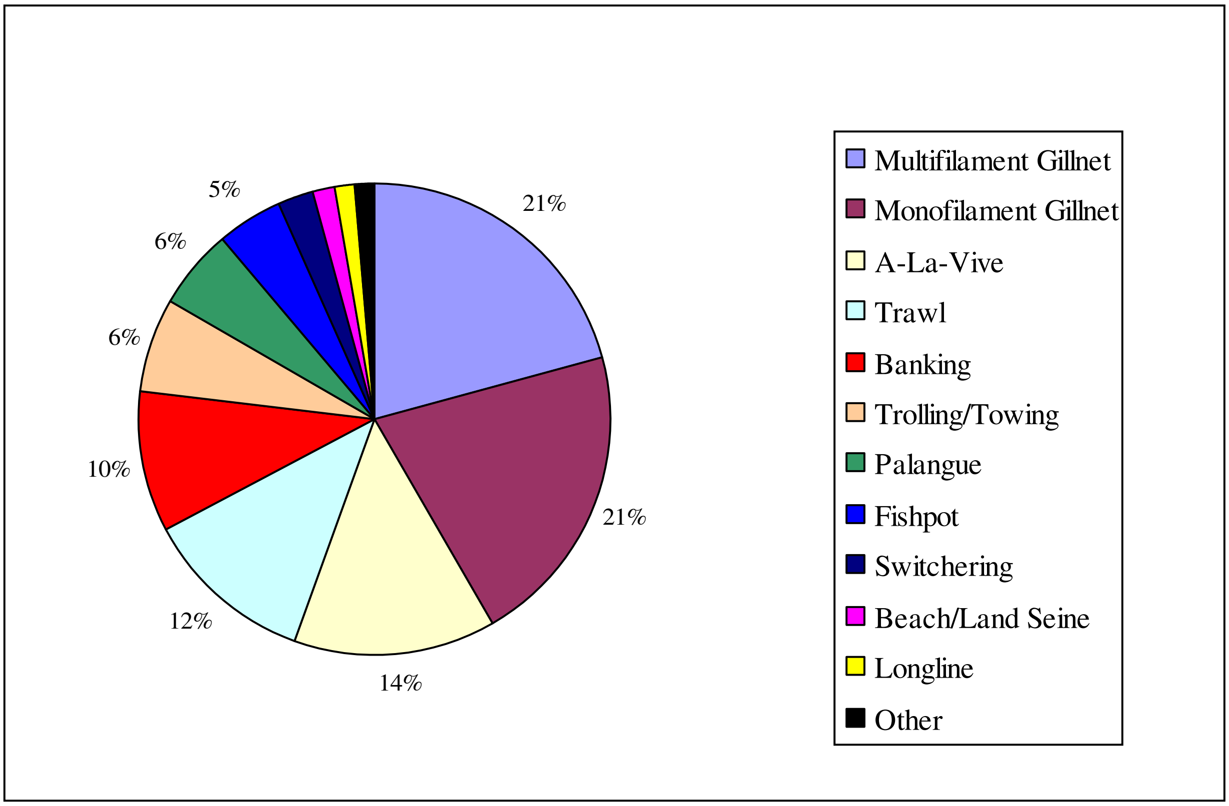
[1] *Trawling is done by vessels from Trinidad only, and not Tobago.*
[2] *Semi-industrial vessels employing gillnets, FADs and troll lines operate out of Tobago only (and not Trinidad) and target flyingfish. They are referred to as "iceboats".*

TABLE 7.5: NUMBER OF VESSELS IN 2003 BY PRIMARY GEAR FOR TRINIDAD

Gear Type	Number of Vessels
Multifilament Gillnet	174
Monofilament Gillnet	172
A-La-Vive	114
Trawl	98
Banking	80
Trolling/Towing	53
Palangue	46
Fishpot	38
Switchering	21
Beach/Land Seine	12
Longline	11
Other	11
Total	**830**

Source: 2003 Fishing Vessel Census for Trinidad

FIGURE 7.1 NUMBER OF VESSELS IN 2003 BY PRIMARY GEAR FOR TRINIDAD



Source: 2003 Fishing Vessel Census for Trinidad

Vessel registration is mandatory by law. Vessels are registered only once unless major modifications are made to them. Table 7.6 shows the number of registered vessels over the period 2001 to 2005 for Trinidad and Tobago.

TABLE 7.6: NUMBER OF VESSELS REGISTERED IN TRINIDAD AND TOBAGO, 2001- 2004

Year	Number of Vessels Registered
2001	153
2002	102
2003	146
2004	141

Source: Fisheries Division Records

7.3 Number of Fishermen

Fisherman registration is not mandatory by law. For those fishermen who do register with the Fisheries Division, the period of validity is three (3) years. The number of fishermen registered (both first time applications and renewals) over the period 2001 to 2005 in Trinidad and Tobago is given in Table 7.7. In 2002 it was estimated that there were some 3,500 fishermen in Trinidad and Tobago with over 6,000 persons estimated to be involved in the fisheries sector as a whole (80 in the input industry, 3,908 in capture fisheries, 76 in aquaculture, 1,225 in processing, and 1,245 in marketing and distribution) (Kuruvilla *et al.* 2002).

Road Side Vendor in Oroupouche, Trinidad

TABLE 7.7: NUMBER OF FISHERS REGISTERED IN TRINIDAD AND TOBAGO, 2001-2004

Year	Number of First Applications	Number of Renewals	Total
2001	251	627	878
2002	203	335	538
2003	268	326	594
2004	260	438	698
2005	370	490	860

Source: Fisheries Division Record

7.4 Fishing Areas

Most artisanal vessels operate in near-shore areas as dayboats. Generally the small size of the vessels (which are not equipped for extended stay at sea), manual setting and retrieving of gears and cultural traditions are major factors which limit the areas of operation. Non-artisanal vessels (which have electronic navigation, fish finding equipment and mechanised operations) fish in areas further offshore, but often compete on the same fishing grounds with the inshore, artisanal vessels.

In this section, fishing areas for the major fishing methods, and associated vessel landing sites around Trinidad and Tobago are presented (see Maps 7.1 - 7.5). The information presented for Trinidad was obtained through a process of collaboration among the fishing communities, on-shore data collectors and other staff of the Fisheries Division in 1996 and 1997. In the case of Tobago the gillnetting and line areas only have been mapped and these were obtained through personal communication with staff of the Department of Marine Resources and Fisheries of the THA in 2000.

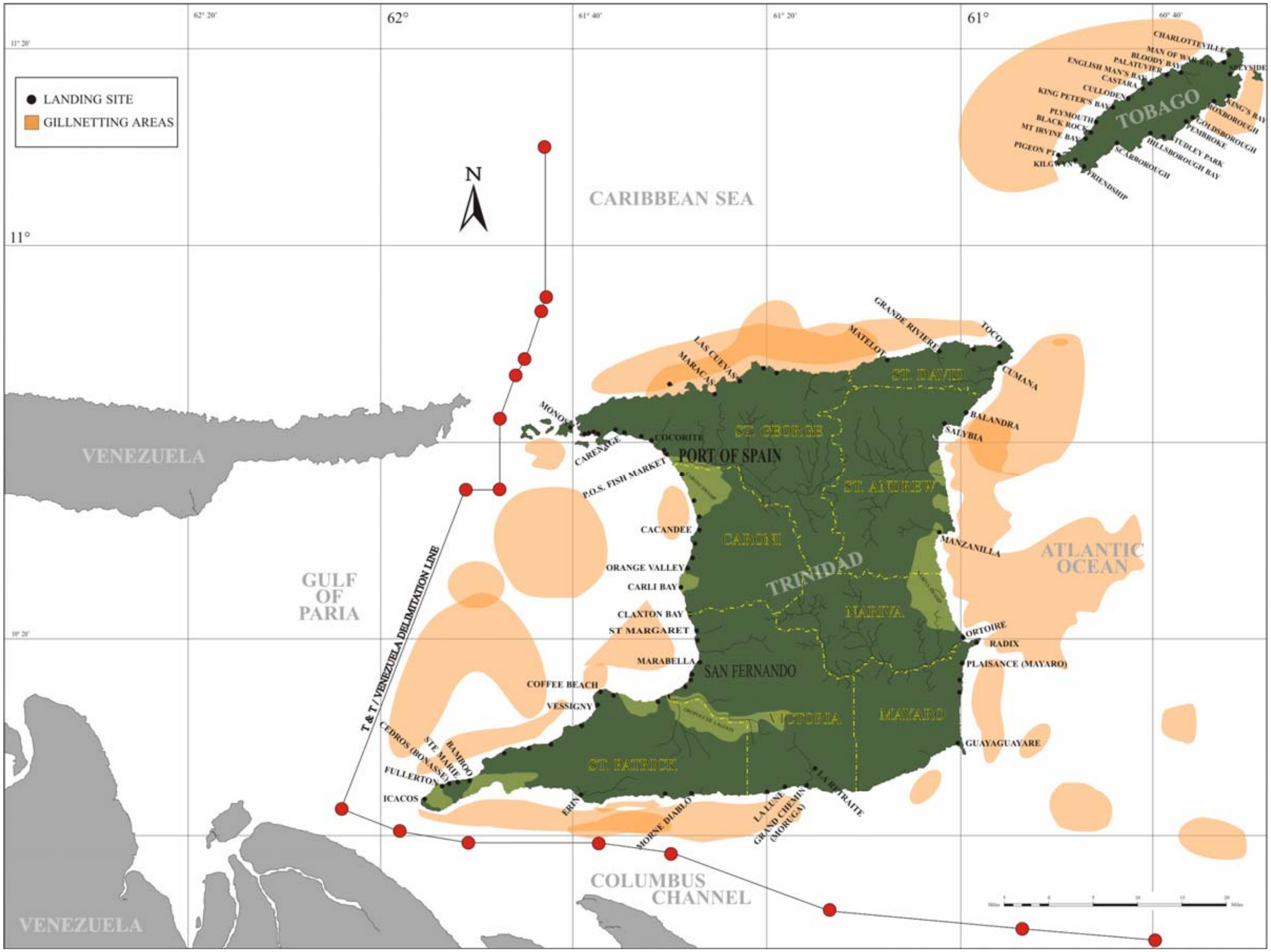
As the maps indicate there is overlap of fishing areas but generally some fishing methods may be more popular in some areas than others. Gillnets are virtually used exclusively by the inshore artisanal fishery and are the most commonly used gear around Trinidad and Tobago. Areas of operation for this gear overlap with most methods. Line methods are most popular off the North and East coasts of Trinidad. Switchering is commonly used on the South coast of Trinidad at sites such as Erin and Moruga. Beach seines are popular at Mayaro on the Southeast coast of Trinidad and at sites along the coastline of the Gulf of Paria, as well as Courland Bay, Charlotteville and Castara in Tobago (Mohammed 1996). The seines used on the North coast of Trinidad are primarily bait seines. The Italian seine is used mainly in the Gulf of Paria. All trawlers operate in the Gulf of Paria at restricted distances from the coast and depths depending on the vessel size and engine horsepower.

The industrial, double-rigged trawlers also operate West of Saut D'eau on the North coast of Trinidad at regulated times of the year, and in the Columbus Channel two (2) nautical miles (3.7 km) from the coast. Trawling off the East coast of Trinidad as well as within 12 nautical miles (22 km) of the coast of Tobago are prohibited by law. Fishpots are now used at many sites but largely by fishermen from the Northwest peninsula of Trinidad, the South coast of Trinidad at Erin and Moruga, the East coast of Trinidad at Balandra and Ortoire, and the Southwest of Tobago. At Ortoire, it is the primary fishing gear employed in the inshore artisanal fishery.

Vessels from Trinidad and Tobago (and Venezuela) are also permitted to fish in a common fishing zone South of Trinidad and North of Venezuela under the current fishing agreement between the two countries.

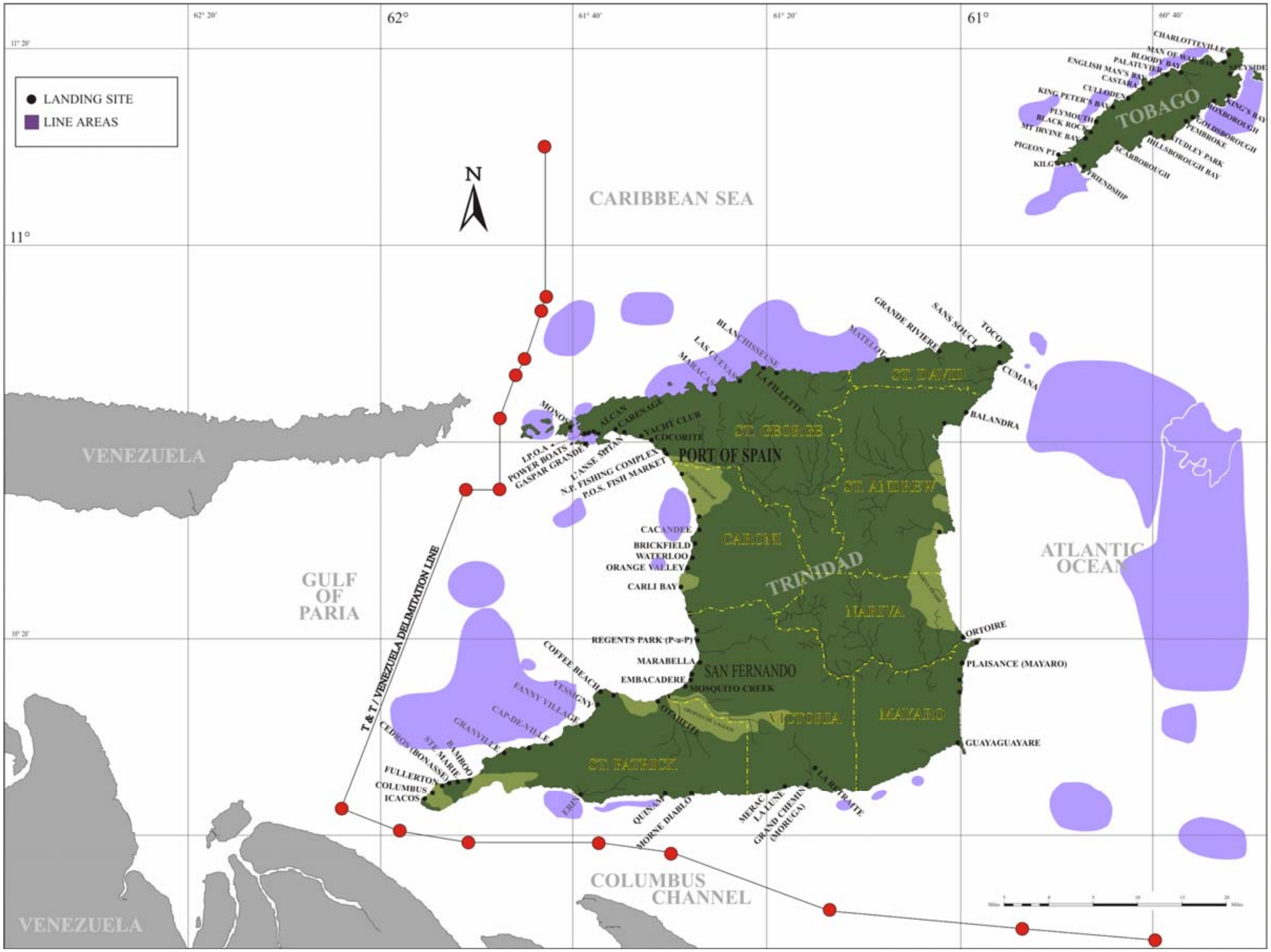
North Coast, Trinidad

MAP 7.1: GILLNETTING AREAS AROUND TRINIDAD AND TOBAGO



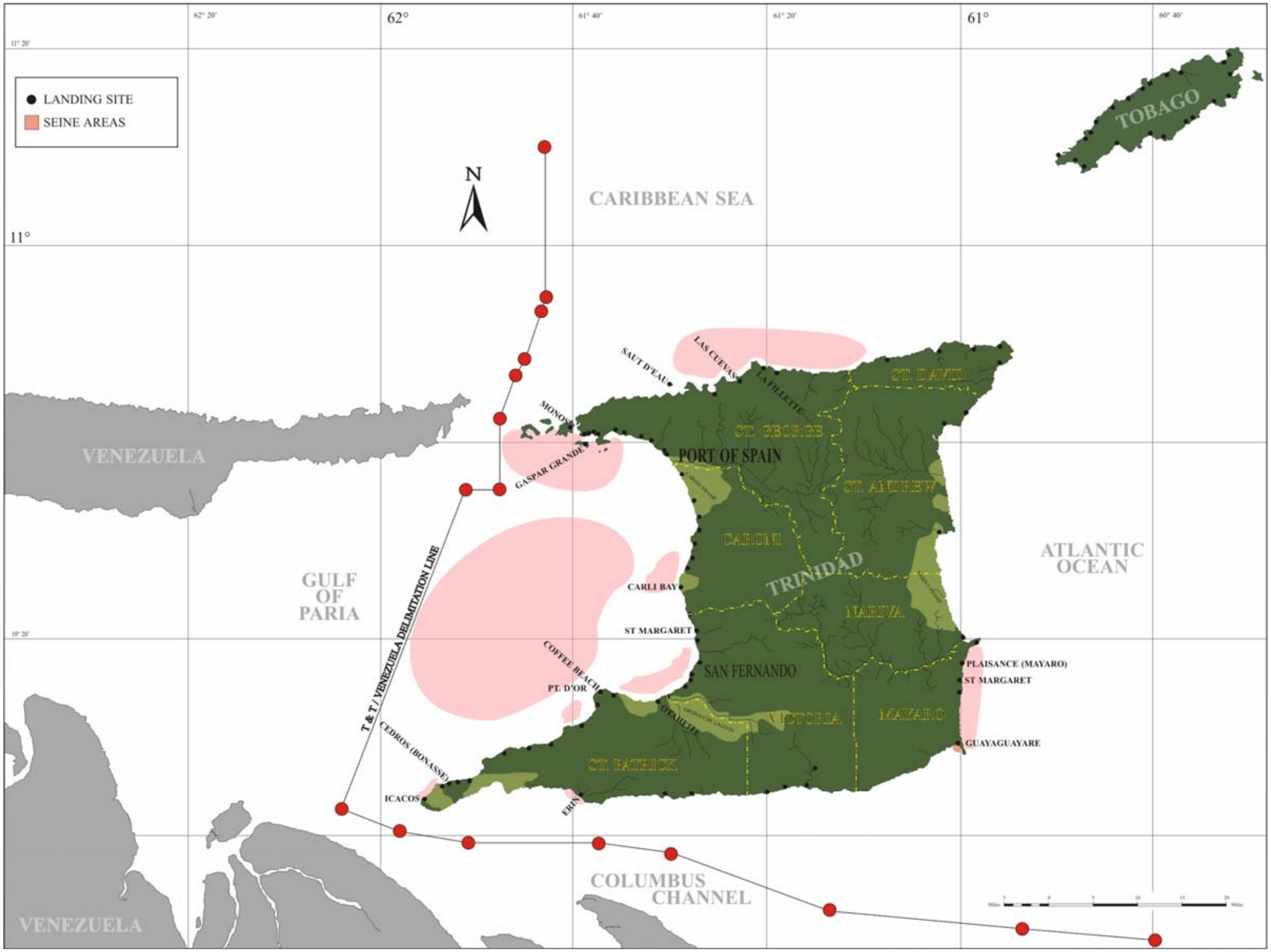
Source: Chan A Shing 2002; communication with THA 2000

MAP 7.2: LINE FISHING AREAS AROUND TRINIDAD AND TOBAGO



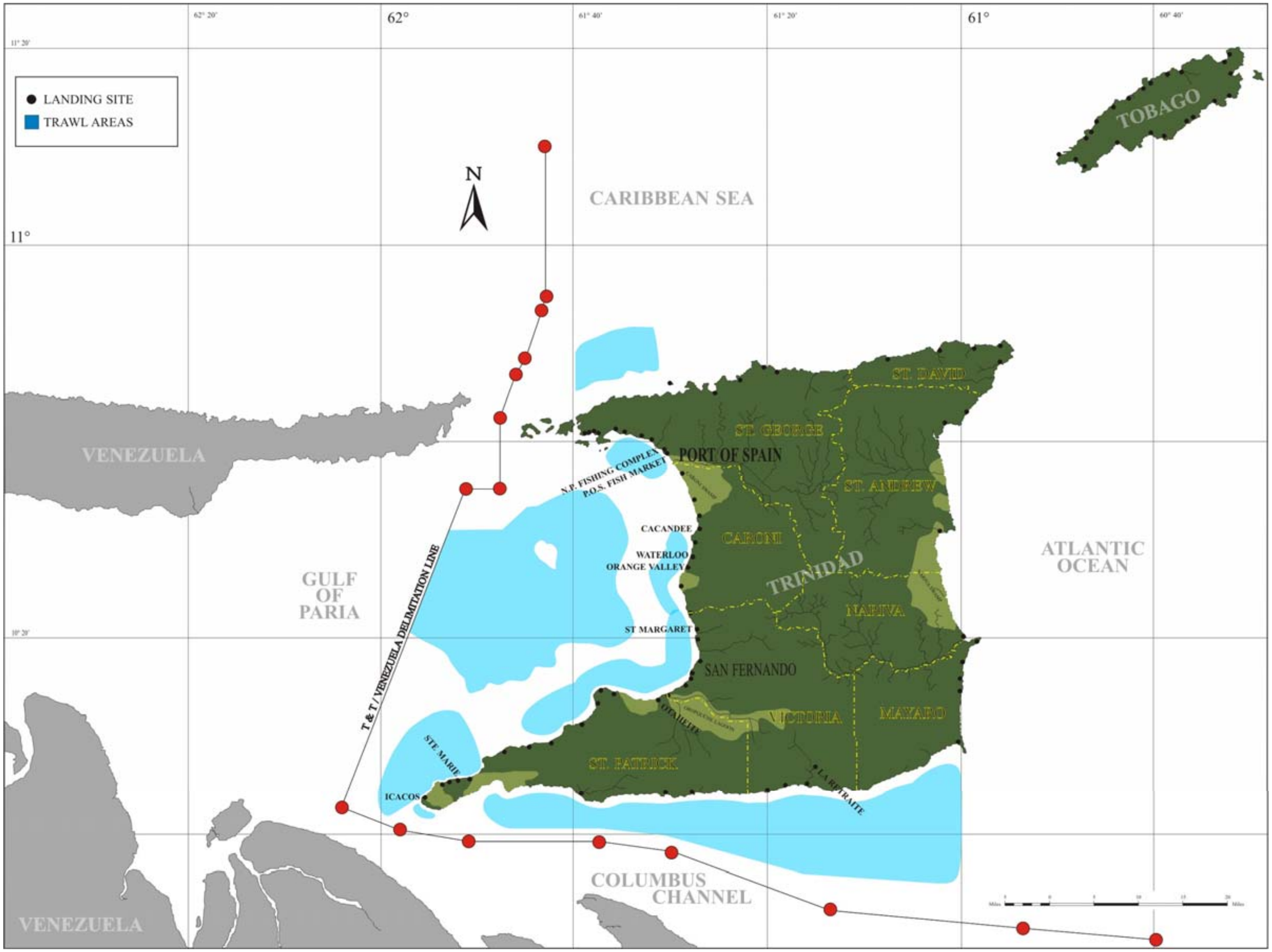
Source: Chan A Shing 2002 and communication with THA 2000

MAP 7.3: SEINING AREAS AROUND TRINIDAD



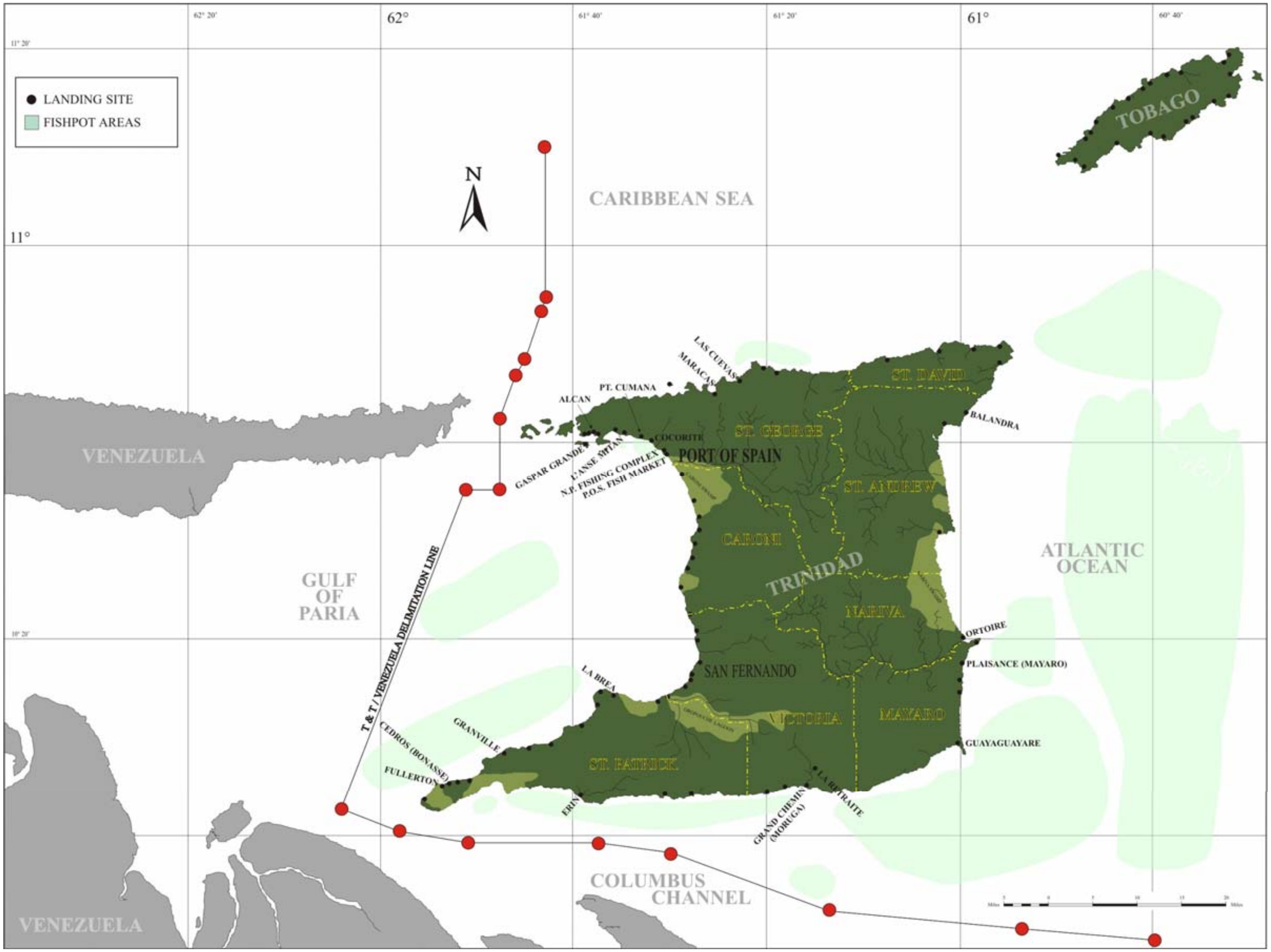
Source: Chan A Shing 2002

MAP 7.4: TRAWLING AREAS AROUND TRINIDAD



Source: Chan A Shing 2002

MAP 7.5: FISHPOTTING AREAS AROUND TRINIDAD



Source: Chan A Shing 2002

7.5 Spawning Grounds

In general, fish spawning grounds around Trinidad and Tobago remain to be determined and documented. There is some information in the case of the four-winged flyingfish stock in the Eastern Caribbean which is patchily distributed and extends from Dominica in the North to Tobago in the South. Based on tagging studies the high retention rates of spawning fish around Tobago suggest greater aggregation of the species towards the Southern extent of its range and a possible important spawning area for the species off Tobago (Oxenford 1994). Although the fishery operates mainly off Southwest Tobago the species is also distributed off the East coast of Tobago as well as Trinidad. The fishery in the Eastern Caribbean targets the spawning stock.

7.6 Marine Reserves

The Marine Areas (Preservation and Enhancement) Act 1970 provides for the designation of restricted areas, and the Marine Areas (Preservation and Enhancement) Regulations 1973, require the permission of the Minister to enter and remove fauna from the restricted area. The Act is currently applied only to the management of coral reefs. The Buccoo Bay Complex / Bon Accord Lagoon was declared a Restricted Area in 1973.

7.7 Fishing Agreements & Foreign Fishing

Trinidad and Tobago has had bilateral fishing agreements with Venezuela and Barbados. The current Trinidad and Tobago/ Venezuela Fishing Agreement provides for a common fishing zone South of Trinidad and North of Venezuela for a range of vessel types from both countries. The Agreement with Barbados, in force for only one year (1990) provided for access by the Barbados fishing fleet to the resources of flyingfish and associated species off Tobago.

With the coming into effect of Act No. 24 of 1986 (the Archipelagic Waters and Exclusive Economic Zone Act in which Trinidad and Tobago declared itself an archipelagic state with a 200 mile Exclusive Economic Zone (EEZ)), and in the decade following, Trinidad and Tobago granted a number of fishing licences for foreign fishing in national waters apart from those granted under the bilateral fishing agreement with Barbados. However, over the past decade no licences have been granted to foreign fishing vessels to fish in national waters.

There are two transshipment ports in Trinidad that service Taiwanese longline fleets and other international vessels that operate outside of Trinidad and Tobago's EEZ. These vessels transship tuna and other migratory species through Trinidad to international markets.

7.8 Marine Capture Fisheries Production

Table 7.8 and Figure 7.2 give the estimated total annual landings by fleet from the marine capture fisheries of Trinidad and Tobago for 1996 to 2004. Over this time period, it is estimated that the commercial fleet accounts for over 90% of the total landings for the country, while the recreational fleet landed just about 6 to 9% of the total each year. With regard to the total commercial landings for Trinidad and Tobago, the landings from Trinidad are estimated to account for about 80%. Of Trinidad's landings, the artisanal fishery accounts for about 80%. Table 7.9 and Figure 7.3 show the estimated annual landings by species group for Trinidad and Tobago for 1998 to 2004 for the fleets for which the data are available. Table 7.10 and Figure 7.4 show the estimated landings for some important sites around Trinidad.

TABLE 7.8:
ESTIMATED TOTAL ANNUAL LANDINGS (TONNES) BY FLEET FROM THE MARINE CAPTURE FISHERIES OF TRINIDAD AND TOBAGO, 1996-2004

Fishing Fleet	1996	1997	1998	1999	2000	2001	2002	2003	2004
Commercial									
Trinidad	**9,901**	**10,962**	**15,014**	**13,335**	**11,633**	**13,482**	**15,487**	**11,058**	**11,204**
Artisanal Multi-Gear (Nets & Lines)	6,867	7,972	11,804	9,893	8,523	10,439	12,221	8,109	8,412
Artisanal Trawl	476	389	541	640	543	571	453	440	401
Total Artisanal	**7,343**	**8,361**	**12,346**	**10,532**	**9,066**	**11,010**	**12,673**	**8,549**	**8,813**
Semi-industrial Trawl	254	280	358	454	405	379	398	362	369
Industrial Trawl	933	890	923	989	1,020	817	1,094	812	672
Semi-industrial Longline	402	461	417	390	171	306	351	365	380
Semi-industrial Fishpot / Line [1]	970	970	970	970	970	970	970	970	970
Total Semi-industrial / Industrial	**2,558**	**2,601**	**2,668**	**2,803**	**2,566**	**2,472**	**2,813**	**2,509**	**2,391**
Tobago [2]	**2,479**	**2,479**	**2,479**	**2,479**	**2,479**	**2,479**	**2,479**	**2,479**	**2,479**
Total Commercial: T&T	**12,380**	**13,441**	**17,493**	**15,814**	**14,112**	**15,961**	**17,966**	**13,537**	**13,683**
Recreational									
Recreational Part Time [3]	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231
Game Fishing Tournaments T&T [4]	3	3	3	3	3	3	4	4	4
Total Recreational: T&T	**1,234**	**1,234**	**1,234**	**1,234**	**1,234**	**1,234**	**1,235**	**1,235**	**1,235**
Grand Total	**13,615**	**14,676**	**18,727**	**17,048**	**15,345**	**17,196**	**19,201**	**14,772**	**14,918**

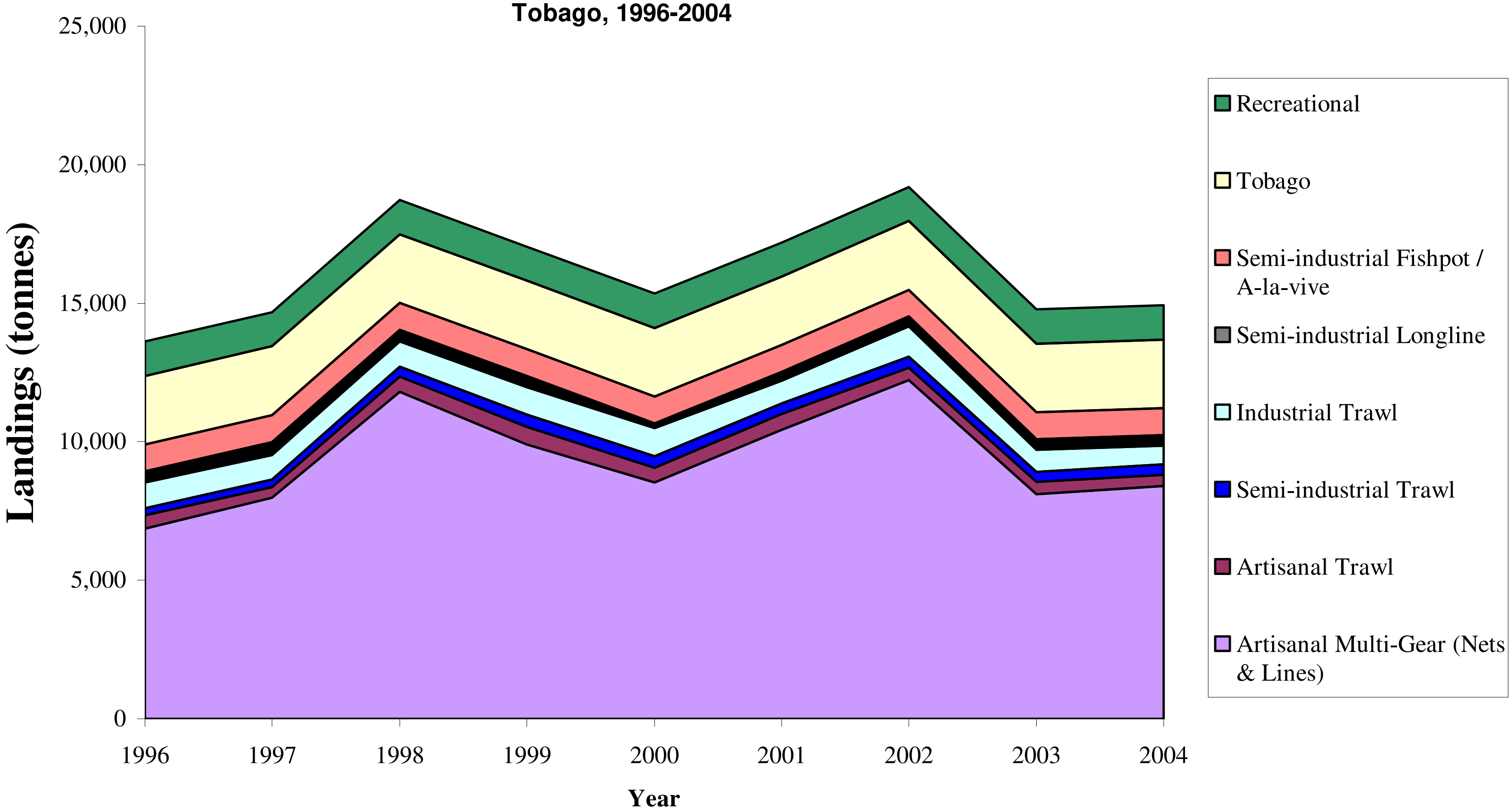
Source: Fisheries Division Records

Notes to Table 7.8

[1] In the absence of a data collection system for the Trinidad Semi-Industrial Fishpot & Line fleet, an estimate for 1997 is used for all years.
[2] In the absence of total landings for the Tobago commercial fishery, an estimate for 1991 (Mohammed 1994) is used for all years. In 1991 there were a total of 275 registered fishing vessels, all of which were artisanal.
[3] In the absence of a data collection system for the recreational fleet, a 1993 annual estimate for the recreational fishery in the Northwest peninsula of Trinidad (Mike 1993) is used for all years.
[4] In the absence of data for Game Fishing Tournaments in 1996, 1997, & 2001, the average for the available years is used.
Other notes for Table 7.8.1 and Figure 7.8.1:

a) Landings from foreign fleets that may have operated in Trinidad and Tobago waters are not included.

Figure 7.2: Estimated Total Annual Landings by Fleet from the Marine Capture Fisheries of Trinidad and Tobago, 1996-2004



Source: Fisheries Division Records

TABLE 7.9:

ESTIMATED ANNUAL LANDINGS (Tonnes) BY SPECIES GROUP FROM THE MARINE CAPTURE FISHERIES OF TRINIDAD & TOBAGO, 1998-2004

Species Group	1998	1999	2000	2001	2002	2003	2004
Shrimp	882	929	916	935	940	799	712
Spanish mackerel (Carite)	2,216	1,365	1,750	2,743	2,245	1,759	2,102
King mackerel (Kingfish)	788	485	433	472	963	588	577
Tunas and Bonitos	489	524	619	722	1,965	958	961
Billfish	194	210	62	101	119	111	113
Sharks	591	745	805	986	1,315	1,034	1,354
Herring and Jashua	722	943	82	178	47	22	12
Weakfish (Salmon)	418	476	546	579	472	448	377
Croaker	1,045	791	1,034	1,367	1,575	1,472	1,077
Snapper	691	544	409	514	508	397	372
Cavalli and other Jacks	380	156	365	546	637	402	482
Other [1]	1,921	2,781	2,603	2,781	3,315	1,932	1,939
Total	**10,337**	**9,948**	**9,624**	**11,926**	**14,100**	**9,922**	**10,079**

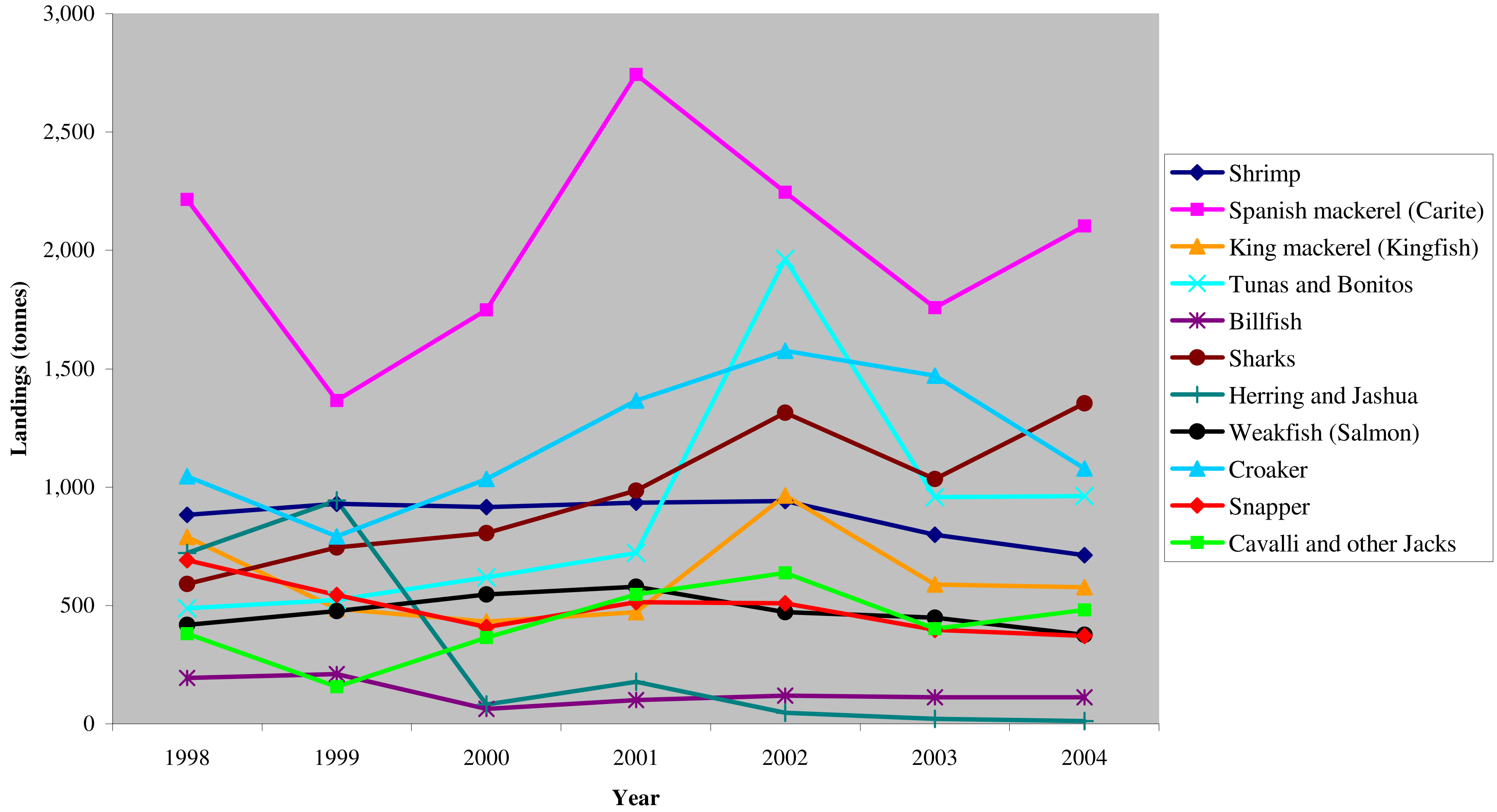
Source: Fisheries Division Records

[1]Category "Other" includes barracuda (bechine), mullet, ancho, blinch, snook, brochet, grunt, grouper, sea catfish, cutlassfish.

a) These data represent landings from Trinidad artisanal fleets, Trinidad semi-industrial/industrial trawl & longline fleets, Tobago artisanal & semi-industrial fleets for tuna-like species only (sample data only, i.e. not estimated total landings - from the Department of Marine Resources and Fisheries, Tobago House of Assembly), and game fishing tournaments in Trinidad & Tobago.

b) These data do not include landings from the Trinidad semi-industrial multi-gear boats, Trinidad & Tobago recreational boats (other than from tournaments), Tobago landings (other than those identified in “a)” above), or landings from foreign fleets that may have operated in Trinidad and Tobago waters.

Figure 7.3: Estimated Annual Landings of Some Commercially Important Species Groups in the Marine Capture Fisheries of Trinidad and Tobago,1998-2004



Source: Fisheries Division Records

TABLE 7.10:

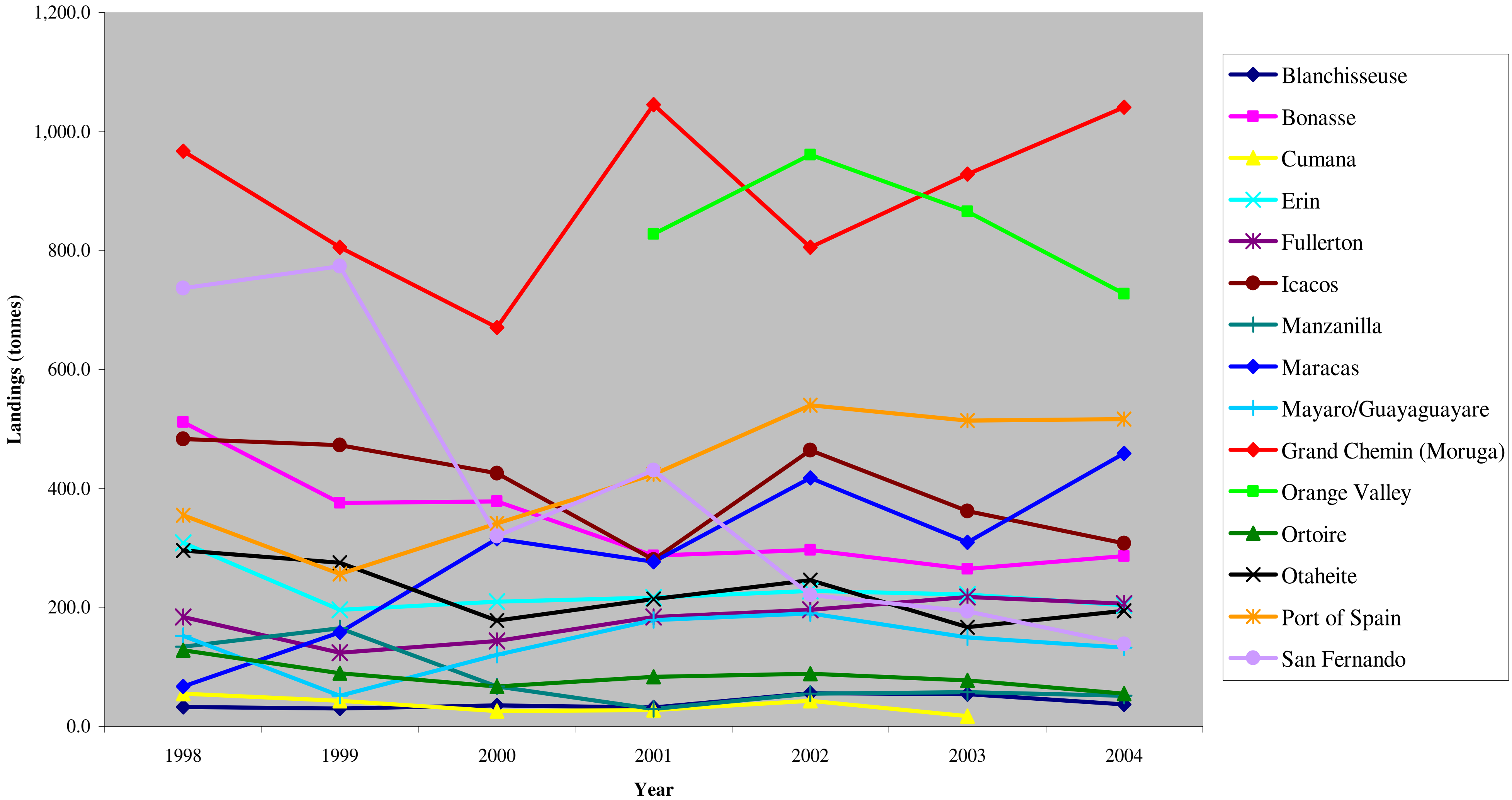
ESTIMATED ANNUAL LANDINGS FROM THE MARINE CAPTURE FISHERIES BY IMPORTANT SELECTED LANDING SITES AROUND TRINIDAD, 1998- 2004

Unit: Tonnes

LANDING SITE	1998	1999	2000	2001	2002	2003	2004
Blanchisseuse	33	30	36	32	56	54	37
Bonasse	511	376	378	287	297	265	287
Cumana	55	43	25	28	43	17	-
Erin	309	196	210	217	228	222	204
Fullerton	184	124	144	184	196	218	207
Icacos	483	473	426	280	464	362	308
Manzanilla	134	165	67	30	55	58	52
Maracas	67	158	315	276	418	309	459
Mayaro/Guayaguayare	152	52	120	179	190	149	132
Grand Chemin (Moruga)	967	805	671	1,046	805	929	1,041
Orange Valley	-	-	-	828	961	865	728
Ortoire	128	90	67	83	88	77	55
Otaheite	296	275	178	214	246	167	194
Port of Spain	357	256	341	423	540	514	517
San Fernando	736	774	320	430	221	194	139

Source: Fisheries Division Records

Figure 7.4: Estimated Annual Landings from the Marine Capture Fisheries for Some Important Sites Around Trinidad,1998-2004



Source: Fisheries Division Records

7.9 Status and Management of Fisheries Resources

7.9.1 Marine

Appendix 7.2 shows the stock status for some of the more commercially important species in Trinidad and Tobago for which assessments have been conducted. The Appendix also provides the recommendations made for the sustainable management of these stocks as well as the management measures currently in place for these fisheries.

7.9.2 Freshwater / Brackish water

Assessments of the status of the freshwater / brackish water fisheries resources remain to be conducted. However, with regard to the mangrove oyster which was once very abundant in the Caroni and Nariva swamps, the numbers are much reduced, due at least in part to over-harvesting, and they are now collected mainly from the Claxton Bay region. Additionally, the vending of oyster cocktails, which was a major source of oyster sales, was significantly affected when a ban was imposed on vending in 1994 due to sanitary concerns. This enterprise was unable to recover even though in 1996, the Oyster Vendors Association attempted to save the industry by proposing a commercial project in the Caroni swamp. The project, however, never materialized.

7.10 Fisheries Management Issues

Results of assessments conducted for the commercially important species indicate that most of them are either close to full exploitation, fully exploited or overexploited from a conservation (biological) sense and require immediate management action. In order to ensure that resources are used as efficiently as possible to maximise benefits to the fishing industry, fishing communities and the country, it is necessary for fisheries to be managed by Government in co-operation with fishing communities.

The management of coastal fisheries in Trinidad and Tobago is complicated by the multisectoral use of the coastal zone for non-fishing activities such as maritime transport, waste disposal, industrial and agricultural activity, recreational and touristic uses and the associated developmental activities resulting in habitat destruction. Success at fisheries management therefore must be based on an integrated approach recognising the other users of the coastal zone and the marine areas and their impact on the fisheries.

Because of the migratory habits of some species and the fishing patterns of neighbouring countries, management regimes for these species need to be co-ordinated at the sub-regional or regional level. In addition, the growing number of international conventions, treaties and agreements to which Trinidad and Tobago is signatory and which have the status of international conservation or trade law, define operational parameters for the conduct of the local fishing industry. The operations of the marine fisheries of Trinidad and Tobago and development of management practices must be consistent with what obtains in the international environment.

Some of the major issues with regard to the management of fisheries in Trinidad and Tobago are identified below:

- Open access nature of the fisheries (except for the industrial trawl fishery);
- Illegal foreign fishing;
- Trend of reducing mesh sizes of nets and fishpots as a strategy by fishermen to enhance catch;
- Large quantities of discards in the trawl and other fisheries;
- Incidental capture of turtles in gillnets;
- Overlapping fishing grounds of artisanal vessels and industrial vessels intended to exploit offshore grounds;
- Competition between commercial and recreational fisheries;
- Limited alternative opportunities in fisheries-dependent, rural, coastal communities;
- Development of unutilised and under-utilised fisheries;
- Pollution of the marine habitat;
- Destruction of coastal wetlands and related habitats;
- Safety and compensation issues related to impacts on fisheries and fisherfolk by the oil and gas sector and natural disasters.

B. Aquaculture

7.11.1 Potential for Aquaculture Development

The suitability of Trinidad and Tobago for inland fish farming was evaluated by Kapetsky and Chakalall (1998) based on certain farming system criteria (see Table 7.11).

TABLE 7.11:
FARMING SYSTEM CRITERIA SUITABILITY FOR INLAND FISH FARMING BY PERCENTAGE OF RELATIVE SURFACE AREA IN TRINIDAD AND TOBAGO, 1998

Farming System Criteria[1]	Very Suitable	Suitable	Moderately Suitable
1. Net annual water loss from ponds through evaporation and seepage.	-	100	-
2. Soil and terrain suitability for ponds.	15	-	-
3. Potential for agriculture by-products as feed and fertilizer inputs.	69	10	-
4. Potential for farm gate sales (depends on population density local to the farm site but does not take into account purchasing power or disposable income).	81	19	-
5. Potential urban markets for commercial fish farming (based on population density at urban centres and estimated travel times along roads to reach urban markets).	-	94	-
6. Suitability for small-scale fish farming	71	29	-
7. Suitability for commercial fish farming.	66	34	-

Source: Kapetsky and Chakalall 1998

Table 7.12 gives some potential aquaculture sites in Trinidad and Tobago. Most of the more extensive areas of brackish water swamp are under pollution risk, and hence are not suitable for aquaculture which requires a supply of good quality water. Sheltered marine areas suitable for mariculture are also available in the Gulf of Paria but pollution and other commercial activities are a serious problem. If aquaculture is to be done using tanks for the rearing system then there are other potential sites on the South and East Coasts of Trinidad (see Appendix 7.3 for other types of rearing systems). In Tobago, good quality freshwater is available in limited quantities, however, there are potential sites for mariculture.

[1]The first four criteria were used to estimate the potential for small-scale fish farming in ponds and the fifth criterion was added to estimate the potential for commercial fish farming. The criteria were combined and weighted by their relative importance.

TABLE 7.12: POTENTIAL AQUACULTURE SITES IN TRINIDAD AND TOBAGO, 1998

Type of Aquaculture	Site
Freshwater (surface water)	**Trinidad** - North Oropouche drainage, Ortoire drainage, Moruga drainage, Nariva swamp, North coast rivers (Yarra, Marianne, Paria, Matelot, Shark, Grande Riviere); **Tobago** - Goldsborough drainage, Bloody Bay drainage
Freshwater (ground water)	**Trinidad** - Orange Grove Estate, parts of Wallerfield and Carsen Field, Santa Cruz Valley, Tucker Valley
Brackish water	**Trinidad** - Nariva River, Southern part of Caroni Swamp, Fullerton Swamp
Mariculture	**Trinidad** - Teteron Bay, Chacachacare Bay, Maracas Bay, Las Cuevas Bay, Cyril Bay; **Tobago** - Man-of-War Bay, Bloody Bay

Source: Ramnarine *et al.* 1998

A list of species with potential for being cultured on a commercial basis is given in Table 7.13.

TABLE 7.13:
POTENTIAL SPECIES FOR COMMERCIAL AQUACULTURE IN TRINIDAD AND TOBAGO

Scientific Name	Common Name
Oreochromis nilotica	silver tilapia
Hoplosternum littorale	cascadura
Tilapia spp.	red hybrid tilapia
Macrobrachium rosenbergii	giant freshwater prawn
Cyprinus carpio	carp
Melongena melongena	black conch
Crassostrea rhizophorae	mangrove oyster
Gracilaria spp.	sea weed
Penaeus spp.	shrimp
Ucides cordatus	mangrove crab

Source: Ramnarine *et al*. 1998

7.11.2 Aquaculture Farmers & Farms

In the early 1980s, eleven (11) farmers pursued subsistence aquaculture, and by 1985 the number of fish farmers exceeded 1,000. In 1991 the total number of fish farmers registered with the Bamboo Grove Fish Farm of the Fisheries Division was 1,020. The total area of all ponds (ranging in size from 0.05 to 5.0 hectares) amounted to approximately 120 hectares. Most of the 1,020 farmers practised small extensive backyard (subsistence) fish farming and they were located in the counties of Caroni, St. Patrick and Victoria.

In 1999, the number of active food fish (limniculture) farmers in Trinidad was estimated to be 53 (Fisheries Division telephone survey). An active farmer is one whose main purpose for production is for sale. Of the 53 farmers identified in the survey, 43 were determined to be subsistence and small-scale cascadura farmers who depended largely on capture fisheries for brood stock and even market supply.

In August 2003, the Ministry of Agriculture, Land and Marine Resources conducted a frame survey of one hundred and forty-nine (149) potential farmers (Planning Division 2003). It was determined that only fifty-five (55) were active. The data showed that just over 76% of these active farmers (i.e., 42 farmers) had less than one (1) acre (0.4 hectares) in aquaculture production. Generally, it was discovered that tilapia production was not being practised on a wide commercial scale. Tables 7.14 to 7.19 and Figures 7.5 to 7.8 provide some details on the organization of the aquaculture industry in Trinidad.

TABLE 7.14:

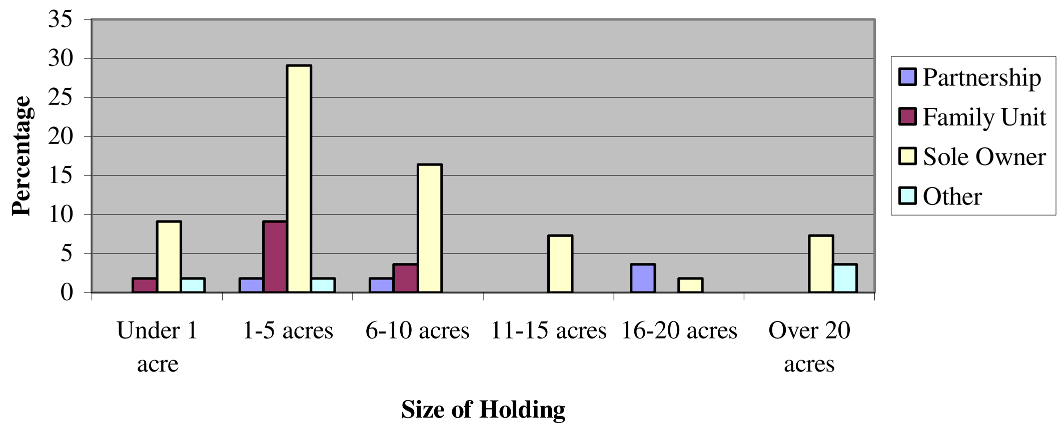
TYPE OF ORGANISATIONAL OWNERSHIP OF AQUACULTURE FARMS BY SIZE OF HOLDINGS IN TRINIDAD, 2003

Size of Holding	Type of Organisational Ownership				Total
	Partnership	Family Unit	Sole Owner	Other[1]	
Under 1 acre		1	5	1	7
1-5 acres	1	5	16	1	23
6-10 acres	1	2	9	-	12
11-15 acres	-	-	4	-	4
16-20 acres	2	-	1	-	3
Over 20 acres	-	-	4	2	6
Total	**4**	**8**	**39**	**4**	**55**

Source: Planning Division 2003

[1]Category “Other” includes training and demonstration.

Figure 7.5: Acquaculture Farms by Type of Organisational Ownership and Size of Holding in Trinidad, 2003



Source: Planning Division 2003

TABLE 7.15: AQUACULTURE FARMS BY TYPE OF OWNERSHIP, AGE AND GENDER IN TRINIDAD, 2003

Age (years)	Gender	Type of Organizational Ownership				Total
		Partnership	Family Unit	Sole Owner	Other[1]	
16-25	Male	-	-	1	-	1
26-35	Male	-	-	3	-	3
36-45	Female	-	1	-	-	1
36-45	Male	-	1	9	1	11
46-55	Male	3	2	11	1	17
56-65	Female	-	-	1	-	1
56-65	Male	-	3	8	1	12
Over 65	Male	-	-	5	-	5
Not stated	Male	-	1	1	-	2
Not stated	Not stated	1	-	-	1	2
Total		**4**	**8**	**39**	**4**	**55**

Source: Planning Division 2003

[1]Category “Other” includes training and demonstration.

TABLE 7.16: AQUACULTURE FARMERS BY YEARS OF EXPERIENCE AND GENDER IN TRINIDAD, 2003

YEARS OF EXPERIENCE	GENDER			TOTAL
	Female	Male	Not Stated	
0-5 years	1	27	-	28
6-10 years	1	13	-	14
11-15 years	-	7	-	7
16-20 years	-	4	-	4
Not Stated	-	-	2	2
Total	**2**	**51**	**2**	**55**

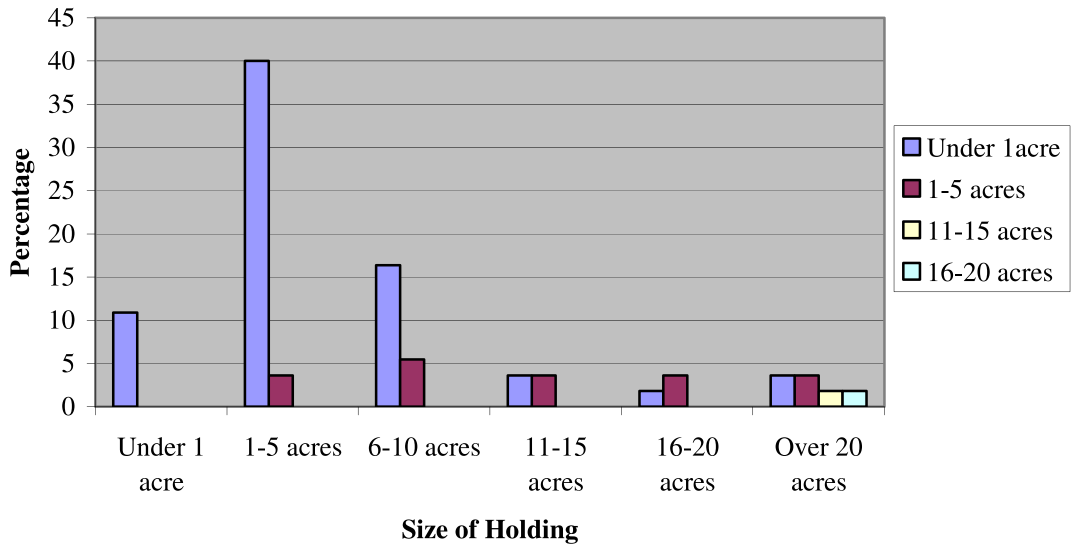
Source: Planning Division 2003

TABLE 7.17: LAND USE: AQUACULTURE FARMING IN TRINIDAD, 2003

Total Size of Holdings	Land Use on Holdings for Aquaculture Farming				Total Number of Holdings
	Under 1 Acre	1-5 Acres	11-15 Acres	16-20 Acres	
Under 1 acre	6	-	-	-	6
1-5 acres	22	2	-	-	24
6-10 acres	9	3	-	-	12
11-15 acres	2	2	-	-	4
16-20 acres	1	2	-	-	3
Over 20 acres	2	2	1	1	6
Total	**42**	**11**	**1**	**1**	55

Source: Planning Division 2003

Figure 7.6: Land Use: Aquaculture Farming in Trinidad, 2003



Source: Planning Division 2003

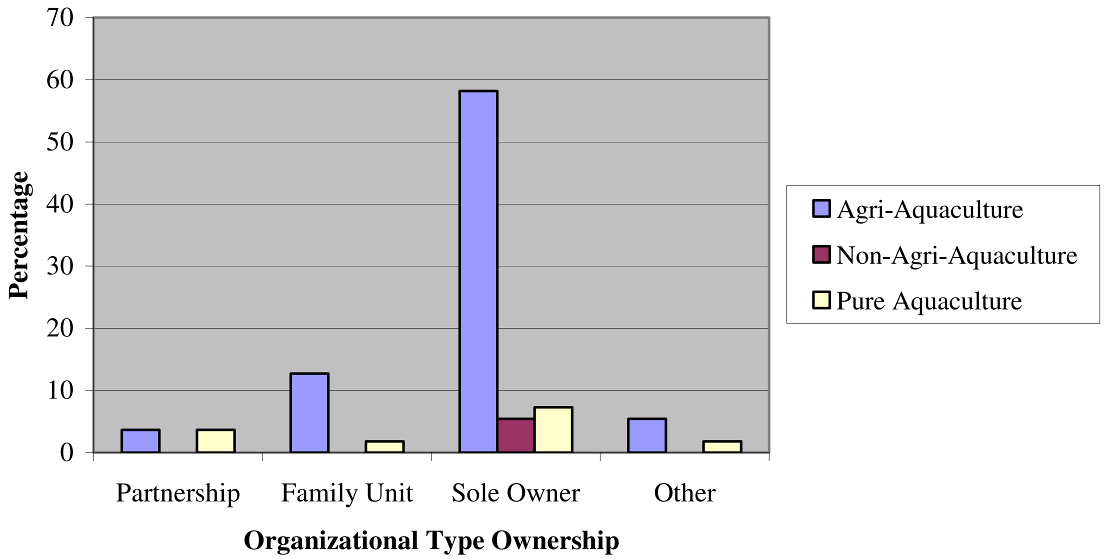
TABLE 7.18:
AQUACULTURE FARMERS BY TYPE OF ORGANISATIONAL OWNERSHIP AND FARMING SYSTEMS IN TRINIDAD, 2003

Farming System	Type of Organisational Ownership				TOTAL NUMBER OF FARMERS
	Partnership	Family Unit	Sole Owner	Other	
Agri-Aquaculture[1]	2	7	32	3	44
Non-Agri-Aquaculture[2]	-	-	3	-	3
Pure Aquaculture[3]	2	1	4	1	8
Total	**4**	**8**	**39**	**4**	**55**

[1] – Farmers engaged in other types of agricultural work.
[2] – Aquafarmers engaged in non-agricultural work.
[3] – Acquafarmers engaged solely in acquaculture.

Source: Planning Division 2003

Figure 7.7: Farming Systems by Type of Organizational Ownership for Aquafarmers in Trinidad, 2003



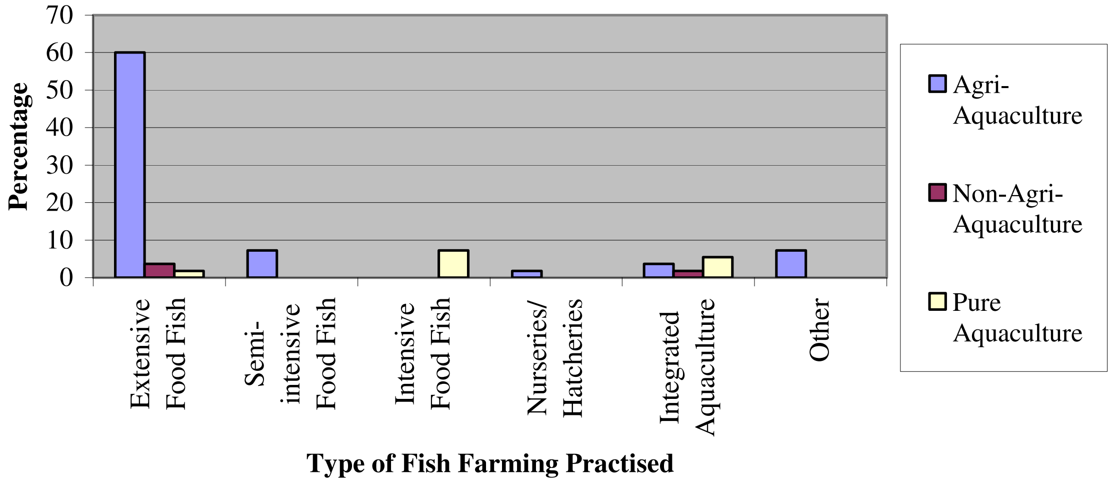
Source: Planning Division 2003

TABLE 7.19: FARMING SYSTEMS BY TYPES OF FISH FARMING PRACTISES IN TRINIDAD, 2003

Types of Fish Farming Practises	Farming Systems			Total
	Agri-Aquaculture	Non-Agri-Aquaculture	Pure Aquaculture	
Extensive Food Fish	33	2	1	36
Semi-intensive Food Fish	4	-	-	4
Intensive Food Fish	-	-	4	4
Nurseries/ Hatcheries	1	-	-	1
Integrated Aquaculture	2	1	3	6
Other	4	-	-	4
Total	**44**	**3**	**8**	**55**

Source: Planning Division 2003

Figure 7.8: Farming Systems by Type of Fish Farming Practises in Trinidad, 2003



Source: Planning Division 2003

Some details on the various types of fish farming practised are provided in Appendix 7.3.

7.11.3 AQUACULTURE PRODUCTION

7.11.3.1 Food Fish

Some history on the fish and shellfish species introduced / cultured in Trinidad from the 1950s to the 1990s is given in Appendix 7.4.

There is currently no formal system in place in the Fisheries Division to collect production statistics for the cultured food fish industry. However, based on communication with aquaculture farmers, the Fisheries Division estimated that in 1991 approximately 2.5 tonnes of fresh fish were sold, mainly the red hydrid tilapia. The combined production figure for the cultured freshwater fish species is likely to be an underestimate as very little of the total production reaches the local markets. Tilapias, as well as the highly regarded cascadura, usually serve the farmer and his immediate family. The former species are rarely sold, while the cascadura, when sold, is taken to the produce market and retailed to the farmer's agent at TT$ 44/kg. The Sugarcane Feed Centre of the Ministry of Agriculture, Land and Marine Resources produces about 2 tonnes of fish yearly but since research, and not production, is their emphasis this quantity is not guaranteed.

The estimated production of freshwater food fish in Trinidad and Tobago during the period 1990 to 1996 is given in Table 7.20. During this period, Caroni (1975) Ltd. was the largest producer of cultured food fish in the country and accounted for an estimated 98% of the Malaysian prawns produced, 80% of the cascadura produced, and 70% of tilapias produced (Ramnarine 1997). Caroni (1975) Ltd produced cascadura during the period 1992 to 1993, and Malaysian prawns from 1990 to 1995, after which production shifted to the red hybrid tilapia (Ramnarine 1997). In mid-1999, Caroni (1975) Limited's aquaculture project was leased to a private farmer (Ramnarine 2000). By 1999, there were no projects in Trinidad which cultured freshwater prawns.

TABLE 7.20: ESTIMATED PRODUCTION OF FRESHWATER FOOD FISH IN TRINIDAD AND TOBAGO, 1990 -1996

YEAR	TILAPIA		CASCADURA		PRAWN	
	Quantity (kg)	Value (TT$)	Quantity (kg)	Value (TT$)	Quantity (kg)	Value (TT$)
1990	1,000	8,000	1,680	43,680	100	2,000
1991	1,000	8,000	1,000	26,000	6,127	122,540
1992	1,000	8,000	4,087	106,262	1,300	26,000
1993	2,530	22,264	2,641	68,666	2,687	53,740
1994	16,000	140,800	1,000	26,000	2,369	59,225
1995	16,016	145,746	1,000	26,000	2,786	78,008
1996	18,590	190,584	1,000	26,000	200	5,600

Source: Ramnarine 1997 based on extrapolation of Caroni (1975) Limited; data collected by the Central Statistical Office

Over the period 1999 to 2001, commercial production of two of the larger, active, privately owned aquaculture farms is given as follows based on personal communication with owners of the farms. With regard to silver tilapia, approximately 200,000 fingerlings and 10 t of fish were produced in 1999, and approximately 50,000 fingerlings and 15 t of fish in 2000. From 1999 to 2001, 0.5 t of cascadura were produced each year. In 2000 and 2001 respectively, 0.5 t and 2 t of red hybrid tilalpia were produced. Two community projects established by the Fisheries Division produced approximately 3.6 t of silver tilapia in 2001, and in 2002 the two projects yielded almost 2.4 t.

Based on the frame survey of aquafarmers in Trinidad conducted by the Ministry of Agriculture, Land and Marine Resources in 2003, the quantity of fish produced is given in Table 7.21.

TABLE 7.21:
CAPACITY OF AQUACULTURE PONDS BY PRODUCTION QUANTITIES IN TRINIDAD, 2003

Capacity (No. of Fishes)	Quantity Produced (Number of fishes)								
	Under 100	101-1000	1001-2000	2001-3000	3001-4000	4001-5000	Over 5000	Unsure	Total
Under 100	1	-	-	-	-	-	-	3	4
101-1000	9	15	3	-	-	-	1	7	35
1001-2000	4	10	-	-	-	-	-	3	17
2001-3000	1	5	2	-	-	-	1	1	10
3001-4000	-	1	3	2	-	-	1	4	11
4001-5000	-	4	-	2	-	1	-	-	7
5001-6000	-	2	4	-	1	-	-	-	7
6001-7000	-	6	-	-	-	-	-	-	6
Over 7000	-	5	-	1	-	-	2	3	11
Unsure	2	7	2	-	-	1	1	4	17
Total	**17**	**55**	**14**	**5**	**1**	**2**	**6**	**25**	**125**

Source: Planning Division 2003

7.11.3.2 Ornamental Fish

The ornamental fish industry spans a period of over forty (40) years in Trinidad and Tobago. It is a more stable industry than the cultured food fish industry, and has been able to sustain production and export over time. Whereas in the early sixties, the fish breeders obtained stock by harvesting natural water sources (rivers and streams) and importing, in the mid-eighties the emphasis shifted to the export of fish by a few investors. The target group of indigenous fishes comprised *Hypostomus robinii* (pui-pui), *Poecilia reticulata* (fancy and feeder guppies) and *Corydoras aeneus* (teta). The Live Fish Act of 1955 governs the trade of ornamentals and a licence approved by the Fisheries Division is required for all imports and exports.

In 1999, ten (10) ornamental fish exporters sold a total of 1,375,000 fishes generating an income of approximately TT$817,700 (Fisheries Division records). These figures are believed to be under-estimated. The fish exports for 2000 to 2005 are given in Table 7.22. The significant decline over the last six years is as a result of exporters leaving the industry as well as the reduced demand for some species of fish such as *Poecilia reticulata*. The latter is now widely cultured in North America and Asia. In 2003, there were forty-five (45) ornamental fish breeders including only five (5) exporters (Fisheries Division records). In the last ten to fifteen years there has been a growing trend towards the preferential culture and export of several exotics. The major exotics produced are listed in Table 7.23.

TABLE 7.22: EXPORTS OF AQUARIUM FISHES IN TRINIDAD, 2000- 2004

Unit: Number of Fishes

YEAR	***Hypostomus Robinii-***	***Corydoras aeneus***	***Poecilia reticulata***	**EXOTICS**	**OTHER[1]**	**TOTAL**
2000	463,062	74,460	5,175,470	1,123,820	614,399	7,451,211
2001	399,885	77,215	4,459,605	1,019,206	631,000	6,586,911
2002	373,285	83,500	4,476,760	820,075	704,000	6,457,620
2003	259,000	88,706	4,636,400	224,210	583,000	5,791,316
2004	165,360	56,845	2,862,135	672,431	476,000	4,232,771

Source: Fisheries Division Records

[1]*The category "**OTHER**" refers to fishes which may be local or imported from other islands in the region from natural or cultured stocks.*

TABLE 7.23: EXOTIC FISHES CULTURED IN TRINIDAD AND EXPORTED

Scientific Name	Common Name
Petrophyllum scalare	angels
Barbus spp.	barbs
Xiphophorus hellerii	swordtails
Astronotus ocellatus	oscars
Brachydanio spp.	danios
Carassius auratus	goldfishes
Characidae family	tetras
Cyprinus carpio	kois
Trichogaster spp., Colisa spp.	gouramies
Xiphophorus maculatus, X. variatus	platies
Betta spp.	fighters
Poecilia spp.	mollies
Symphysanodon spp.	discus
Cichlidae family	African cichlids

Source: Ramnarine *et al.* 1998

7.12 FISH IMPORTS & EXPORTS

Tables 7.24 and 7.25 provide the quantities and values, respectively, of fish imports into Trinidad and Tobago for the period 1995 to 2004, while Tables 7.26 and 7.27 provide the quantities and values, respectively, of fish exports from Trinidad and Tobago for the same period. The fish imports and exports are separated into two major categories: (i) Fresh / Chilled / Frozen / Processed; and (ii) Live. The former category is further separated into four groups: (i) Finfish; (ii) Crustaceans; (iii) Molluscs; and (iv) Other. With regard to the interpretation of these data, it should be noted that "0" imports or exports of a particular species or species group in a particular year does not necessarily mean that there were no imports or exports of that particular species or species group, since it is possible that the particular species or species group may be included within a more general category for example "Other Crustaceans", "Other Molluscs", "Other fish & fish products (mixed/unidentified)".

TABLE 7.24: FISH IMPORTED BY QUANTITY IN TRINIDAD AND TOBAGO, 1995 – 2004 (Unit: Kgs)

FRESH / CHILLED / FROZEN / PROCESSED	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Finfish										
Snappers & Groupers	-	-	-	-	2,974	36,088	118,330	80,056	30,227	32,950
Tunas & Bonitos	410,511	302,824	335,501	625,070	601,391	535,869	1,345,028	3,280,355	2,484,576	2,250,432
Mackerels	189,182	166,769	129,282	230,782	250,087	247,416	218,371	207,360	211,715	228,892
Flyingfish	-	2,701	6,352	95	136,163	-	-	-	-	2,186
Herrings, Sardines, Anchovies	1,382,251	1,769,508	1,627,454	1,225,385	1,766,783	1,381,209	1,468,839	1,329,920	1,701,252	1,854,304
Dogfishes & Other Sharks	-	-	-	-	27,740	39,848	164,148	147,931	80,270	267,972
Eels	-	-	-	-	-	-	-	-	-	114
Cod	22,406	1,601	7,628	22,720,421	7,545	557	2,339	4,943	4,893	1,560
Trout	-	-	-	-	32	394	-	-	203	4,456
Salmon	24,556	52,016	79,396	97,658	129,111	145,342	98,905	147,695	171,580	612,094
Alewives, Saithe, Pollock, Haddock, Hake	-	-	-	-	-	-	-	-	-	36,695
Flatfishes, Soles, Plaice, Halibut	-	-	-	-	931	45	-	-	-	-
Total Finfish	*2,028,906*	*2,295,419*	*2,185,613*	*24,899,411*	*2,922,757*	*2,386,768*	*3,415,960*	*5,198,260*	*4,684,716*	*5,291,655*
Crustaceans										
Shrimps & Prawns	20,534	31,678	20,603	50,445	10,704	24,912	34,343	60,217	54,972	129,679
Crabs	2,108	2,707	8,065	5,258	17,750	9,635	15,150	19,127	11,266	57,726
Lobsters	3,685	3,059	409	1,104	239	177	3,584	4,749	3,028	6,320
Other Crustaceans	2,242	4,559	6,755	8,828	2,527	44,065	7,010	4,871	3,868	9,433
Total Crustaceans	*28,569*	*42,003*	*35,832*	*65,635*	*31,220*	*78,789*	*60,087*	*88,964*	*73,134*	*203,158*
Molluscs										
Mussels	-	-	-	-	2,780	3,439	5,036	3,581	5,883	12,481
Oysters	-	-	-	-	915	314	201	64	522	848
Scallops	-	-	-	-	449	1,415	2,125	3,685	2,952	1,711
Other Molluscs	10,562	2,486	10,333	13,577	6,527	14,996	24,129	23,156	18,476	24,345
Total Molluscs	*10,562*	*2,486*	*10,333*	*13,577*	*10,671*	*20,164*	*31,491*	*30,486*	*27,833*	*39,385*
Other										
Cephalopods (octopus, cuttlefish)	-	-	-	-	2,080	2,490	8,995	6,318	7,449	3,856
Sea eggs	-	-	23	-	-	11	-	-	-	15
Caviar, Roes, Liver	89	382	160	275	237	947	969	5,541	3,524	1,180
Other fish & fish products (mixed/unidentified)	985,281	785,140	843,664	1,267,120	1,280,316	1,079,222	1,849,812	3,231,772	2,173,174	2,768,381
Total Other	*985,370*	*785,522*	*843,847*	*1,267,395*	*1,282,633*	*1,082,670*	*1,859,776*	*3,243,631*	*2,184,147*	*2,773,432*
TOTAL FRESH / CHILLED / FROZEN / PROCESSED	*3,053,407*	*3,125,430*	*3,075,625*	*26,246,018*	*4,247,281*	*3,568,391*	*5,367,314*	*8,561,341*	*6,969,830*	*8,307,630*
LIVE										
Live fish	150	-	-	440	-	144	33	-	-	-
Live shrimps & prawns	-	-	-	-	-	-	140	-	-	-
Other live crustaceans	-	267	-	819	-	-	-	-	-	-
Live mussels	-	-	-	-	-	-	-	-	-	10
Live scallops	-	-	-	-	-	177	-	276	-	-
Other live mollusks	-	-	-	180	-	-	-	-	-	-
Live octopus	-	-	-	-	-	94	-	-	-	-
Live cuttlefish	-	-	-	-	-	-	-	-	901	1,208
Ornamental fish	1,262	2,433	2,757	5,132	2,412	3,361	6,129	4,942	5,394	5,250
TOTAL LIVE	*1,412*	*2,700*	*2,757*	*6,571*	*2,412*	*3,776*	*6,302*	*5,218*	*6,295*	*6,468*
GRAND TOTAL	**3,054,819**	**3,128,130**	**3,078,382**	**26,252,589**	**4,249,693**	**3,572,167**	**5,373,616**	**8,566,559**	**6,976,125**	**8,314,098**

Source: Central Statistical Office, Trade Statistics

TABLE 7.25: FISH IMPORTED BY VALUE IN TRINIDAD AND TOBAGO, 1995 – 2004 (Unit: $TT CIF)

FRESH / CHILLED / FROZEN / PROCESSED	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Finfish										
Snappers & Groupers	-	-	-	-	41,688	565,657	1,407,228	893,875	389,015	430,946
Tunas & Bonitos	6,078,930	4,261,479	4,899,144	9,457,177	8,198,423	6,182,284	8,517,930	23,732,760	21,441,663	24,633,633
Mackerels	1,205,743	1,339,843	1,094,413	1,875,386	2,010,512	2,365,107	1,758,276	1,444,243	1,719,753	1,800,653
Flyingfish	-	120,916	108,980	1,798	373,739	-	-	-	-	62,980
Herrings, Sardines, Anchovies	14,370,101	17,610,579	17,948,572	14,439,936	16,561,761	15,594,568	16,292,493	13,790,678	17,237,638	19,414,246
Dogfishes & Other Sharks	-	-	-	-	308,577	256,785	1,225,645	1,256,977	712,001	2,267,644
Eels	-	-	-	-	-	-	-	-	-	8,109
Cod	171,161	23,254	105,838	284,660	20,363	15,257	102,385	84,431	116,864	19,115
Trout	-	-	-	-	334	11,637	-	-	5,550	2,105
Salmon	537,256	1,035,876	1,373,202	1,716,726	2,445,418	2,627,383	1,638,852	2,028,027	3,138,164	4,111,745
Alewives, Saithe, Pollock, Haddock, Hake	-	-	-	-	-	-	-	-	-	360,741
Flatfishes, Soles, Plaice, Halibut	-	-	-	-	14,394	1,359	-	-	-	-
Total Finfish	*22,363,191*	*24,391,947*	*25,530,149*	*27,775,683*	*29,975,209*	*27,620,037*	*30,942,809*	*43,230,991*	*44,760,648*	*53,111,917*
Crustaceans										
Shrimps & Prawns	1,061,311	753,288	967,812	891,691	202,169	586,187	507,633	875,872	1,095,207	1,817,119
Crabs	21,893	26,508	75,424	68,518	210,859	214,091	248,058	258,277	190,385	216,283
Lobsters	70,438	80,285	29,181	82,529	15,357	1,356	112,897	217,160	80,090	601,628
Other Crustaceans	42,788	119,040	166,936	210,202	38,708	52,280	134,511	96,856	36,651	112,229
Total Crustaceans	*1,196,430*	*979,121*	*1,239,353*	*1,252,940*	*467,093*	*853,914*	*1,003,099*	*1,448,165*	*1,402,333*	*2,747,259*
Molluscs										
Mussels	-	-	-	-	39,084	42,058	58,221	31,448	78,059	66,332
Oysters	-	-	-	-	17,287	14,486	17,244	10,270	8,959	17,029
Scallops	-	-	-	-	13,133	35,001	55,647	63,350	67,365	36,523
Other Molluscs	71,110	41,627	135,597	211,885	89,624	314,520	351,757	358,975	310,581	430,948
Total Molluscs	*71,110*	*41,627*	*135,597*	*211,885*	*159,128*	*406,065*	*482,869*	*464,043*	*464,964*	*550,832*
Other										
Cephalopods (octopus, cuttlefish)	-	-	-	-	28,954	32,382	131,637	93,098	112,703	54,701
Sea eggs	-	-	4,990	-	-	5,035	-	-	-	1,286
Caviar, Roes, Liver	2,329	8,816	4,434	5,624	6,901	19,921	18,767	34,181	56,675	22,758
Other fish & fish products (mixed/unidentified)	7,939,203	9,711,382	11,313,084	15,550,292	15,081,287	12,834,031	20,100,011	27,565,287	28,511,766	29,702,996
Total Other	*7,941,532*	*9,720,198*	*11,322,508*	*15,555,916*	*15,117,142*	*12,891,369*	*20,250,415*	*27,692,566*	*28,681,144*	*29,781,741*
TOTAL FRESH / CHILLED / FROZEN / PROCESSED	*31,572,263*	*35,132,893*	*38,227,607*	*44,796,424*	*45,718,572*	*41,771,385*	*52,679,192*	*72,835,765*	*75,309,089*	*86,191,749*
LIVE										
Live fish	14,771	-	-	13,401	-	12,280	2,888	-	-	-
Live shrimps & prawns	-	-	-	-	-	-	10,692	-	-	-
Other live crustaceans	-	11,385	-	17,787	-	-	-	-	-	-
Live mussels	-	-	-	-	-	-	-	-	-	223
Live scallops	-	-	-	-	-	9,694	-	6,841	-	-
Other live molluscs	-	-	-	2,000	-	-	-	-	-	-
Live octopus	-	-	-	-	-	5,160	-	-	-	-
Live cuttlefish	-	-	-	-	-	-	-	-	11,410	17,510
Ornamental fish	29,953	66,639	68,730	91,423	51,957	63,129	105,450	93,618	156,767	149,351
TOTAL LIVE	*44,724*	*78,024*	*68,730*	*124,611*	*51,957*	*90,263*	*119,030*	*100,459*	*168,177*	*167,084*
GRAND TOTAL	**31,616,987**	**35,210,917**	**38,296,337**	**44,921,035**	**45,770,529**	**41,861,648**	**52,798,222**	**72,936,224**	**75,477,266**	**86,358,833**

Source: Central Statistical Office, Trade Statistics

TABLE 7.26: FISH EXPORTED BY QUANTITY FROM TRINIDAD AND TOBAGO, 1995 – 2004 (Unit: kgs)

FRESH / CHILLED / FROZEN / PROCESSED	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Finfish										
Snappers & Groupers	-	-	-	-	1,868,210	944,241	1,325,438	834,277	534,346	386,507
Tunas & Bonitos	362,899	291,562	210,155	691,857	84,291	62,155	82,598	133,194	451,300	720,405
Mackerels	32,547	43,386	22,333	12,242	8,279	17,827	5,821	5,816	4,115	1,788
Flyingfish	89,024	141,725	49,763	175,556	99,793	85,560	144,983	172,696	166,633	197,613
Herrings, Sardines, Anchovies	515,728	589,781	88,595	33,763	53,651	54,664	51,298	83,450	23,103	18,211
Dogfishes & Other Sharks	-	-	-	-	12,749	31,993	56,845	40,727	16,787	12,846
Eels	-	-	-	-	-	-	-	-	-	-
Cod	16,424	14,859	22,906	114,872	68,269	5,268	1,119	255	371	1,547
Trout	-	-	-	-	-	200	20	2,098	45	60
Salmon	386	-	2,965	296	22,505	1,521	5,409	521	730	1,222
Alewives, Saithe, Pollock, Haddock, Hake	-	-	-	-	1,374	113	1,134	3,276	14	-
Flatfishes, Soles, Plaice, Halibut	25	-	-	642	260	10,521	3,516	10,899	2,184	717
Total Finfish	*1,017,033*	*1,081,313*	*396,717*	*1,029,228*	*2,219,381*	*1,214,063*	*1,678,181*	*1,287,209*	*1,199,628*	*1,340,916*
Crustaceans										
Shrimps & Prawns	498,534	348,962	5,092,408	162,842	146,811	116,338	183,612	101,861	119,104	84,032
Crabs	-	3	-	-	64,290	34,447	42,095	39,812	28,132	34,173
Lobsters	5,563	511	899	383	6,689	3,484	3,941	12,559	30,016	15,108
Other Crustaceans	117,535	74,054	86,661	39,054	504	538	2,870	15,723	16,343	5,648
Total Crustaceans	*621,632*	*423,530*	*5,179,968*	*202,279*	*218,294*	*154,807*	*232,518*	*169,955*	*193,595*	*138,961*
Molluscs										
Mussels	-	-	-	-	20	-	-	-	-	104
Oysters	-	-	-	-	-	-	-	-	-	-
Scallops	-	-	-	-	-	-	-	-	-	-
Other Molluscs	2,313	1,270	11,974	25,238	10	182	1,491	13,220	2,632	1,686
Total Molluscs	*2,313*	*1,270*	*11,974*	*25,238*	*30*	*182*	*1,491*	*13,220*	*2,632*	*1,790*
Other										
Cephalopods (octopus, cuttlefish)	-	-	-	-	1,520	634	481	305	73	515
Sea eggs	-	-	-	-	-	-	-	-	-	-
Caviar, Roes, Liver	117	16,765	481	23	-	23	-	1,061	3	440
Other fish & fish products (mixed/unidentified)	3,198,224	4,098,012	4,566,961	7,216,740	5,600,255	2,867,871	3,051,050	3,503,818	2,518,679	1,526,058
Total Other	*3,198,341*	*4,114,777*	*4,567,442*	*7,216,763*	*5,601,775*	*2,868,528*	*3,051,531*	*3,505,184*	*2,518,755*	*1,527,013*
TOTAL FRESH / CHILLED / FROZEN / PROCESSED	*4,839,319*	*5,620,890*	*10,156,101*	*8,473,508*	*8,039,480*	*4,237,580*	*4,963,721*	*4,975,568*	*3,914,610*	*3,008,680*
LIVE										
Live fish	2,407	3,215	2,694	1,430	-	1,018	30	45	3,575	90
Live shrimps & prawns	-	-	-	-	10	-	-	-	-	1,639
Other live crustaceans	2,375	9,091	24,663	23,458	-	-	-	-	-	-
Live mussels	-	-	-	-	-	-	15	-	-	30
Live scallops	-	-	-	-	-	-	-	-	-	-
Other live molluscs	-	-	-	30	-	-	-	-	-	-
Live octopus	-	-	-	-	-	-	-	-	-	-

Live cuttlefish	-	-	-	-	170	91	60	-	-	59
Ornamental fish	100,961	106,537	121,434	134,346	118,614	128,025	127,346	100,486	88,201	81,472
TOTAL LIVE	*105,743*	*118,843*	*148,791*	*159,264*	*118,794*	*129,134*	*127,451*	*100,531*	*91,776*	*83,290*
GRAND TOTAL	**4,945,062**	**5,739,733**	**10,304,892**	**8,632,772**	**8,158,274**	**4,366,714**	**5,091,172**	**5,076,099**	**4,006,386**	**3,091,970**

Source: Central Statistical Office, Trade Statistics

TABLE 7.27: FISH EXPORTED BY VALUE FROM TRINIDAD AND TOBAGO, 1995 – 2004 (Unit: $TT f.o.b.)

FRESH / CHILLED / FROZEN / PROCESSED	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Finfish										
Snappers & Groupers	-	-	-	-	23,661,702	15,482,308	12,514,968	13,952,260	9,838,739	6,897,574
Tunas & Bonitos	3,977,079	3,583,764	3,007,680	5,529,924	1,020,607	730,681	926,275	1,150,635	3,907,095	5,720,134
Mackerels	124,899	233,312	173,614	92,577	51,604	166,051	87,666	95,052	42,580	22,047
Flyingfish	2,253,800	2,473,325	1,105,989	4,099,776	2,330,941	2,789,991	3,547,462	3,760,055	3,792,215	4,671,456
Herrings, Sardines, Anchovies	4,538,011	6,237,765	1,018,184	365,606	286,947	638,804	568,807	920,420	233,448	323,616
Dogfishes & Other Sharks	-	-	-	-	120,649	343,938	732,528	1,035,519	425,864	456,221
Eels	-	-	-	-	-	-	-	-	-	-
Cod	321,395	220,567	403,098	1,640,314	674,655	38,696	16,375	4,748	9,356	42,098
Trout	-	-	-	-	-	3,937	150	23,139	4,000	2,331
Salmon	7,615	-	41,388	6,223	134,397	20,805	35,343	7,660	8,688	30,974
Alewives, Saithe, Pollock, Haddock, Hake	-	-	-	-	18,760	2,284	12,500	40,000	200	-
Flatfishes, Soles, Plaice, Halibut	360	-	-	10,590	4,645	155,029	28,174	202,547	55,228	30,017
Total Finfish	*11,223,159*	*12,748,733*	*5,749,953*	*11,745,010*	*28,304,907*	*20,372,524*	*18,470,248*	*21,192,035*	*18,317,413*	*18,196,468*
Crustaceans										
Shrimps & Prawns	17,582,190	13,537,834	10,621,505	9,995,982	9,619,951	7,483,940	8,800,699	4,821,945	5,020,507	3,598,312
Crabs	-	149	12	0	651,531	411,324	446,801	504,800	458,876	573,366
Lobsters	616,924	18,449	94,862	24,003	303,298	123,569	163,476	350,212	773,000	688,149
Other Crustaceans	3,940,727	427,388	720,493	420,899	11,740	25,611	48,032	422,907	609,253	78,153
Total Crustaceans	*22,139,841*	*13,983,820*	*11,436,872*	*10,440,884*	*10,586,520*	*8,044,444*	*9,459,008*	*6,099,864*	*6,861,636*	*4,937,980*
Molluscs										
Mussels	-	-	-	-	320	-	-	-	-	9,550
Oysters	-	-	-	-	-	-	-	-	-	-
Scallops	-	-	-	-	-	-	-	-	-	-
Other Molluscs	26,344	29,669	257,964	272,467	1,500	1,635	39,774	154,605	92,325	42,144
Total Molluscs	*26,344*	*29,669*	*257,964*	*272,467*	*1,820*	*1,635*	*39,774*	*154,605*	*92,325*	*51,694*
Other										
Cephalopods (octopus, cuttlefish)	-	-	-	-	27,117	12,969	6,993	4,358	3,996	22,377
Sea eggs	-	-	-	-	-	-	-	-	-	-
Caviar, Roes, Liver	3,279	93,848	6,960	657	-	1,362	-	10,807	283	8,320
Other fish & fish products (mixed/unidentified)	25,248,637	43,451,158	43,439,507	67,142,157	36,225,898	36,259,539	35,209,591	42,065,117	35,880,587	18,470,374
Total Other	*25,251,916*	*43,545,006*	*43,446,467*	*67,142,814*	*36,253,015*	*36,273,870*	*35,216,584*	*42,080,282*	*35,884,866*	*18,501,071*
TOTAL FRESH / CHILLED / FROZEN / PROCESSED	*58,641,260*	*70,307,228*	*60,891,256*	*89,601,175*	*75,146,262*	*64,692,473*	*63,185,614*	*69,526,786*	*61,156,240*	*41,687,213*
LIVE										
Live fish	61,734	103,240	87,151	47,508	-	26,573	105	954	12,639	2,381
Live shrimps & prawns	-	-	-	-	140	-	-	-	-	158,587
Other live crustaceans	7,582	85,473	118,951	190,792	-	-	-	-	-	-
Live mussels	-	-	-	-	-	-	168	-	-	3,500
Live scallops	-	-	-	-	-	-	-	-	-	-
Other live molluscs	-	-	-	560	-	-	-	-	-	-
Live octopus	-	-	-	-	-	-	-	-	-	-
Live cuttlefish	-	-	-	-	2,903	2,180	795	-	-	4,564
Ornamental fish	1,732,548	2,091,239	2,808,202	2,602,239	2,414,483	2,200,841	2,104,745	1,870,218	1,622,610	1,543,535
TOTAL LIVE	*1,801,864*	*2,279,952*	*3,014,304*	*2,841,099*	*2,417,526*	*2,229,594*	*2,105,813*	*1,871,172*	*1,635,249*	*1,712,567*
GRAND TOTAL	**60,443,124**	**72,587,180**	**63,905,560**	**92,442,274**	**77,563,788**	**66,922,067**	**65,291,427**	**71,397,958**	**62,791,489**	**43,399,780**

Source: Central Statistical Office, Trade Statistics

CHAPTER 8

WATER RESOURCES

Photograph courtesy THA

Photograph courtesy Richard Edwards

Photograph courtesy Tyrone Gopaul

Photograph courtesy THA

8 Water Resources

Introduction

Water is vital to all forms of life on earth, from the simplest of living organisms to the most complex of human systems. It is a vital element in the social and economic infrastructure and as populations increase, the demand for water grows. The health and welfare of this increasing population bears a direct relationship to the availability of water, first for personal use and secondly for use in their economic activities. Water consumption is directly related to the size, distribution and composition of the population. Population projections therefore assume major importance in estimating future potable water requirements. The main water-related socio-economic activities in Trinidad and Tobago are industry, agriculture, recreation and tourism.

Leisure activity near "The Creek"
in South Trinidad

Water requirement criteria set by the World Bank states that the minimum water availability required to sustain human life is approximately 1000 cubic meters per capita per year. Trinidad and Tobago, with an annual average water production of 2500 cubic meters per capita per year, is clearly not a water scarce country. This availability indicates that the water needs of the populace can be adequately met.

However, there is the potential for an increase in extreme events, for example, an increase in flooding and or extended drought-like periods as a result of climate change. The predicted impacts of global warming on these aspects are negative.

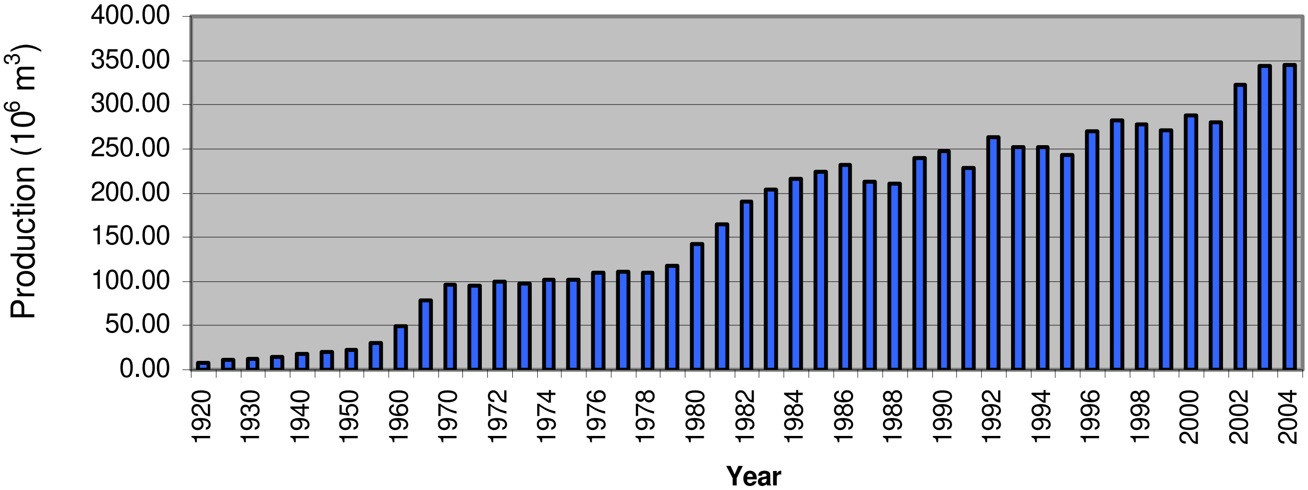
8.1 Water Production and Consumption

Potable water was first produced in Trinidad in 1835 with the commissioning of the Maraval Water Treatment Plant, which had an output of 1 million gallons per day (mgd) whereas in Tobago, Water Development started in 1952 with the commissioning of the Hillsborough Water Treatment Facility, with a production of 1.5 mgd.

In Trinidad the total water production for the public water supply system increased steadily over the period 1950 to 2002. In 1962, the Navet Waterworks and Treatment Plant were commissioned to treat approximately 10 million cubic meters (10 MCM) per year. During the period 1970 to 1990 the average supply increased by about 160 % from approximately 99 MCM to 255 MCM per year.

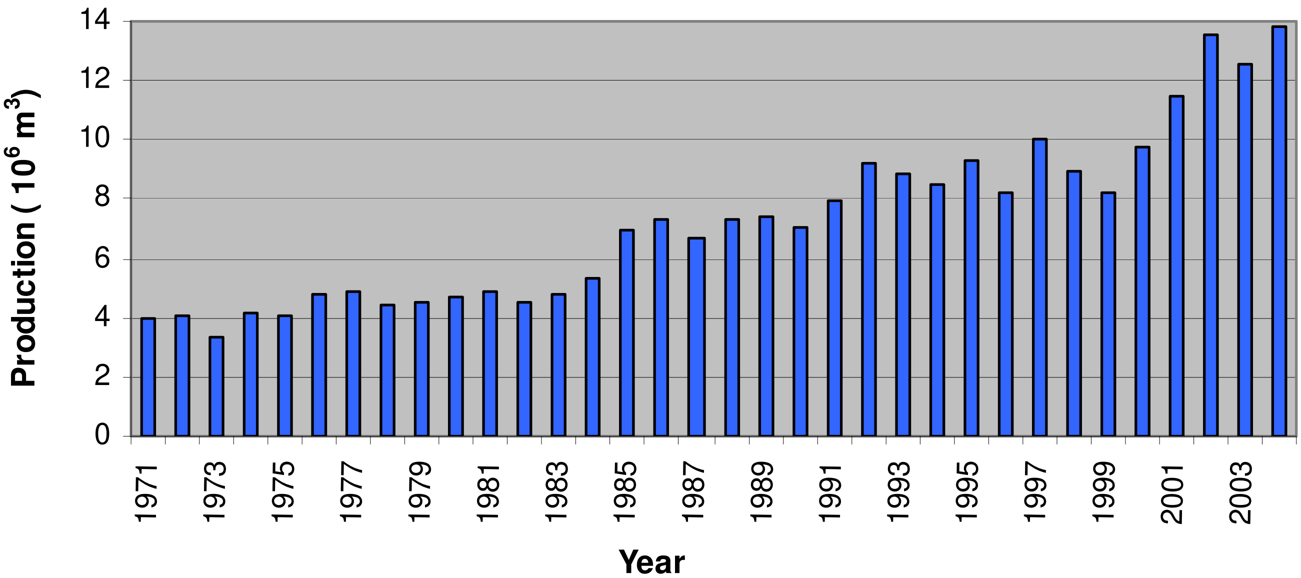
Prior to the year 2000, surface water abstraction in Tobago accounted for approximately 98% of the public water supply, with groundwater abstraction occurring primarily at Bloody Bay and Government Farm in Scarborough. The public water supply was provided by the Hillsborough impounding reservoir, two (2) intakes and three (3) wells to supply Scarborough and the West of the island, while isolated intakes supplied the rest of the island on a local basis. Production data for Trinidad for the period 1920 to 2004 and Tobago for the period 1971-2004 are presented in Figures 8.1 and 8.2 respectively.

FIGURE 8.1 ANNUAL WATER PRODUCTION IN TRINIDAD, 1920 – 2004



Throughout the mid to late 1990's various programmes aimed at augmenting the public water supply have been commissioned. These developments include the South and North Water projects (1998-2000), the Caroni Water Treatment Plant upgrade (1999), the Tobago Well Development (2000), and The Trinidad Well Development Programme.

FIGURE 8.2 ANNUAL WATER PRODUCTION IN TOBAGO, 1971 – 2004



Source of Figs 8.1 and 8.2: Water and Sewerage Authority of Trinidad and Tobago

During the year 2001, total water production in Trinidad and Tobago stood at approximately 291 MCM per year. Approximately 207 MCM (71%) came from surface water sources, while groundwater production accounted for the balance of 84 MCM (29 %).

8.2 Existing State of the Water Supply Sector

Throughout the decades, the expansion and improvements in the public water supply network has continued to such an extent that today outlying districts in, for example, Cedros and Moruga are connected to the distribution system. It is estimated that at present approximately 86% of the population of Trinidad and Tobago has a potable water supply. This is expected to increase to 98% by the year 2010.

The public water supply is composed of both surface and groundwater sources. The various components of public water supply system for both islands are presented in Table 8.1. A cursory glance at these tables reveals that, with the exception of the Navet scheme, the major portion of the surface water input into WASA's production capacity in Trinidad is obtained from river intakes and storage dams in the Northern areas of the country. It is essential to recognize that the sustainability of the country's water supplies depends on maintaining these surface water systems.

TABLE 8.1 THE PUBLIC WATER SUPPLY SYSTEM OF TRINIDAD AND TOBAGO

System	Components
Northern Systems	Hollis Reservoir and other smaller intakes serves Arima and surroundings
North Oropuche	River Intake to serve Sangre Grande, Arima and Westwards.
Caroni Dam and WTP	A major reservoir in the North Central to serve the North and South of the island in an approximate 50:50 ratio.
NorthWest System	Water from Caroni North is supplemented by seven (7) wellfields and river intakes to serve the City of Port-of-Spain and suburbs.
Southern System	Water from Caroni South for areas in Central (including Point Lisas) and South.
Navet Scheme	The second largest reservoir in the Central area to serve the City of San Fernando and suburbs.
Isolated South Plants	Small intakes, and wellfield within the South one-third of the island to supply localised demands.
Tobago – South west System	Hillsborough impounding reservoir, two (2) intakes and eight (8) wells to supply Scarborough and the West of the island.
Tobago - Isolated Plants	Three (3) small intakes and four (4) wells supply the rest of the island on a localised basis.

Source: Water and Sewerage Authority of Trinidad and Tobago

TABLE 8.2 IMPORTANT FACTS ON WATER RESOURCES IN TRINIDAD AND TOBAGO

Number of Water Production Sources	142
Pumping stations (booster station)	110
Rural intakes and spring sources	48
Wells	439
Surface reservoirs with a total capacity of 409 millions gallon (85 in use)	175
Water treatment plants	57
Lift stations	24
Water customers	300,000
Wastewater customers	46,000
Raw water reservoirs: Arena Hollis Navet Hillsborough	 9.8 billion gallons capacity 1.04 billion gallons capacity 4.1 billion gallons capacity 225 million gallons capacity
Water mains (pipeline) ranging from 20 mm to 1,350mm in diameter	4,073.7 kilometers
Public sewer mains	1,140km
Population- access to water services	90%
Population- covered by WASA wastewater	20%
24/7 supply of water	18%
Compliance- chemical	63%
Wastewater water treated	200 i.m.g.d.

Source: Water and Sewerage Authority of Trinidad and Tobago

Hillsborough Dam in Tobago

Navet Dam - Trinidad

Arena Dam - Trinidad

Hollis Dam – Trinidad

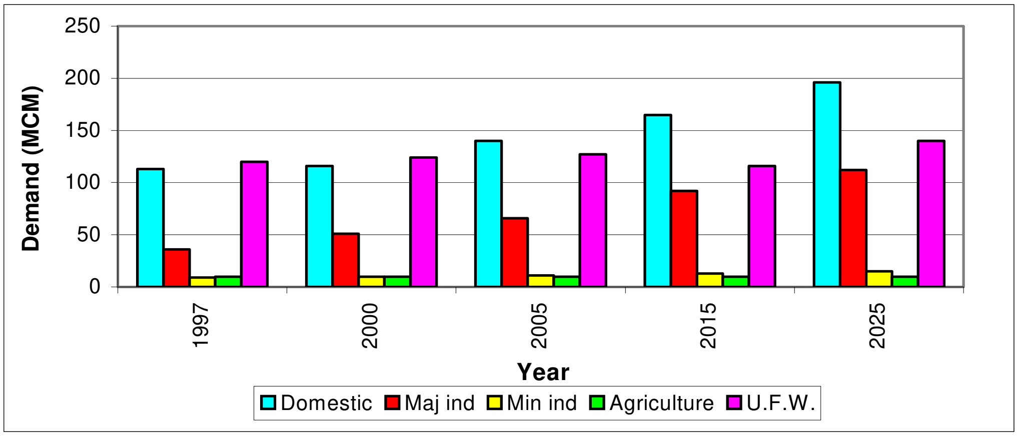
8.3 Water Demand

The demand for water on the islands is classified as consuming or non-consuming. The former includes domestic water, industrial (major and minor), irrigation requirements and unaccounted-for-water (UFW). The latter classification is related to the minimum flows required to maintain healthy ecosystems in rivers and swamps, and is generally estimated as a minimum of 20% of the natural river flow.

Estimates of consuming demands for the year 1997 and future projections in Trinidad and Tobago are shown in Figures 8.3 and 8.4. The proportion of each demand component with respect to the overall demand in 2000 is illustrated in Figures 8.5 and 8.6

While there is no formal policy, allocation of the resources among competing users is in the following order of priority: - domestic, industrial, agricultural and ecological. However, there are many cases where the order of priority changes within certain basins.

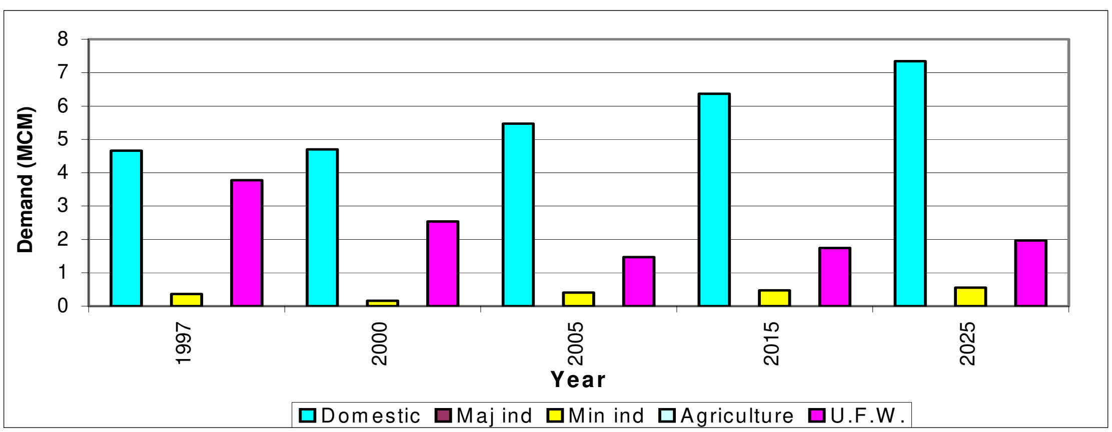
FIGURE 8.3 CONSUMING WATER DEMAND FOR TRINIDAD, 1997 – 2025



Source: Water and Sewerage Authority of Trinidad and Tobago

The water demand for domestic consumers was calculated using a population growth rate of 0 .7 % per annum, beginning with a population base of 1.3 million in 1995 and a per capita consumption of 2 cubic meters m^3/day. Estimated UWF was 43% for 1997, and expected to decline to 30% in the 2025.

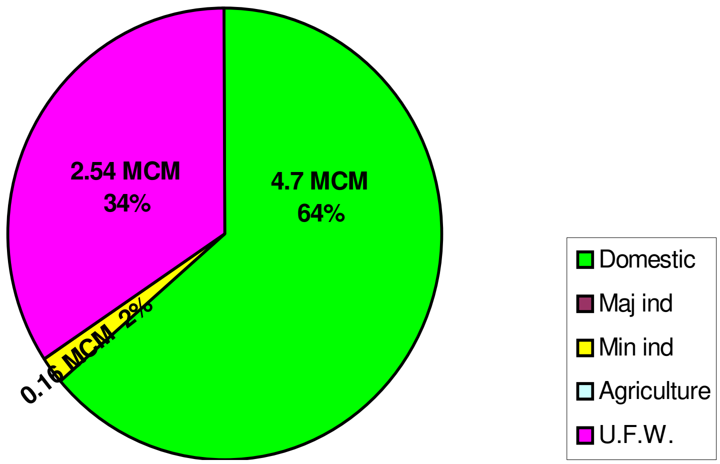
FIGURE 8.4 CONSUMING WATER DEMAND FOR TOBAGO, 1997 – 2025



Source: Water and Sewerage Authority of Trinidad and Tobago

Irrigation demand estimates have been obtained by scrutiny of the irrigated area (present base- 3, 40 hectares), the unit demand for each crop, and irrigation efficiency. Given the current economic outlook, indications are that this sector will not expand significantly over the period. However, there are substantial amounts of arable lands, which, when irrigated, could provide for expansion in the agricultural sector. Unlikely though that is, should that happen the demand for irrigation water will increase dramatically, and will have to be factored in the projections.

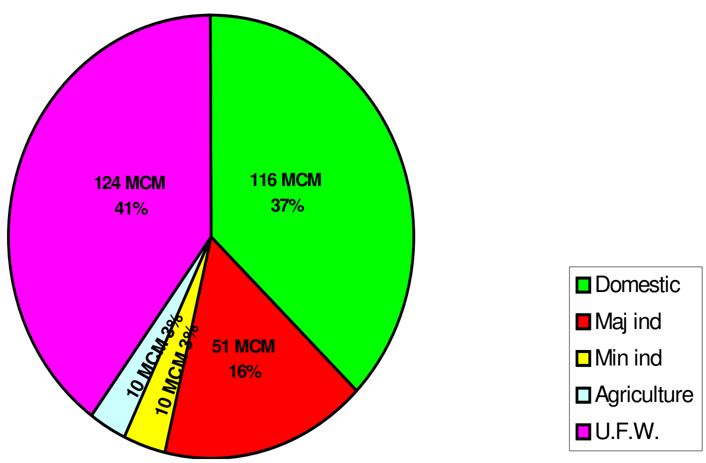
FIGURE 8.5 PROPORTIONS OF COMPETING CONSUMING DEMANDS, Trinidad 2000



Source: Water and Sewerage Authority of Trinidad and Tobago

FIGURE 8.6 PROPORTIONS OF COMPETING CONSUMING DEMANDS, Tobago 2000

Source: Water and Sewerage Authority of Trinidad and Tobago



8.4 Public Water Supply and Demand

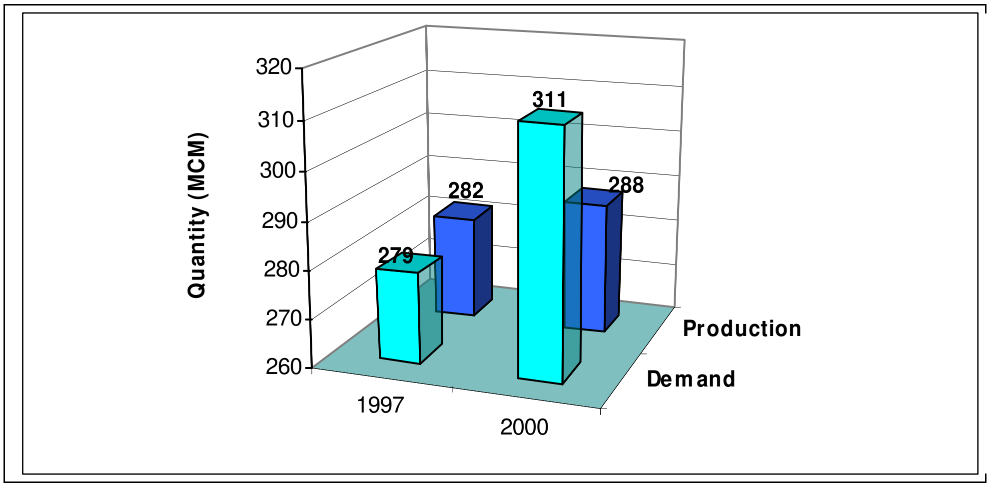
In 1997, the demand was generally equaled by water production in Trinidad. In 2000, WASA reported that 288 MCM of water was produced from surface water and groundwater sources for the public water system in Trinidad. During this year however, a total non-consuming water demand of 311 MCM was reported, leading to a deficit of some 23 MCM.

WASA pipeline

Similarly in Tobago, water production generally satisfied demand in 1997. In 2000, WASA reported that 12 MCM was supplied to its customers through the public water system. During this year, a total non-consuming water demand of 8.7 MCM was reported. Approximately 4 MCM of this supply originated from recently developed groundwater sources in bedrock aquifers.

The public water supply and demand situation for the islands is presented in Figures 8.7 and 8.8.

FIGURE 8.7 PUBLIC WATER SUPPLY AND DEMAND IN TRINIDAD, 1997 AND 2000



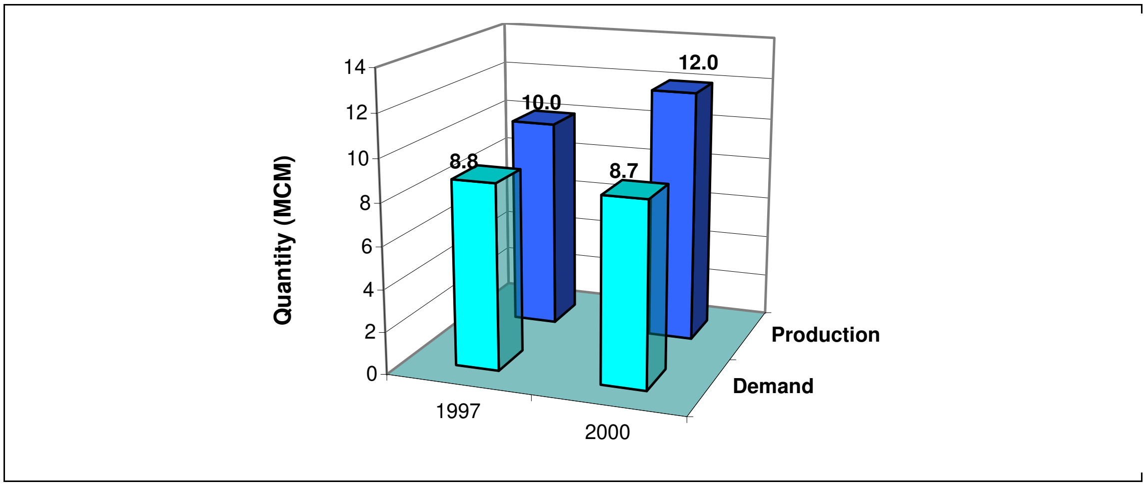
Source: Water and Sewerage Authority of Trinidad and Tobago

Figure 8.7 shows a shortfall in the production supply in the year 2000. However, it must be realized that these demand and production figures are averages over the country and over individual year periods. It must also be remembered that:

- They do not reflect daily variations where these are not buffered by storage
- They do not reflect seasonal variations
- The supply-versus-demand situation varies from area to area in the country (distribution restrictions)
- The supply is presently intermittent in many areas and therefore where a twenty-four hour supply is contemplated, losses may well be considerably higher than the assumed 34%.

Furthermore, the reliability of the production data may be limited by the distribution of functioning metering devices. Production records in many cases are likely to reflect only the number of days or months that the facility has been operational at a production rate, which is presumed to equate to the original design capacity.

FIGURE 8.8 PUBLIC WATER SUPPLY AND DEMAND IN TOBAGO, 1997 and 2000



Source: Water and Sewerage Authority of Trinidad and Tobago

Therefore, considering the actual situation in Trinidad and Tobago where scheduled supply is judged necessary in many areas in order to distribute inadequate resources as best as possible, it must be concluded that:

- Maximum effort must be made to reduce leakage
- Improvements must be made to the distribution system to bring water from the production facilities to the demand areas
- Existing production facilities must be refurbished so as to ensure maximum output
- Additional production facilities should be planned, designed and constructed
- Data collection on actual supply and demand must be improved.

8.5 Industrial Demand and Sea Water Desalination

Projected scenarios indicate that the demand for domestic water is expected to nearly double over the next twenty-five (25) years while the industrial demand will increase by three (3) times over the same period.

To meet short term industrial demand at Point Lisas, a new source of water had to be developed as soon as possible. It was evident from the recent rapid growth in industrial demand, that there was need for a short-term, low-risk solution. After an exhaustive look at all available alternatives, an on-site desalination plant was recommended (WRMS, 1999). The plant was subsequently commissioned in March 2002.

Based on the projected growth in demand of the industrial, domestic, agricultural/irrigation and tourism sectors, from a national supply point of view the desalination plant is only a temporary measure. The provision of a desalination plant at Point Lisas was recommended as being the most important part in a plan stressing the need to relieve the burden on the domestic water supply system in the shortest possible time. The development of intakes and reservoir systems in areas such as North Oropouche, Matura, and Moruga have proved the most reliable supply, but due to their lengthy gestation period of between ten (10) and fifteen (15) years are not expected to be completed before 2015.

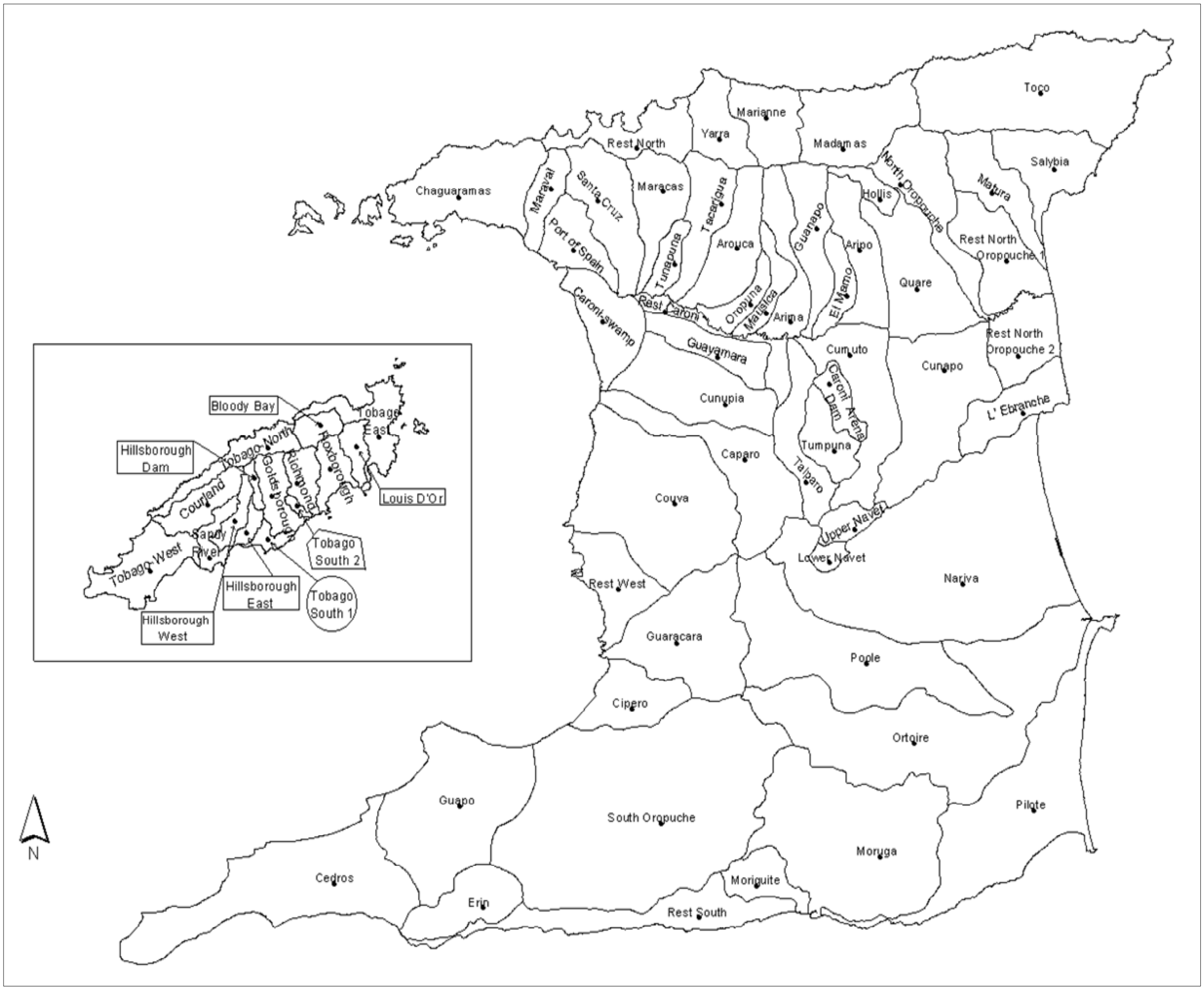
The desalination project has provided short-term relief, by reducing the gap between water demand and supply in the estate. The deslination plant has reduced current shortfall and allows more water from Caroni Waterworks to be available to improve supplies to domestic customers. Although seawater desalination is new to Trinidad, it is an option adopted for the provision of potable water by many countries of the world – including Barbados here in the Caribbean. The advantages of this project are a limitless supply of seawater from the Gulf of Paria and the lessening of transmission losses due to the close proximity of the demand centre.

The Point Lisas desalination facility is owned and operated by the Desalination Company of Trinidad and Tobago (Desalcott). WASA purchased 25.86 MCM from the plant in 2002 and 35.08 MCM in 2003.

8.6 Watersheds and Catchments Status

For the purposes of watershed management, Trinidad and Tobago has been subdivided into fifty-four (54) and fifteen (15) watershed areas respectively, as illustrated in Map 8.1. By reducing catchment degradation and soil erosion rates, watershed management practices aim to have a significant effect on the country's water resources.

MAP 8.1 CATCHMENT AREAS OF TRINIDAD AND TOBAGO



Source**:** Water and Sewerage Authority of Trinidad and Tobago

The timing and distribution of the streamflow within the catchment, and the sediment load of discharges entering the lower reaches of rivers are particularly influenced by the state of a particular watershed. Proper watershed management practices strive to minimise the sediment load in river systems, thereby reducing reservoir storage losses, treatment costs and incidents of flooding.

8.7 Water Pollution

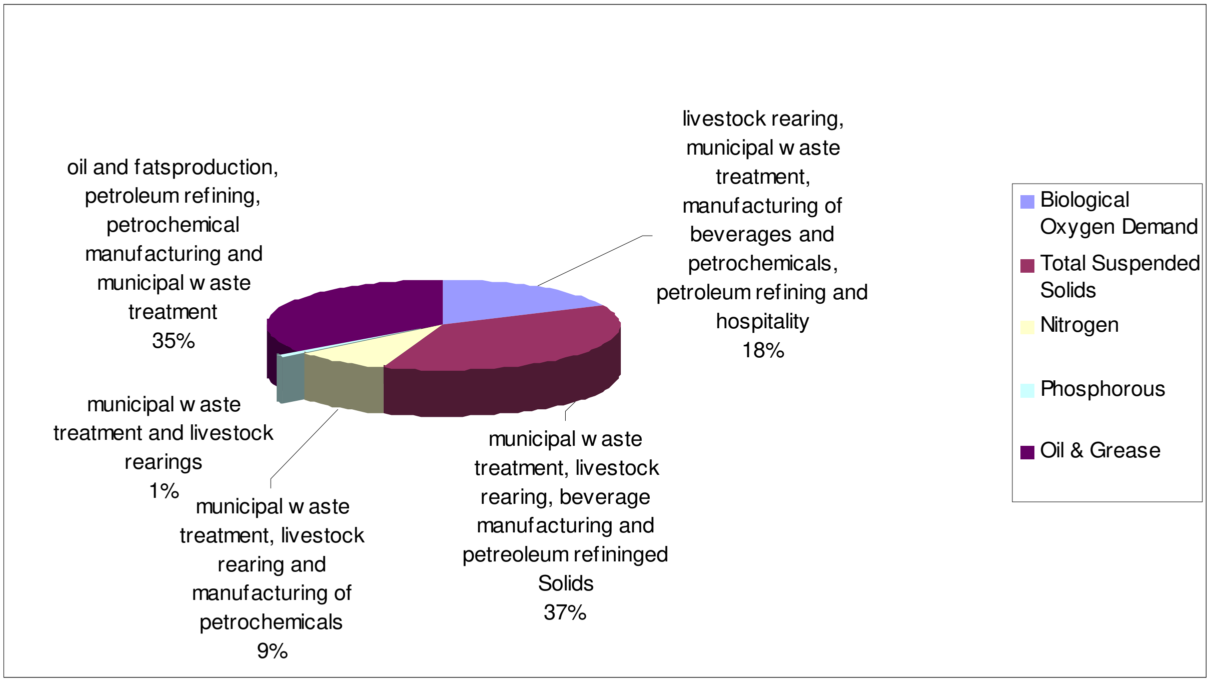
Categories of Pollution

Surface Water Systems**:**

The major pollutants found in the Trinidad and Tobago water systems are solids (measured as total suspended solids), organics (measured as biological oxygen demand), oil and grease, nitrogen and phosphorous. The relative percentages of these pollutant loads and their sources are shown in Figure 8.8. Other pollutants, heavy metals – namely nickel, cadmium, chromium, lead, zinc and copper were also detected in certain river systems and river sediments across Trinidad and Tobago. However, only lead, zinc and copper were above the United States Environment Protection Agency (USEPA) National Recommended Water Quality Criteria (Corrected, 1999).

Water turbidity of water course in South Trinidad

FIGURE 8.9 MAJOR POLLUTANTS IN TRINIDAD AND TOBAGO'S WATER SYSTEMS, 1998



Source: Environmental Management Authority, 1998

Trinidad and Tobago is one of the most industrialised countries in the Caribbean region with industries ranging from sugar and oil refining, rum distillation and the manufacture of petro-chemicals, to paint, metal finishing, and agro-processing. Effluents from oil and sugar cane refining affect the rivers in South Trinidad. The impact of industrial effluents on water resources is seen mainly along the foothills of the Northern Range, Central-West and the South-West coast of Trinidad. Industrial activity in Tobago is relatively small, being concentrated in the South-West and Central parts of the island.

Most of the sewerage treatment plants operating in Trinidad and Tobago are inefficient, since they produce effluent, which exceeds the standards for faecal coliform and biological oxygen demand (BOD). Non-functional sewerage treatment plants, livestock farms, overflowing septic tanks and pit latrines discharge significant quantities of organic waste into the nation's waterways.

The total domestic and livestock waste for Trinidad and Tobago was estimated as 10.4 million kilograms/year with 45% being contributed from domestic sources and 55% from livestock. Table 8.3 shows the annual pollutant loads for BOD, suspended solids, nitrogen and phosphorous. It must be noted that Tobago accounts for 4% of both the domestic waste and livestock waste.

TABLE 8.3 WASTE LOAD PRODUCTION/DISCHARGES FOR TRINIDAD AND TOBAGO

Country	Source	Type of Load	BOD	Suspended Solids	Nitrogen	Phosphorous
			(x 1000 kg/yr)	(x1000 kg/yr)	(x 1000 kg/yr)	(x 1000 kg/yr)
Trinidad	Domestic	Produced	19,371	114,073	3,300	825
	Livestock	Produced	39,444	105,980	3,460	562
Tobago	Domestic	Discharged	1,438	2,593	492	131
	Livestock	Discharged	197	5,299	173	28

Source: Water and Sewerage Authority of Trinidad and Tobago

Substantial quantities of domestic refuse and solid wastes are dumped in the watercourses of Trinidad and Tobago. These wastes consist of animal entrails, chicken feathers, faeces, used containers, and bulky household items. Domestic refuse and solid waste not only clog the waterways and produce offensive odours, but may also dissolve to produce chemical residues which lower water quality.

The existing wastewater infrastructure covers only thirty percent (30%) of the population, with WASA covering twenty percent (20%) of this figure and other providers the remaining ten (10%) percent. The remainder of the population is covered by either private on lot systems such as cesspits and soakaways or pit latrines.

The total volume of wastewater treated is approximately 200 i.m.g.d. There are over 200 Wastewater Treatment Plants (WWTPs) of which 35 are either WASA owned or operated. Twelve (12) were originally owned by WASA while twenty-one (23) plants have been taken over from the HDC (previously NHA), one (1) from the LSA and one (1) from the Sugar & Welfare. Some of the major WWTPs in Trinidad and Tobago are:

New Beetham WWTP
San Fernando WWTP
Arima WWTP
Scarborough WWWTP
Trincity WWTP
Penco Lands WWTP
Lange Park WWTP
Malabar WWTP
Techier WWTP
Edinburgh WWTP
Point Gourde WWTP

The Authority has embarked on the implementation of some of the recommendations of several studies conducted on the wastewater sector in Trinidad and Tobago, including:

- Construction of a new wastewater treatment plant at Beetham to serve three hundred and sixty thousand customers of the greater Port of Spain area (nearing completion);
- Construction of a wastewater facility for Southwest Tobago;
- Adoption/regularization, on a phased-basis, of all NHA and private package wastewater treatment plants

The Water and Sewerage Authority (WASA) conducts the most extensive ongoing water quality monitoring in the country through its routine samplings at all surface water intakes. The sampling regime, although focused on water sources for the public water supply, yields information characteristic of a substantial portion of the island of Trinidad. Over the years there is proof that many surface bodies of water are affected by high levels of organic material (expressed as BOD), pathogens (expressed as faecal coliform) and solids (expressed as turbidity). Table 8.4 shows data from this sample regime for the year 1995.

This table shows clearly that most rivers are heavily polluted, the only exception being the North Oropouche River while the South Oropouche River still has a reasonable water quality. There is very little difference between the main Caroni River and its tributaries. All suffer from uncontrolled waste discharges and the poor performance of wastewater treatment plants, resulting in high BOD loads and low dissolved oxygen contents. This is also the case in the Couva, Guaracara and Cipero Rivers. The Cipero River shows particularly excessive BOD levels. The high BOD figure for the Couva River is due to one sampling point downstream of a major ammonia based fertilizer plant.

TABLE 8.4 AVERAGES PER RIVER OF THE MEAN 1995 CONCENTRATIONS FOR WASA SAMPLING AREAS

Substances	BOD	Ortho Phos-phate	Total P	DO	FC	Free N	Settle-able Matter	Total NFR
River	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**nr/100ml**	**mg/l**	**mg/l**	**mg/l**
North Oropouche	0.90	0.04	0.19	7.40	770	0.20	0.02	25
Caroni (main)	9.80	0.24	0.55	4.50	122,885	0.90	0.14	29
Caroni (trib.)	10.50	0.27	0.57	4.90	144,850	0.90	0.16	17
Couva	23.00	0.07	0.34	6.40	15,120	1.90	0.44	145
Guaracara	15.00	0.08	0.35	4.70	25,350	1.60	0.30	69
Cipero	342.5	0.17	0.50	3.10	171,213	1.50	0.94	66
South Oropouche	3.90	0.05	0.37	5.50	16,387	0.50	0.06	225
Average all locations	58.10	0.16	0.46	4.90	88,486	1.00	0.27	78

Source**:** Water and Sewerage Authority of Trinidad and Tobago

BOD - Biological Oxygen Demand **P - Phosphorous**

DO- Dissolved Oxygen Concentration **FC - Faecal Coliform** **NFR - Non-Filtration Residue**

Two (2) major water quality studies (1977 and 1999) in the country have been restricted to the Caroni River Basin, the major water-producing basin in the country, where the Caroni Water Treatment Plant producing 40% of Trinidad's water supply is located. The Caroni River is one of the major rivers in Trinidad, with a length of approximately 35 km, from its source to the mouth in the Gulf of Paria; it receives water from fourteen (14) tributary streams. There are two main industrialized areas along the Caroni River. However, for most of its length the Caroni River flows through sugar cane fields with scattered settlements.

Monitoring of the Caroni River and its tributaries during the wet season (1999) showed a progressive increase in pollutant levels from the upper Caroni River, mid Caroni River and lower Caroni River. There were increases in levels of ammonia, BOD_5, chlorides, nitrates, phosphates, total and faecal coliforms. Consistently low dissolved oxygen levels and high BOD and faecal coliforms indicated considerable organic pollution in the Caroni River. Elevated levels of hydrogen sulphide and the foul smell of this gas were consistent with the anoxic condition of the Caroni River. Continued monitoring of the Caroni River during the dry season showed a similar trend to that of the wet season. There were progressive increases downstream in BOD_5, nutrients, total and faecal coliforms with consistent lowering in dissolved oxygen. The anoxic condition of the Caroni River, due to extensive pollution, makes the water quality extremely poor.

The origins of the individual pollutants were identified as follows:

- Nitrogen (ammonia) Mainly from the flushing of soil constituents
- Nitrogen (nitrates) Mainly from point source (municipal and industrial) discharges.
  Soil constituents may also be a minor source
- Nitrogen (nitrites) Mainly from point sources and soil constraints
- BOD
- Oil and Grease
- Total Phosphorous
- Solids Mainly from particulate matter derived from Sheet erosion, bed mobilization and the flushing of soil constituents

The majority of the rivers in the study area were found to be polluted with industrial and domestic wastes and includes agricultural wastes proceeding from poor land use practices.

Field surveillance studies in the watersheds of the Caroni River Basin identified the major activities affecting the catchments as quarrying, industrial and domestic waste discharges, and domestic dumping of solid waste.

The water quality problems were attributed to:

- Untreated effluent discharges by households and industry
- Limited waste water treatment capacity

- Low efficiency of existing waste water treatment facilities
- Lack of sewer systems and only a small fraction (40%) of households connected to available sewers
- Surface runoff (turbidity)

There have been several incidences of spills on land in the Southern one-third of the island that have resulted in severe pollution of the waterways in these areas. These spills often drain into coastal areas causing substantial damage to the mangrove and beach. The South-East and South-West areas are those most often affected. Recent efforts by the Ministry of Energy to limit such damage through the enforcement of clean-up actions by the polluters have had some, albeit limited, success to date.

Chronic oil pollution is not as severe a problem. However, the chronic discharge of oilfield brines from producing wells has changed the salinity of several small waterways and thus their natural environment. The impact of this form of pollution on coastal zones is considered minimal. While there is no comprehensive island-wide assessment of the quality of the water resources of the country, a number of independent studies of varying levels of reliability have been carried out.

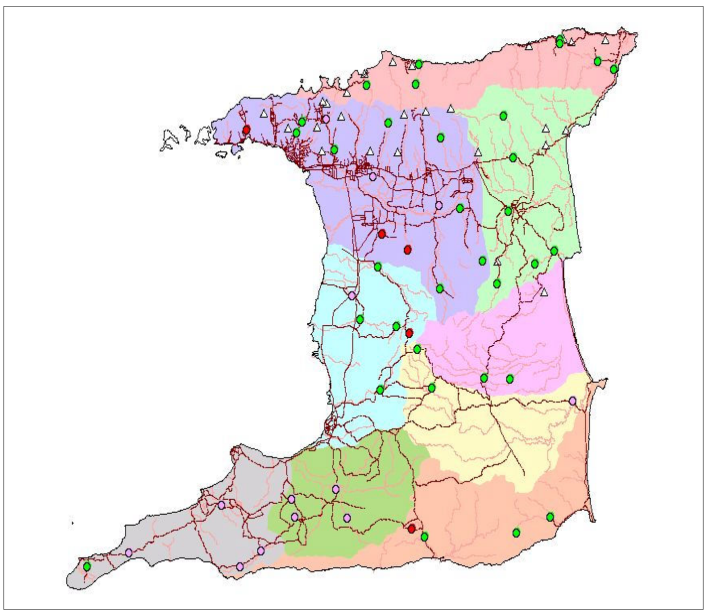
Consequently the results of these studies, together with expert opinion, and the results of the Caroni River Basin water quality studies, have been combined to arrive at an overview of the quality of the surface water resource of Trinidad and Tobago. The overview shows a relatively low surface water quality in the North, Central and Western part of Trinidad, while the North-eastern part of Trinidad and Tobago has relatively high water quality levels. The activities affecting the water quality and the aquatic environment are (watershed degradation) modification of the hydrological regime, discharge of chemicals, disposal of sewerage and farm wastes, and the dumping of refuse and solid wastes.

8.8 Heavy Metal and Physico-chemical Pollution

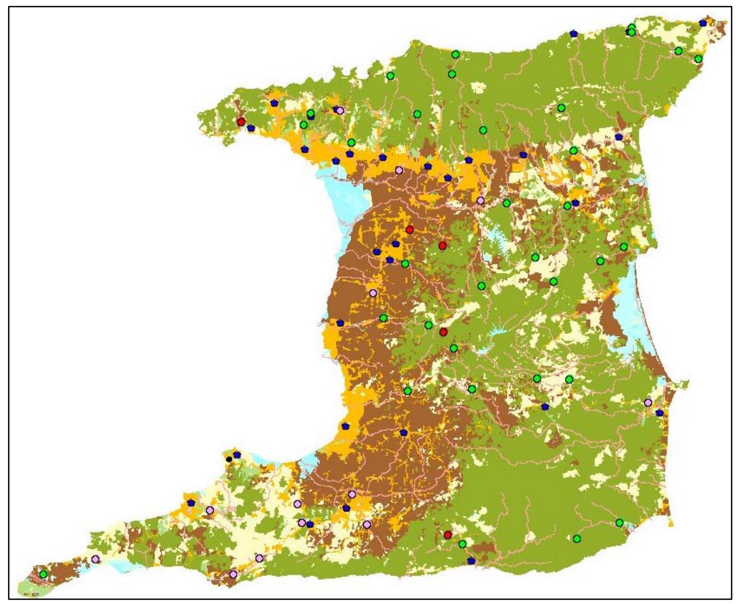
In a study carried out by the University of the West Indies: Life Sciences and Chemistry Departments which was presented at the Commonwealth Environmental Health Institute (CEHI) Conference in 2004, it was found that heavy metals such as lead, zinc and copper were indeed present in the rivers of Trinidad and Tobago as well as in the river sediments themselves. The study was carried out at sixty-four (64) sites across Trinidad and Tobago from November 1998 to June 2001 and the rivers were judged in three (3) categories: clean (free from heavy metal and physico-chemical pollution), perturbed (slightly contaminated with heavy metals but still useable) and polluted (well contaminated and not useable).

The following Map 8.2 shows the variation of the physico-chemical pollution across Trinidad. It can be seen that most of the rivers monitored across the North, Central and East were clean. However, in the areas of Central, and most of South were either polluted or perturbed.

MAP 8.2 PHYSICO-CHEMICAL SURFACE WATER QUALITY



Source: University of the West Indies, 2001



Source: University of the West Indies, 2001

a. Watersheds and Intakes

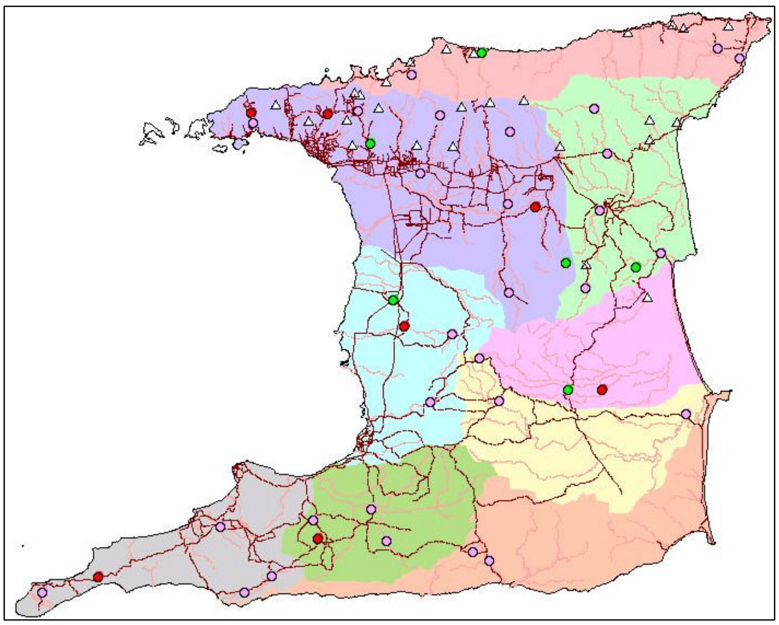
- Nariva
- West Peninsula/Caroni
- Central West
- North Coast
- North Oropouche
- Ortoire
- Southern Range
- South Oropouche
- Cedros Peninsula

b. Land Use

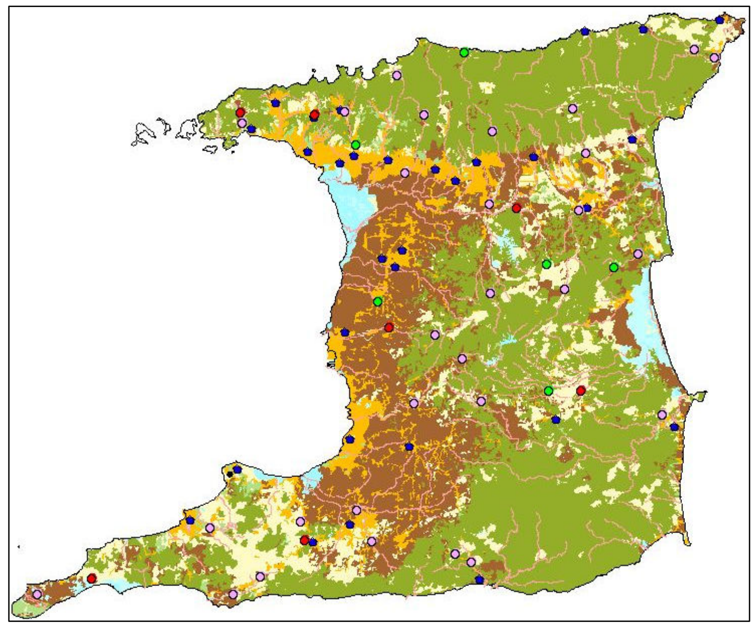
- Agriculture
- Commercial/Industr./Residential
- Swamp/Reservoirs
- Grasslands
- Forest
- Disturbed natural ecosystem
- Pitch Lake

Map 8.3 shows the analysis of the heavy metal pollution of river waters in Trinidad. Only a small number of rivers (one on the North coast and five spread across the North and central regions) can be categorized as clean.

MAP 8.3 HEAVY METALS IN THE SURFACE WATERS OF RIVERS OF TRINIDAD



Source: University of the West Indies, 2001



Source: University of the West Indies, 2001

Nariva
West Peninsula/Caroni
Central West
North Coast
North Oropouche
Ortoire
Southern Range
South Oropouche
Cedros Peninsula

Clean
Perturbed
Polluted

Water Intake or Extraction point

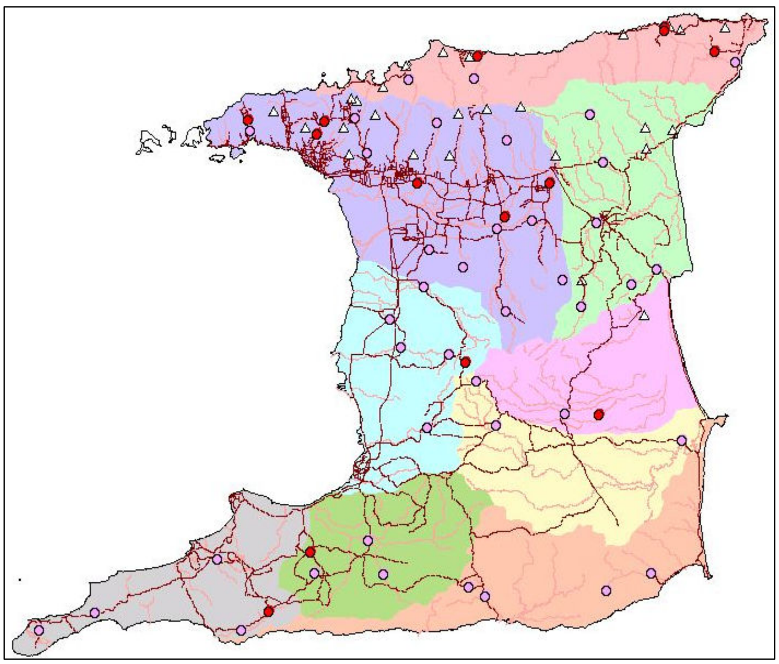
Town

Roads

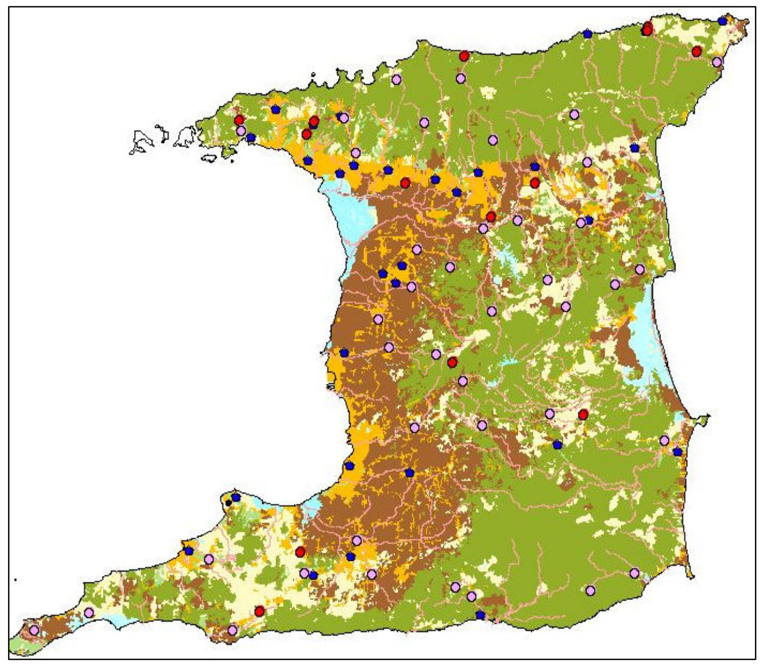
Agriculture
Commercial/Industrial/Residential
Swamp/Reservoirs
Grasslands
Forest
Disturbed natural ecosystem
Pitch Lake

Heavy metals were also detected in samples of sediments on the monitored rivers, as sediments tend to trap the presence of pollution for a longer period of time. This analysis showed that there were no clean rivers to be found across the country. Rivers of the North Coast also showed signs of heavy metal pollution. However, this may be due to the geology of the soils in that area. The North-West Peninsula/ Caroni Region also showed most of the sampled sediment as polluted with few perturbed areas. The rest of Trinidad showed mainly perturbed sediment with some areas in South as polluted. The following map illustrates this (see Map 8.4).

MAP 8.4 HEAVY METALS IN THE SEDIMENTS OF RIVERS OF TRINIDAD



Source: University of the West Indies, 2001



Source: University of the West Indies, 2001

Nariva
West Peninsula/Caroni
Central West
North Coast
North Oropouche
Ortoire
Southern Range
South
Cedros Peninsula

Clean
Perturbed
Polluted

Water Intake or Extraction point

Town

Roads

Agriculture
Commercial/Industrial/Residential
Swamp/Reservoirs
Grassland**s**
Forest
Disturbed natural ecosystem
Pitch Lake

TABLE 8.5 WATER QUALITY OF TOBAGO RIVERS

	SITE	UPPER /LOWER	PHYSICO	SEDIMENT	WATER
1	Bloody Bay		Perturbed	Polluted	Clean
2	Courland	Upper	Clean	Perturbed	Perturbed
3	Courland	Lower	Clean	Perturbed	Perturbed
4	Hillsborough West	Lower	N/A	Polluted	Perturbed
5	Lambeau	Lower	Perturbed	Polluted	Perturbed
6	Louis D'or	Lower	Clean	Polluted	Clean
7	Louis D'or	Upper	Clean	Polluted	Clean
8	Speyside	Upper	Clean	Polluted	Polluted
9	Speyside	Lower	Clean	Polluted	Perturbed

Source**:** Water and Sewerage Authority of Trinidad and Tobago

N/A – Not Applicable

8.9 Geochemistry of Surface Water

The natural surface waters of both islands are fresh high quality potable water of low dissolved solids (250 to 650 milligrams per litre), low chlorides (<25 milligrams per litre), low sulphate (<50 milligram per litre) and soft (< 500 milligrams per litre hardness). Iron levels at several locations studied in Trinidad are somewhat high but variable, generally in the range of 0.1 to 1.0 milligrams per litre. Lower values of iron are present in the surface waters of Tobago of 1.0 to 0.4 milligram per litre.

8.10 Groundwater Systems

On the whole, there have been no instances of significant widespread groundwater pollution in Trinidad and Tobago. However, preliminary data indicated that there may be localised seepage of hydrocarbons into the sub-surface environment in the vicinity of gas stations. Consequently a comprehensive study was undertaken in Trinidad by the EMA in conjunction with National Petroleum Marketing Company and the WRA. The report on this study indicates the presence of MTBE (methyl tertiary butyl ether) and BTEX (benzene, toluene, ethylbenzene and xylene) in areas of North Trinidad that are relatively close to gas stations. At present, there is no real cause for concern with respect to MTBE and BTEX pollution in Tobago. However, mitigation measures must be put in place to prevent such disasters in the future since gasoline storage tanks are constantly deteriorating.

MTBE is a carcinogenic substance that is soluble in water and not easily absorbed into the soil which means it can spread faster and farther in the ground than other gasoline chemicals. MTBE does not biodegrade and will, therefore, persist in groundwater. BTEX is made up of all components of gasoline. It is also very carcinogenic and its mere presence in groundwater indicates the possibility of leaking gasoline storage tanks.

Excessive chloride concentrations (>250 mg/l) have been recorded in aquifers in close proximity to the coast (e.g. Port-of-Spain Gravels, Diego Martin Gravels, El Socorro Gravels, Mayaro Sandstone). This is due to localised seawater intrusion whenever over-abstraction occurs. In Tobago, recent quality assessments (WASA, 2000) of the groundwater systems show that there are no significant pollution concerns.

Given the state of pollution of Trinidad's surface water systems, the lack of detection of significant contamination in the island's aquifers is surprising. This may be related to the frequency and method of groundwater quality monitoring being employed. The most advanced methods to detect micro-pollutants such as polychlorinated biphenyls (PCB's), polyaromatic hydrocarbons (PAH's), pesticides, and benezene, toluene, ethylbenzene and xzylene (BTEX's) need to be employed on a more sustained basis.

- The threats to groundwater quality appear to be by point source pollution, occurring on a local scale. In the absence of thick overlaying clay layers, some aquifer systems are vulnerable to infiltration by contaminants. The potential risk of pollution to aquifers may be the result of leakage from:
- Hazardous waste dump;
- Underground fuel storage tanks;
- Untreated sewerage;
- Industrial activities;
- Pit latrines and septic tanks

8.11 Geochemistry of Groundwater

Groundwater varies in composition throughout the various sources in the islands. In Trinidad the North-West Peninsula Gravels are of mediocre hardness and little iron. Elevated levels of chloride and hardness are present in one coastal aquifer that experienced salt-water intrusion. Within the Northern Gravels the El Socorro aquifer has also been over-pumped resulting in elevated levels of salinity and hardness. The other aquifers are generally fresher and higher in iron as one travels from West to East.

TABLE 8.6 NATURAL WATER QUALITY OF MAJOR GROUNDWATER SOURCES

Aquifer Systems	TDS mg/L	Chloride mg/L	Hardness mg/L	Alkalinity mg/L	Iron mg/L
NorthWest Gravels	125 – 128	18 – 33	75 – 200	42 – 180	0.00 – 0.08
Northern Gravels	122 – 420	20 – 100	28 – 200	15 – 200	0.00 – 0.14
Central Sands	75 – 430	10 – 140	15 – 120	120 – 250	0.10 – 7.25
Southern Sands	70 – 720	10 – 160	15 – 200	30 – 410	0.20 – 2.30

Source: Water and Sewerage Authority of Trinidad and Tobago

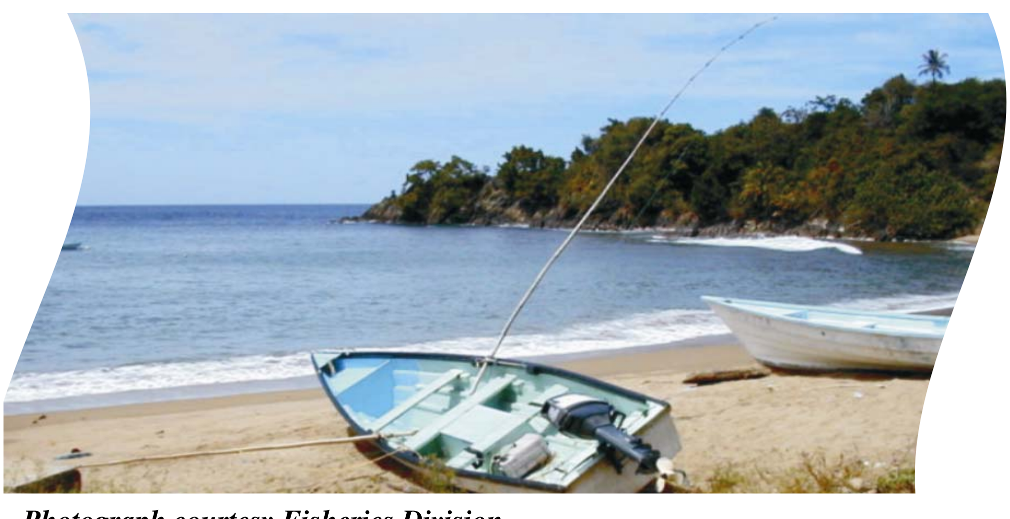
The Central Sands are generally very fresh with the exception of Sum Sum aquifer in Carlsen Field, the Mahaica Sands of Wallerfield and the Durham Sands of Freeport. Hardness and alkalinity are also elevated in these aquifers contributing to the elevated Total Dissolved Solids (TDS) levels; however, higher chlorides also contributed to the TDS levels of Carlsen Field. Most of the Central Sand aquifers contain substantial iron, the exception being Sum Sum Sands in Carlsen Field and Mahaica in Wallerfield.

The Southern Sands have high TDS values with the exception of the Erin Sands of Granville. The high TDS values always correlate with high hardness and alkalinity (due to calcium and magnesium carbonates). Iron levels are significant but not as high as in the Central Sands.

CHAPTER 9

COASTAL AREAS

Photograph courtesy Satee Boodoo



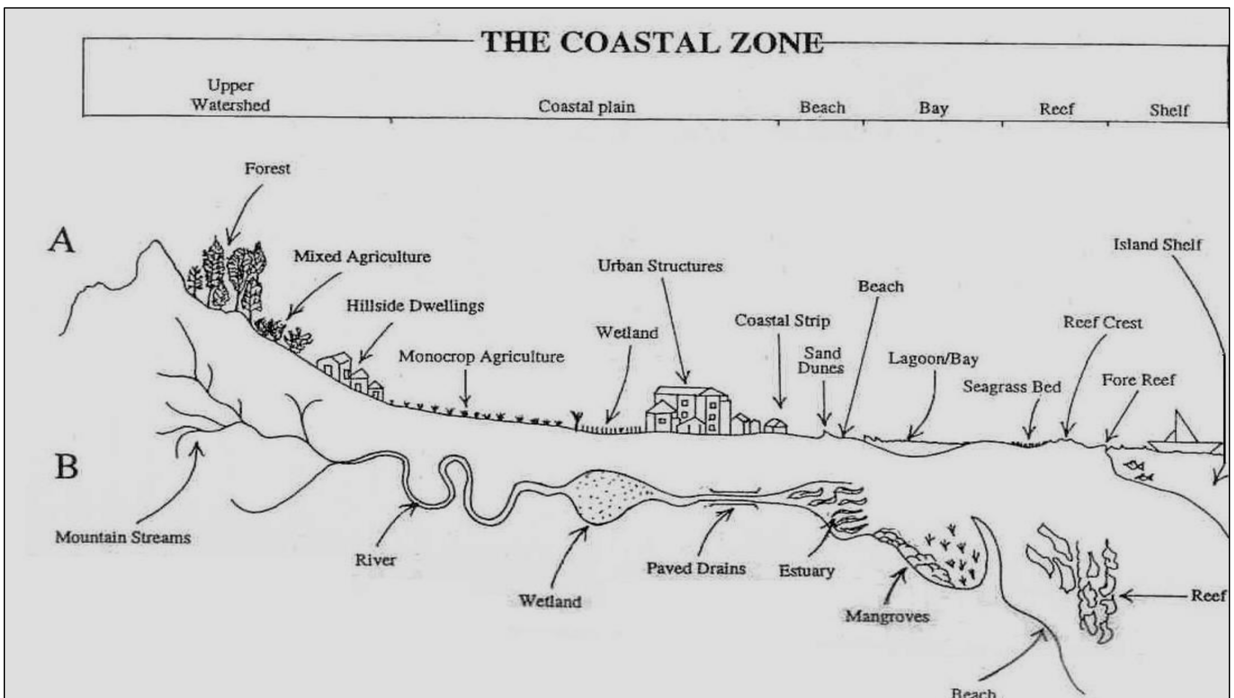
Photograph courtesy Fisheries Division

9 COASTAL AREAS

Introduction

The coastal areas of many Small Island Developing States (SIDS), under which Trinidad and Tobago falls, are hosts to copious activities. The coast can be defined from a spatial point of view as all those areas that drain out to the sea and those that are periodically inundated by the tides or are permanently covered by the sea, down to the edge of the continental shelf where the sea bottom slopes rapidly to the deep sea. This definition embraces the coastal watersheds, plains and shorelines, the rivers, estuaries, the wetlands that drain them, the beaches, sea grass beds, coral reefs and other marine formations occurring on the continental shelf (Chart 9.1).

CHART 9.1: - SCHEMATIC ILLUSTRATION OF THE COAST



Source: - Wade and Webber, (2002)[1].

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[1]**Wade, B., and D. Webber. "Coastal Zone Management." In *Natural Resource Management for Sustainable Development*, by Ivan Goodbody and Elizabeth Thomas, 427-481. Kingston: Canoe Press, 2002.**

In Trinidad and Tobago, the critical significance of coastal areas is due to their support of life systems, their economic contribution and their recreational and aesthetic value. These are highlighted below[2]:

- A sizeable percentage of the population resides in coastal areas;

- Some 80% of industrial activities of strategic national importance are located within coastal areas;

- Sixty per cent of small scale economic activities significant for the support of human lives are located within coastal areas;

- Eighty per cent of urbanized land is located within or adjacent to coastal areas;

- Approximately 50% of the country's national transportation arteries (coastal roads, bridges etc), some of them providing important access to large towns and remote communities, pass through coastal areas;

- Approximately 90% of tourist facilities and hotel room budget in the country are located within coastal areas;

- Coastal areas account for about 90% of annual fish production;

- Coastal areas encompass scenic nature sites, contain habitats critical to the sustained production of fisheries, are important for the maintenance of good water quality; and

- Coastal areas contain rich biodiversity reserves including world famous coral reefs (Tobago), sea grass beds, mangrove forests and coastal swamps with unique coastal based fauna (Nariva, Oropouche, Caroni).

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[2] Information adapted from: The Water Resources Agency. "Integrating the Management of Watersheds and Coastal Areas in Trinidad and Tobago." In National Report, 2001.

9.1 The Coastal Environment

The coastal environments of Trinidad and Tobago comprise unique ecosystems formed by the integration of land and water features which are described by the following:

- Bathymetry
- Freshwater Habitats and Ecosystems
- Marine water quality
- Coastlines, beaches and bays
- Wetlands (estuaries, swamps, and marshes)

9.1.1 Bathymetry[3]

The bathymetry of the Caribbean Sea is particularly well documented and is available in navigational charts of the British Admiralty and United States Navy. The general bathymetry of offshore and nearshore waters of Trinidad have been comparatively well documented in the past (Map 9.1). Instability of nearshore conditions leading to erosion, siltation and developmental activities has produced changes in bathymetry. In addition, errors made prior to the availability of electronic sounding and positioning equipment, including satellite positioning, continue to need correction.

Gulf of Paria

The Gulf of Paria is probably the area most lacking in topographic irregularities. It is a shallow semi-enclosed sedimentary basin with an average depth of 20 metres and maximum depth in the centre of about 37 metres rising gradually to the coastline of western Trinidad and eastern Venezuela. While mostly featureless, the seabed adjacent to the islands off the north-western peninsula displays a range of bottom types and some varied topography. Some steep-sided troughs are found with depths exceeding 200 metres in the Bocas Passages. The sea bottom consists mainly of mud, but there are scattered patches of shell debris.

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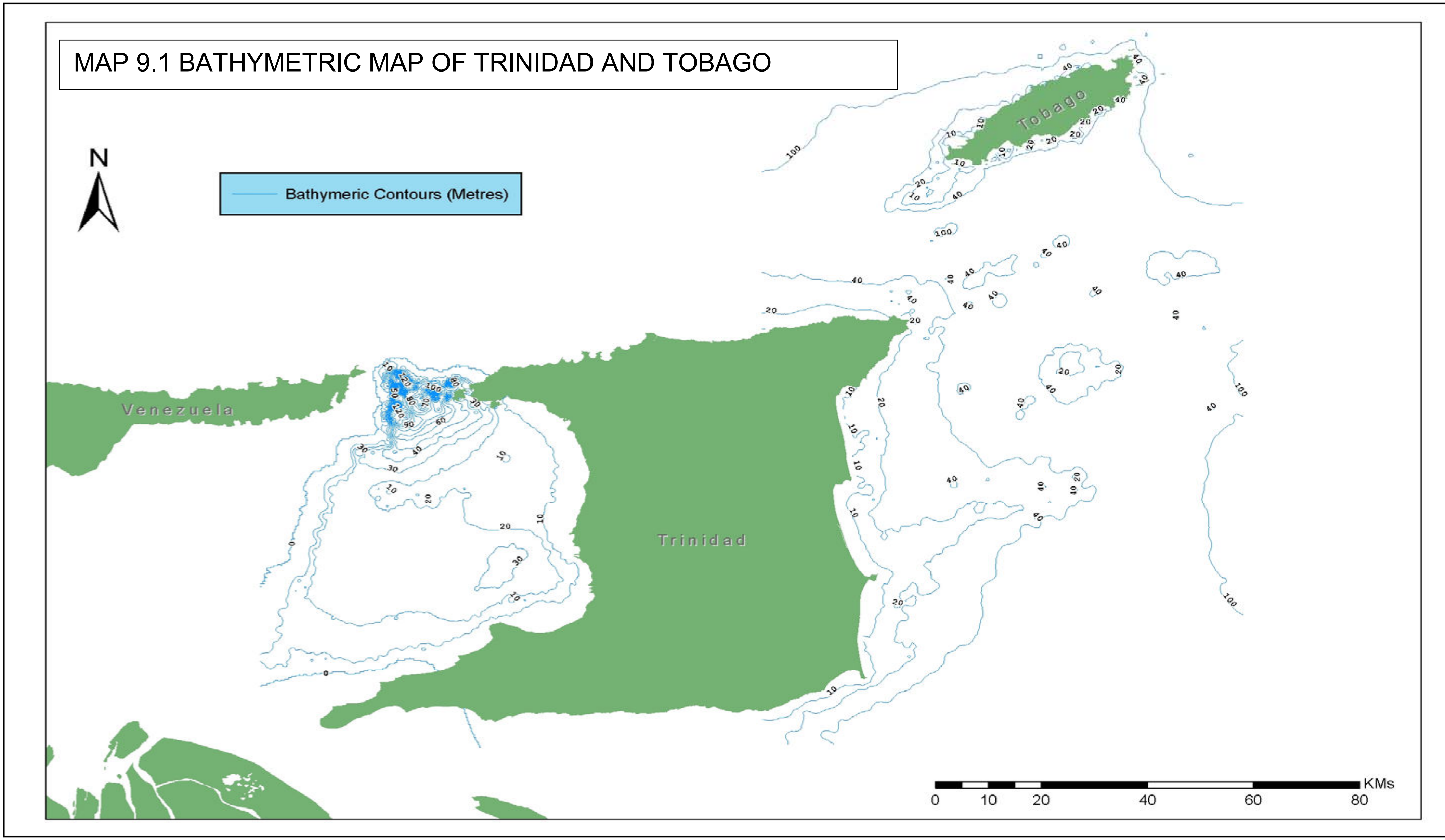
[3] Information on the Bathymetry of Trinidad and Tobago was taken from: The Institute of Marine Affairs. "State of the Marine Environment Report." CEPNET/IDB Project, 1999.

North and East Coasts of Trinidad

The seabed to the north of Trinidad shelves gradually with the 200 metres contour being some 60 kilometres offshore. The nearshore sea bottom varies from firm mud to sand, but offshore the sea bottom is mainly mud. The seabed to the east of Trinidad is extremely varied in substrate type and topography. In the east, the seabed dips more gently downwards from the coast towards the edge of the continental shelf approximately 100 kilometres away. Prominent features include the Manzanilla Bank running east to Darien Rock, the Drew Shallow between Toco and Tobago, and the Emerald Shoals and Delaware Bank east of Toco. These are all hard bottom banks supporting algal growth and coral reefs.

Columbus Channel

In contrast, the Columbus Channel, which separates the South Coast of Trinidad from the South American mainland, is a comparatively shallow current-worn channel with depths about 35 metres and with varied bottom types ranging from mud to mud-stone. In the navigable area that exists throughout the length of the Columbus Channel, mid-channel depth reaches 77 metres. The seabed slopes gently downward from both the Trinidad and Venezuelan coasts.


MAP 9.1 BATHYMETRIC MAP OF TRINIDAD AND TOBAGO
N
Bathymeric Contours (Metres)
Tobago
Venezuela
Trinidad
KMs
0
10
20
40
60
80

9.1.2 Freshwater Habitats and Ecosystems[4]

The islands of Trinidad and Tobago have been mapped under hydrometric areas - which are major hydrologic units - within which a number of watersheds/sub- watersheds have been placed. While there is no “Protective Area System” *per se*, there are instruments for protection of some of these watershed areas. The “Forest and Nature Reserve” areas especially in the North Coast of Trinidad, by virtue of their locations, give protection to the upper reaches of some of the watershed areas.

In Tobago, the Hillsborough Main Ridge is one of the oldest protected areas (established since 1734) in the Western Hemisphere. Under the National Parks Project several other areas have been recommended to fall under such a “protected area system.” The largest watersheds contain the major river systems (and fresh water ecosystems). In Trinidad these are the Caroni, North Oropouche, Navet, Ortoire and South Oropouche Rivers and their associated wetland/swamp areas.

The Caroni River is one of the main contributors to the potable water supply of Trinidad. The Caroni River Basin, the hydrometric area that encompasses the Caroni Swamp, covers1000 km^2, (approximately 1/5 of the total area of Trinidad). In Tobago, major systems are the Richmond, Goldsborough and Hillsborough Rivers.

The country's rivers directly support life (plankton, fish, crab, conch and other invertebrates) and useful plants (used in local craft industry) which rural peoples depend on for local consumption and/or export trade. Examples include the Caroni and Nariva which support abundant avifauna, especially waterfowl (Anhingas, cormorants, herons, gulls and egrets) and other wildlife. (The Nariva River is not a true river but a lagoon; the rivers do not support the avifauna it is the wetlands associated with the river)

[4] Information adapted from The Water Resources Agency (WRA). “Integrating the Management of Watersheds and Coastal Areas in Trinidad and Tobago”. National Report. 2001.

These systems provide water for game animals (e.g. lappe, deer, wild hog, tattoo, manicou and agouti) and non-game animals (howler monkey, porcupine, anteater, ocelot, and squirrel), small rodents, bats and insects such as damselflies and dragon flies. There is also large-scale agriculture on the alluvial flood plains of Caroni and Nariva. The major threats to the management of watersheds and freshwater ecosystems in Trinidad and Tobago include the threat of groundwater and river degradation from:

- industrial, agricultural and domestic pollution;
- soil erosion, deforestation, habitation on steep slopes, annual bush and forest fires, indiscriminate and unplanned construction (this can reduce the free flow of fresh water resulting in changes in composition of fresh water plants, sedges and invertebrate composition);
- flooding, poor drainage and maintenance, pressures (and associated problems) of urbanization;
- over abstraction from surface and groundwater sources;
- pressure on land for housing and poor land practices;
- reduced crop and land productivity, and
- poor systems of logging.

In Tobago, some additional major problems in watershed areas include proximity to Scarborough and pressure on land for residential and commercial buildings, improved vehicular access to forest and watershed areas and illegal sand mining.

9.1.3 Marine Water quality

Marine water quality in Trinidad and Tobago is affected by activities both on land and in the marine areas. Water quality is much influenced by the Orinoco River which displays marked seasonality of discharge as indicated by surface salinities in the wet and dry seasons (wet season: 15-27 ppt; dry season 29-35 ppt). Peak discharge takes place between August and October, but shows some variability in timing as well as in volume. In most years, at that time, salinity in the Columbus Channel and in the near shore waters at Icacos and Cedros falls to approximately one tenth, and in the Gulf of Paria to about one half that of oceanic seawater. Along the east coast there is also considerable dilution and mixing. At Galera, in the northeast, salinities may fall to three quarters that of oceanic seawaters. The effects in Tobago are not severe except at the windward side of the southwest coast where salinity may fall.

Associated with this seasonal dilution of near shore waters from riverine discharge is stratification in the water column and a significant increase in turbidity due to suspended matter, both organic and inorganic. This drastically reduces light penetration and in extreme instances light may disappear at the comparatively shallow depth of 35 metres.

Occasionally, organic flocculation may completely coat the substratum in sheltered places and cause 'die back' of coral communities, as happened at the Buccoo Reef in the early 1970s.

Activities that contribute to a degradation of marine water quality and highlighted by the Water Resources Agency (WRA) in 2001 are:

Watershed degradation: Watershed degradation is one of the major sources of water quality and aquatic-ecosystems impairment in the country. The water resource management study in 2001 has shown that 5.8 % (282.2 sq km) of the land in Trinidad requires soil and water conservation while 23.2 % (75.2 sq km) of the land in Tobago requires soil and water conservation. The 1960 erosion status (no update is available) shows that 15 % of the catchments in Tobago had lost their entire topsoil and 42 % lost more than half of their topsoil, while for Trinidad the figures were 1 % and 10 % respectively. Watershed degradation has contributed to increased sediment yields, increased turbidity and reduction in stream flow capacity. The relatively large increase in watershed infiltration through squatting, slash and burn agriculture, growth of elevated residential areas and logging has had a dramatic impact on the erosion status in the past 40 years. This has been most severe in the western areas of the Northern Range in Trinidad.

Modification of Hydrological Regime: Modifications of the hydrological regimes through structural and engineering works have also negatively affected the water quality. These activities include the paving of waterways, channel realignment, diversion of watercourses, location of residential (housing) settlements and over-pumping of aquifers. The major effects are drying out of watercourses and salt water intrusion in coastal aquifers, swamps and waterways; the water wells along the East-West Corridor in Trinidad have been most severely impacted upon.

<u>Discharge of Chemicals</u>: Chemical pollution of the water resources comes from agricultural, industrial and domestic sources. Occasional fish kills in rivers have been attributed to the excessive use of agrochemicals. The increasing use of cleaning agents in households is also contributing to the decline in water quality in the country.

The impact of industrial effluents on the water resources is predominant along the foothills of the Northern Range and the western coast of Trinidad where varying degrees of sediment contamination from petroleum hydrocarbon and heavy metals are observed. In the Gulf of Paria sediments, the higher concentrations of petroleum hydrocarbon, 200 to 500 µg /g, are evident in the vicinity of runoff from drilling or refinery operations and natural oil seeps (IMA, 1999)[5]. Concentrations of heavy metals in the water are higher in the wet season, suggesting that during this time, runoff from land is a greater source of heavy metal contamination than offshore fields. Bioavailable metals in the surface sediments of Trinidad's west coast have been generally found to be below the concentrations necessary to evoke toxic responses in marine benthic organisms.

The east coast of Trinidad, while not as contaminated as the west coast, does show evidence of pollution by petroleum hydrocarbons where oil exploration and production are taking place.

Industrial activity in Tobago is relatively small, being concentrated in the south-west and central parts of the island. In the coastal waters of Tobago, average levels of heavy metals were all below the limits set for the protection of marine life, the only exception being copper, limits for which were marginally exceeded at Charlotteville Bay (IMA, 1999)[6]. The absence of baseline data on heavy metals for the area means that it is unknown whether levels of heavy metals have increased. In Tobago, the levels of petroleum hydrocarbon in the seawater indicate minimal contamination due to boat and shipping activities.

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[5] Institute of Marine Affairs. "State of the Marine Environment Report." CEPNET/IDB Project, 1999

[6] Institute of Marine Affairs. "State of the Marine Environment Report." CEPNET/IDB Project, 1999

9.1.4 Coastline, Beaches and Bays

Trinidad and Tobago's coastline consists of 705 kilometres with Trinidad accounting for approximately 546 kilometres and Tobago approximately 159 kilometres. Beaches and bays serve as buffer zones between the land and the water. They are usually made up of unconsolidated sediments[7] such as sand, stone, and rubble. Beaches and bays are dynamic coastal features which are constantly changing as a result of natural processes and human actions.

Many important animals such as sea turtles use the beaches to dig their nests and deposit their eggs. The beaches and bays also provide a habitat for species such as crab and other invertebrates.

To the people of Trinidad and Tobago beaches and bays represent important places for income, conducting religious ceremonies and recreation (Maps 9.2 and 9.3). They also serve as the main natural protective structures for property along the shoreline. However, they are easily damaged by the removal of sand, improper buildings or blocking of sources of sand replenishment.

[7] According to the Wentworth Scale sediments are classified as very fine (0.0625mm to 0.125mm); fine (0.125mm to 0.25mm); medium (0.25mm to 0.50mm); coarse (0.50mm to 1.00mm) and very coarse-grained sand (1.00mm to 2.00mm).

North Coast

The north coast of Trinidad is open to the Caribbean Sea and also to the direct influence of the Northeast Trade Winds. The north coast is fairly exposed and as such is a high wave energy environment. This coast is located along the foothills of the Northern Range. It is less susceptible to coastal erosion than other coastal areas of Trinidad because it consists of resistant low-grade rocks. Las Cuevas Bay is the largest bay of the North Coast followed by Maracas Bay (Table 9.1).

TABLE 9.1 - BEACHES AND BAYS OF NORTH COAST, TRINIDAD

Name	Length (Approximate)	Texture of Beach Sediment
Macqueripe Bay	0.12 km	Grey-brown, coarse-grained sand
Maracas Bay	1.80 km	Fine-grained, off-white quartz sand
Las Cuevas Bay	2.20 km	Grayish-brown, fine-grained sand, predominantly quartz
L'Anse Martin	0.09 km	Dark-brown and fine-grained
Blanchisseuse Bay	1.40 km	Brown, medium-grained and quartz-rich sand
Paria Bay	0.94 km	Brown, medium-grained sand
Grand Tacarid	1.08 km	Light-greyish brown, medium-grained sand
Madamas Beaches	0.54 km	Greyish-brown, medium-grained sand
Matelot Bay	0.62 km	Pebbles and cobbles
Grande Riviere Bay	1.20 km	Coarse-grained, brown, quartz-rich sand
Sans Souci Bay	0.30 km	Dark grey, medium-grained, quartz-rich sand
Salybia Bay	0.70 km	Whitish-grey, coarse-grained sand composed primarily of quartz and carbonate particles

Source: Institute of Marine Affairs, 2004[8]

[8] **Information on the beaches and bays of Trinidad and Tobago was taken from: Institute of Marine Affairs. *A Guide to Beaches and Bays of Trinidad and Tobago.* 2004.**

East Coast

The east coast (see Table 9.2) is rugged in its northern section and gentler further to the south. It is exposed to the Atlantic Ocean and is subjected to large swells especially during the North Atlantic winter period (November to April) and during storms. The northward flowing component of the Guiana Current moves along this coast from the south. The shoreline from Matura to Galeota has suffered extensive erosion over the years.

On the east coast, winds whip up waves, ceaselessly rolling up the miles-long stretches of flat, low–lying land, much of which is covered by coconut plantations. A wide surf zone and several rows of breakers characterise this coastline. Matura Bay, with 12.8 km, is one of the largest bays on the east coast and is an important turtle-nesting site. The sea is fairly rough with strong currents which make it unfit for swimming.

TABLE 9.2 - BEACHES AND BAYS OF TRINIDAD, EAST COAST

Name	Length (Approximate)	Texture of Beach Sediment
Sena Bay	1.0 km	Light brown, fine-grained sand, mainly quartz and minor carbonate particles
Balandra Bay	1.7 km	Fine-grained, light brown sand, composed mainly of carbonate material
Saline Bay	2.1 km	Light-brown, coarse-grained, quartz sand
Matura Bay	12.8 km	Coarse-grained, brownish-grey sand
Cocos Bay	20.0 km	Brownish-grey, fine-grained sand with high quartz content
Mayaro Bay	17.0 km	Fine-grained, brown sand with mainly quartz

Source: Institute of Marine Affairs. *A Guide to Beaches and Bays of Trinidad and Tobago.* 2004.

South Coast

The south coast (see Table 9.3) is separated from the South American mainland by the Columbus Channel. The waters of the south coast tend to be muddy, particularly during the rainy season. This is caused by high sediment discharge from the rivers on the South American mainland. Eroding cliffs back the beaches for most of the coastline. This is one of Trinidad's most dynamic coastlines. The geological outcrops of this coast consist mainly of weak unconsolidated silts, clay and sandstones which provide little resistance to oncoming waves.

Guayaguayare Bay is one of the larger bays on the south coast. and has been under tremendous pressure from the exploration and production of oil and gas activities. The South Chatham Beach is second in length and is ideal for swimming, boating and fishing.

TABLE 9.3 - BEACHES AND BAYS OF TRINIDAD, SOUTH COAST

Name	Length (Approximate)	Texture of Beach Sediment
Guayaguayare Bay	5.0 km	Light brown, fine-grained, quartz rich sand
Gran Chemin Beach	1.2 km	Fine-grained, light brown sand primarily of mineral fragments, low in carbonate and rock particles
Quinam Bay	1.6 km	Fine-grained, pale brown sand with mainly quartz
Los Iros Bay	2.0 km	Light brown, fine-grained, quartz-rich sand
South Chatham Beach	2.3 km	Brown, fine-grained and quartz-rich sand

Source: Institute of Marine Affairs. *A Guide to Beaches and Bays of Trinidad and Tobago.* 2004.

West Coast

The west coast (see Table 9.4) is rocky and rugged in the northern section, giving way to low wetlands in its mid section. Low and medium cliffs of sandstone, clay and siltstone outcrop along the southern section. This coast faces the Gulf of Paria, a semi-enclosed shallow sea between Trinidad and Venezuela. This shoreline is mixed in character with the southern sections experiencing most erosion due to its composition. Mangrove, swamps and mudflats characterise the west coast between the southwest and northwest. Granville Beach is one of the largest beaches on the west coast. Swimming and camping are popular activities at this beach.

TABLE 9.4 - BEACHES AND BAYS OF TRINIDAD, WEST COAST

Name	Length (Approximate)	Texture of Beach Sediment
Columbus Bay	4.00 km	Greyish-brown, medium-grained, quartz rich sand
Bonasse Beach	0.40 km	Fine-grained, grayish-brown sand, composed primarily of quartz
Granville Beach	4.90 km	Burnt silts and clays. Medium grained, brown sand
Guapo Beach	1.00 km	Light brown, fine-grained, quartz rich sand
Vessigny Beach	0.90 km	Fine-grained, brown sand
Station Beach	1.60 km	Fine-grained, light brown sand composed mostly of quartz
Williams Bay	1.10 km	Pale brown sand, pebbles and cobbles
Chagville Beach	0.60 km	Light brown, coarse-grained sand, gravel and broken coral
Chaguaramas Bay	0.13 km	Greyish brown, medium-grained sand
Scotland Bay	0.40 km	Sand, pebbles and cobbles
La Tinta Bay	0.30 km	Sand and gravel

Source: Institute of Marine Affairs. *A Guide to Beaches and Bays of Trinidad and Tobago.* 2004.

Tobago

Tobago's leeward coast (See table 9.5) is rugged and fringed by coral reefs. The beaches are generally of bio-organic origin and some of them are turtle nesting sites. Many of the beaches are good for swimming although some of them are accessible only by boat. Great Courland Bay is the largest bay of the leeward coast. Great Courland Bay is a leatherback turtle nesting site, a good spot for bird watching and is fringed with coconut palms and almond trees.

TABLE 9.5 - BEACHES AND BAYS OF TOBAGO, LEEWARD COAST

Name	Length (Approximate)	Texture of Beach Sediment
Store Bay	0.21 km	Pale brown, medium-grained sand
Pigeon Point	1.00 km	Very pale brown, medium-grained sand
Sheerbird's Point	1.60 km	Very pale brown, medium-grained sand
Buccoo Bay	1.40 km	Very pale brown, medium-grained sand
Mount Irvine Bay	0.55 km	Pale brown and coarse-grained sand, consisting of limestone
Little Back Bay	0.50 km	Pale brown, medium-grained sand
Stone Haven Bay	0.90 km	Pale brown, medium-grained sand
Great Courland Bay	1.80 km	Very dark grey, medium-grained sand
Arnos Vale Bay	0.23 km	Light brown, coarse-grained sand
Culloden Bay	0.11 km	Very dark grey, medium-grained sand
Castara Bay	0.31 km	Fine-grained, light greyish brown sand
Englishman's Bay	0.36 km	Light brown and medium-grained sand
Parlatuvier Bay	0.45 km	Light brown, fine-grained sand
Bloody Bay	0.37 km	Light greyish brown, medium-grained sand, with gravel and pebble deposits
Man O War Bay	0.75 km	Medium-grained, light greyish brown sand

Source: Institute of Marine Affairs. *A Guide to Beaches and Bays of Trinidad and Tobago.* 2004.

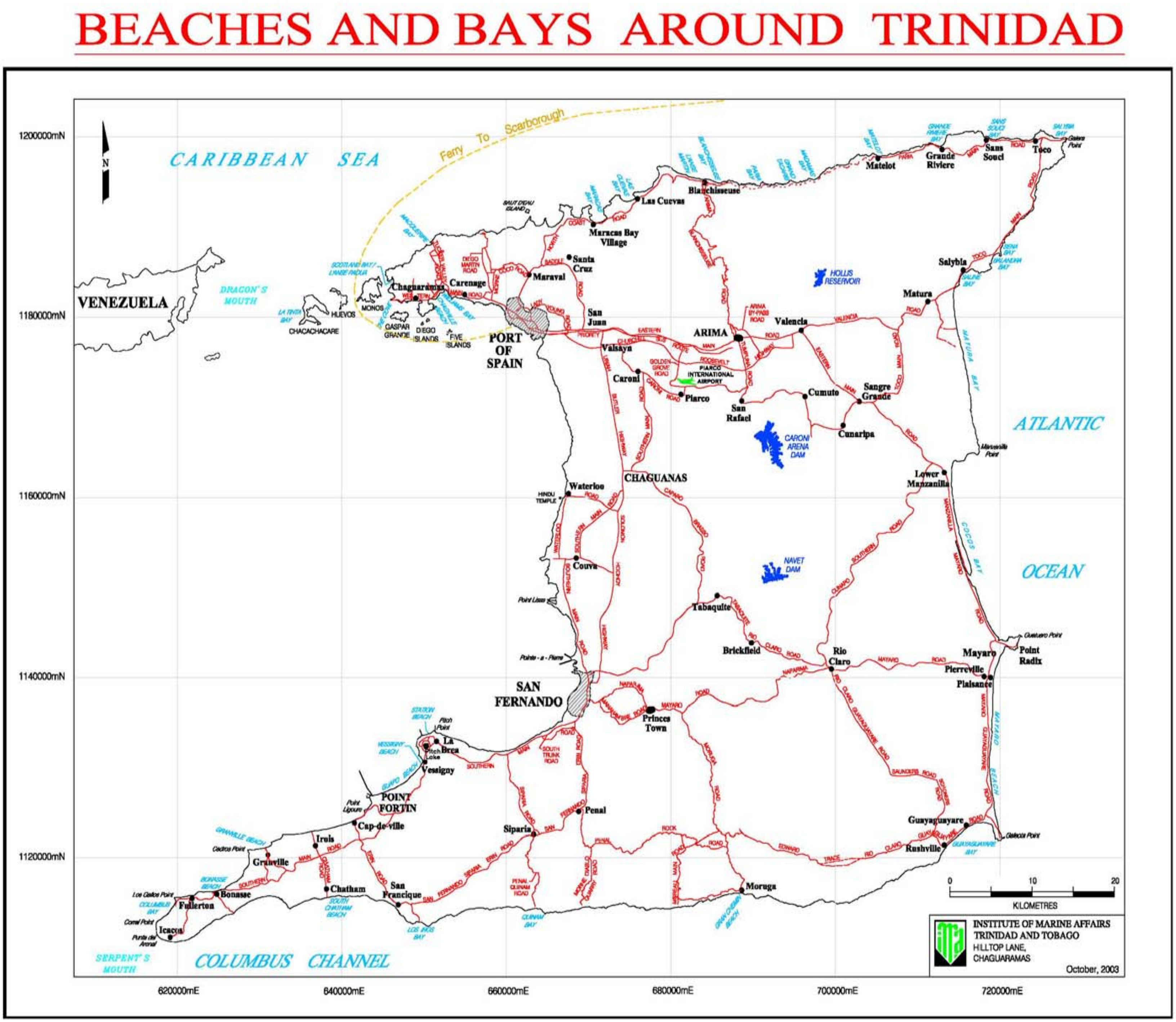
The windward coast (see Table 9.6) is the more populated side of Tobago. The beaches tend to be more exposed. Rockly Bay is the largest bay of the windward coast followed by Little Rockly Bay.

TABLE 9.6: BEACHES AND BAYS OF TOBAGO, WINDWARD COAST

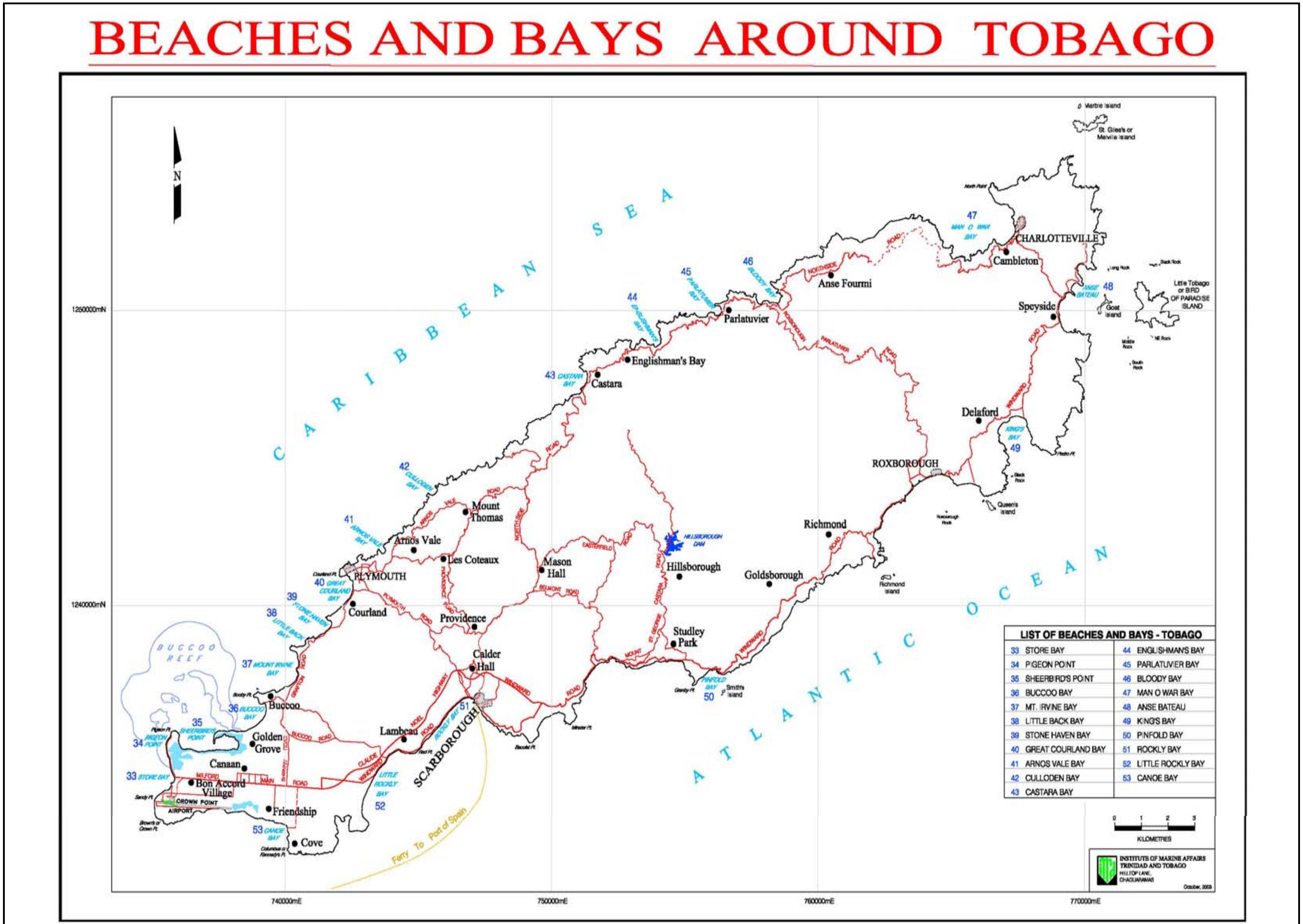
Name	Length (Approximate)	Texture of Beach Sediment
Anse Bateau	0.32 km	Medium-grained, pale brown sand
King's Bay	0.60 km	Very dark grey, fine-grained sand
Pinfold Bay	0.60 km	Fine-grained, brown sand
Rockly Bay	2.00 km	Pale brown, medium-grained sand
Little Rockly Bay	1.30 km	Pale brown, medium-grained sand
Canoe Bay	0.10 km	Fine-grained, light grayish brown sand

Source: Institute of Marine Affairs. *A Guide to Beaches and Bays of Trinidad and Tobago.* 2004.

MAP 9.2 BEACHES AND BAYS AROUND TRINIDAD



MAP 9.3 BEACHES AND BAYS AROUND TOBAGO



9.2 Wetlands

The Ramsar definition of wetlands as *'areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres' has been adopted by the Government of Trinidad and Tobago and is used in the National Wetlands Policy.* This definition is broad and encompasses inland wetlands (such as marshes, rivers, swamp wood and palm forests); coastal and near-shore marine wetlands (such as mangrove forests, seagrass beds and coral reefs); and human-made wetlands (such as dams, rice fields and sewage ponds). In Trinidad and Tobago, these ecosystems are recognised as environmentally sensitive systems that have important ecological and economical functions and values.

Wetlands in Trinidad and Tobago (Map 9.4) are important for economic, social, cultural and recreational purposes and perform the following functions:

- They act as sieves and are useful in filtering debris, sediments, nutrients, bacteria, and other pollution and preventing them from reaching the ocean;

- They are used as habitats for wildlife such as crab, birds, and fish.

Despite an increasing recognition of their importance, coastal ecosystems continue to be under severe pressure, and are faced with serious threats of degradation. It is estimated that more than 50% of wetlands in Trinidad and Tobago have been lost (National Wetland Policy, 2002)[9]

West Coast

The wetlands on the west coast of Trinidad are opened to the Gulf of Paria and are predominantly mangrove systems. This coastline is the most populated and developed coast in Trinidad. The west coast comprises 20 wetland areas. The Caroni Swamp is the largest and covers approximately 55.5% of the west coast wetland, followed by the Godineau Swamp with approximately 31.4%.

South Coast

The wetlands on the south coast of Trinidad are predominantly mangrove-dominated systems that are separated from the sea by a beach barrier. There are six wetland areas on the south coast of which the majority is covered by the marsh and mangroves of the Los Blanquizales wetland area.

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[9] Government of Trinidad and Tobago. "National Policy and Programmes on Wetland Conservation for Trinidad and Tobago." National Wetlands Committee. 2002.

North Coast

On the north coast of Trinidad the dominant wetland type is freshwater swamp forest. The area contains six wetlands of which Maracas Bay (swamp forest and marsh) accounts for approximately 55.3% and the Marianne River (flood plain) approximately 33.2%.

East Coast

Nine wetland areas are found on the east coast. Unlike the west coast of Trinidad, the wetlands on the east coast are separated from the Atlantic Ocean by a beach barrier. While most of the wetlands on this coast are mangrove-dominated systems, the Nariva Swamp, which is the largest, most diverse wetland in Trinidad and Tobago, is predominantly a freshwater system.

Tobago

The largest existing wetlands in Tobago are located in the southwestern part of the island. The Bon Accord Lagoon on the south coast occupies approximately 60% of the wetlands around Tobago followed by Buccoo Bay, Kilgywn Swamp and Friendship. (Table 9.8).

Stand of Royal palm in Nariva Swamp

Prop root system of red mangrove

Fresh water marsh (foreground) and
palms (background) in Nariva Swamp

Source: Institute of Marine Affairs. A Guide to Beaches and Bays of Trinidad and Tobago, 2004.

TABLE 9.7: COASTAL EMERGENT WETLANDS AND THEIR SIZE AROUND TRINIDAD; 2001[10]

Area	Dominant Plant Community/Communities	Size
	WEST COAST	
Hart's Cut	Basin mangrove swamp	0.02 ha
Cuesa River	Estuarine mangrove swamp	0.01 ha
Mucurapo Swamp	Mangrove Swamp	3 ha
Sealots	Mangrove Swamp	0.01 ha
Caroni Swamp	Estuarine mangrove swamp/freshwater marsh	8,340 ha
La Cuesa River, Waterloo	Mangrove swamp	0.10 ha
Orange Valley	Mangrove swamp	0.02 ha
Couva River	Estuarine mangrove swamp	363 ha
Pt. Lisas Bay	Fringed mangrove swamp/Salt marsh	26 ha
North Claxton Bay	Fringed mangrove swamp	92 ha
Hermitage River	Mangrove Swamp	<1 ha
Marabella River	Mangrove Swamp	65 ha
Godineau Swamp	Tidal marsh, mangrove swamp	3,171 ha
Rousillac Swamp	Mangrove swamp/ freshwater marsh	496 ha
La Brea	Mangrove swamp	< 2 ha
Los Gallos	Mangrove swamp	-
Fullerton	Mangrove Swamp	-
Granville	Mangrove swamp	-
Irois Bay	Mangrove Swamp	15 ha
Icacos Bay	Mangrove swamp/freshwater marsh	237 ha

[10] Information on wetlands in Trinidad and Tobago was taken from Juman, R., and J.K. James-Alexander. *An Inventory of Sea grass Communities around Trinidad and Tobago.* Coastal Conservation Project, IMA, 2006(Information on the sizes of some emergent wetlands listed in this Table has not been updated and therefore might no longer be accurate.)

SOUTH COAST		
Los Blanquizales	Mangrove swamp/Freshwater marsh	1,084 ha
Erin Bay	Mangrove swamp	-
Moruga River	Mangrove swamp	24 ha
Lozard River	Mangrove swamp	20.6 ha
Pt. Galeota	Mangrove swamp	39.3 ha
Rustville	Mangrove swamp	45.1 ha
NORTH COAST		
Scotland Bay	Fringed mangrove swamp	0.20 ha
Maracas Bay	Swamp forest/freshwater marsh	21 ha
Las Cuevas	Annual flood plain	3 ha
Grand Riviere	Annual flood plain/ Swamp forest	<1 ha
Yarra River	Freshwater marsh/Swamp forest	<1 ha
Marianna River	Annual Floodplain	15 ha
EAST COAST		
Matura River	Mangrove swamp	15 ha
Guayamara River	Mangrove swamp	<1 ha
North Manzanilla	Mangrove swamp	0.02 ha
Manzanilla Windbelt	Mangrove swamp/Freshwater marsh	44 ha
Ortoire River	Mangrove swamp	100 ha
L'Ebanche River	Mangrove swamp	47 ha
Nariva Swamp	Freshwater marsh/ swamp forest/mangrove swamp	11,343 ha (*Ramsar site*)
North Oropouche/Fishing Pond	Mangrove swamp/freshwater marsh	1,220 ha
Mayaro Bay	Mangrove swamp	6 ha
OFFSHORE ISLANDS		
Salt Lake	Mangrove Swamp	<1 ha
La Chapelle Bay	Mangrove Swamp	0.003 ha

Source: Juman, R., and J.K. James-Alexander. *An Inventory of Seagrass Communities around Trinidad and Tobago.* Coastal Conservation Project, IMA, 2006.

Note: -indicates not known in Table 9.7

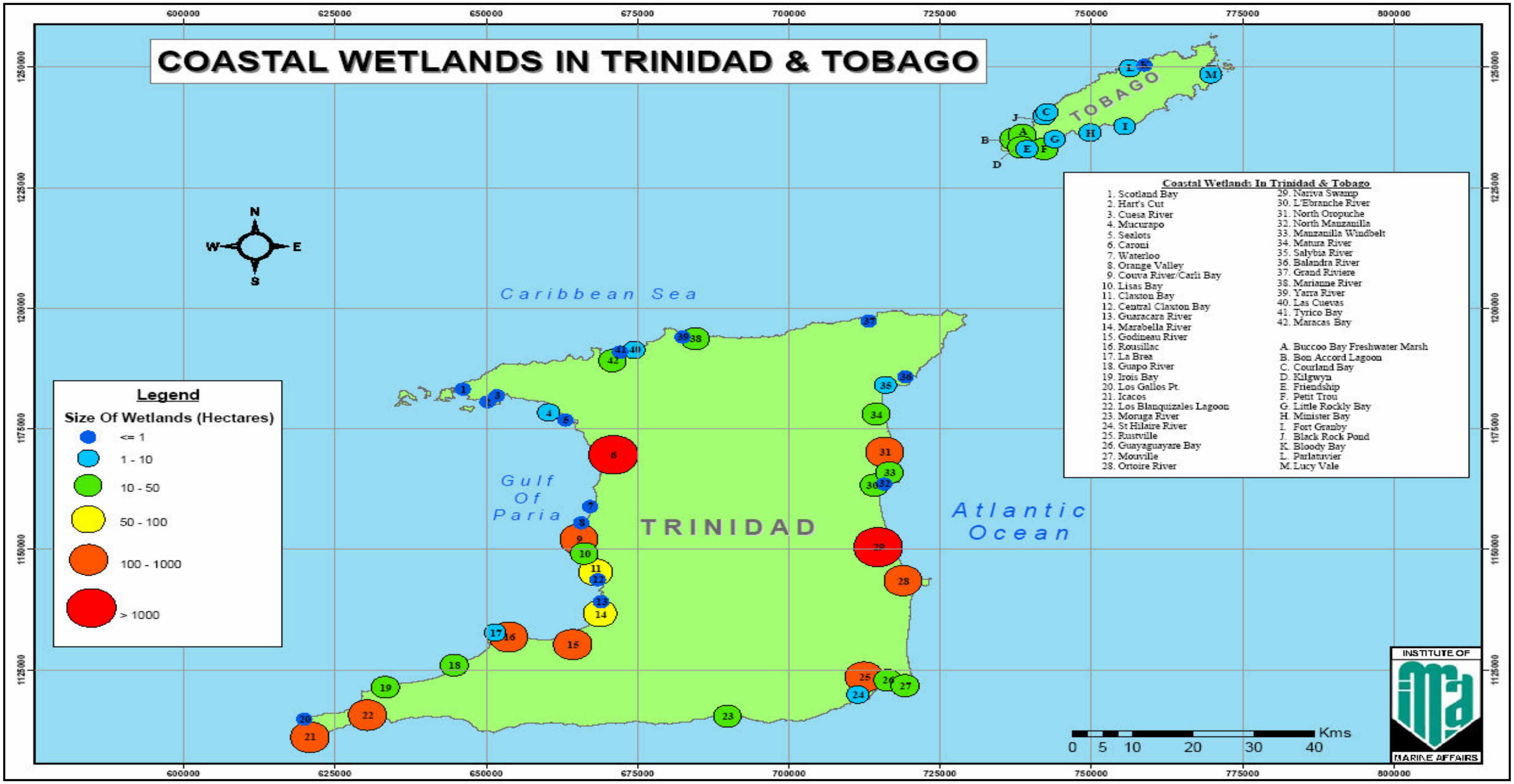
TABLE 9.8: COASTAL EMERGENT WETLANDS AROUND TOBAGO, THEIR SIZES AND DOMINANT PLANT COMMUNITY/ COMMUNITIES, 2001

Area	Dominant Type Community /Communities	Size
Friendship	Mangrove Swamp	12 ha
Kilgywn Swamp	Mangrove swamp/Lagoon	12 ha
Bon Accord Lagoon	Fringed mangrove swamp/ponds	88 ha
Big Bacolet Bay	Riparian/mangrove swamp	<1 ha
Black Rock Pond	Pond/Freshwater marsh	2 ha
Bloody Bay	Freshwater marsh/ Annual floodplain	-
Buccoo Bay	Freshwater marsh/mangrove swamp	15 ha
Roxborough	Freshwater marsh	-
Courland River	Riparian vegetation	-
Frenchman/King's River	Annual floodplain	-
Fort Granby	Freshwater marsh/mangrove forest	3 ha
Invelawe River	Annual floodplain	-
Little Rockly Bay	Mangrove swamp/salt marsh	2 ha
Louis D'or	Mangrove swamp	10 ha
Parlatuvier	Annual floodplain	1-2 ha
Petit Trou	Mangrove swamp/ Freshwater marsh	-

Source: Juman, R., and J.K. James-Alexander. *An Inventory of Seagrass Communities around Trinidad and Tobago.* Coastal Conservation Project, IMA, 2006.

Note: - indicates not known in Table 9.8

MAP 9.4 COASTAL WETLANDS IN TRINIDAD AND TOBAGO



9.3 Seagrass beds[11]

Seagrass communities have been recognised as an important marine resource. The functions of seagrass beds are: –

- Stabilization of bottom sediments even through the enormous stresses of hurricane and temperate storms, thus preventing erosion
- Slowing and retarding current flow to reduce water velocity
- Filtering of suspended solids and nutrients from coastal waters
- Production of organic matter
- Provision of shelter and refuge for resident and transient adults and juvenile animals, many of which are of commercial and recreational importance
- Provision of feeding pathways through direct grazing and/or detrital webs
- Production and trapping of detritus and secretion of dissolved organic matter that tends to internalise nutrient cycling within the ecosystem.

Three species of sea grass were recorded in Trinidad, *Thalassia testudinum* (turtlegrass), *Halodule wrightii* (Shoalgrass) and *Halophila decipiens (Juman and James-Alexander, 2006)*. *T. testudinum* is the dominant seagrass species and the climax species throughout the Caribbean. The most extensive *Thalassia* dominated seagrass communities in Trinidad are found along the northwestern peninsula (Map 9.5) at William's Bay (Map 9.6) and between St. Peter's Bay and Point Cumana River (Map 9.7). Smaller communities were observed near the Point-a-Pierre Yacht Clubs. Sparse *Thalassia* beds were also found about 500 m south of the Hermitage River mouth in Claxton Bay, and among coral rubbles in Salybia Bay, just west of the Salybia River mouth (Juman and James-Alexander, 2006).

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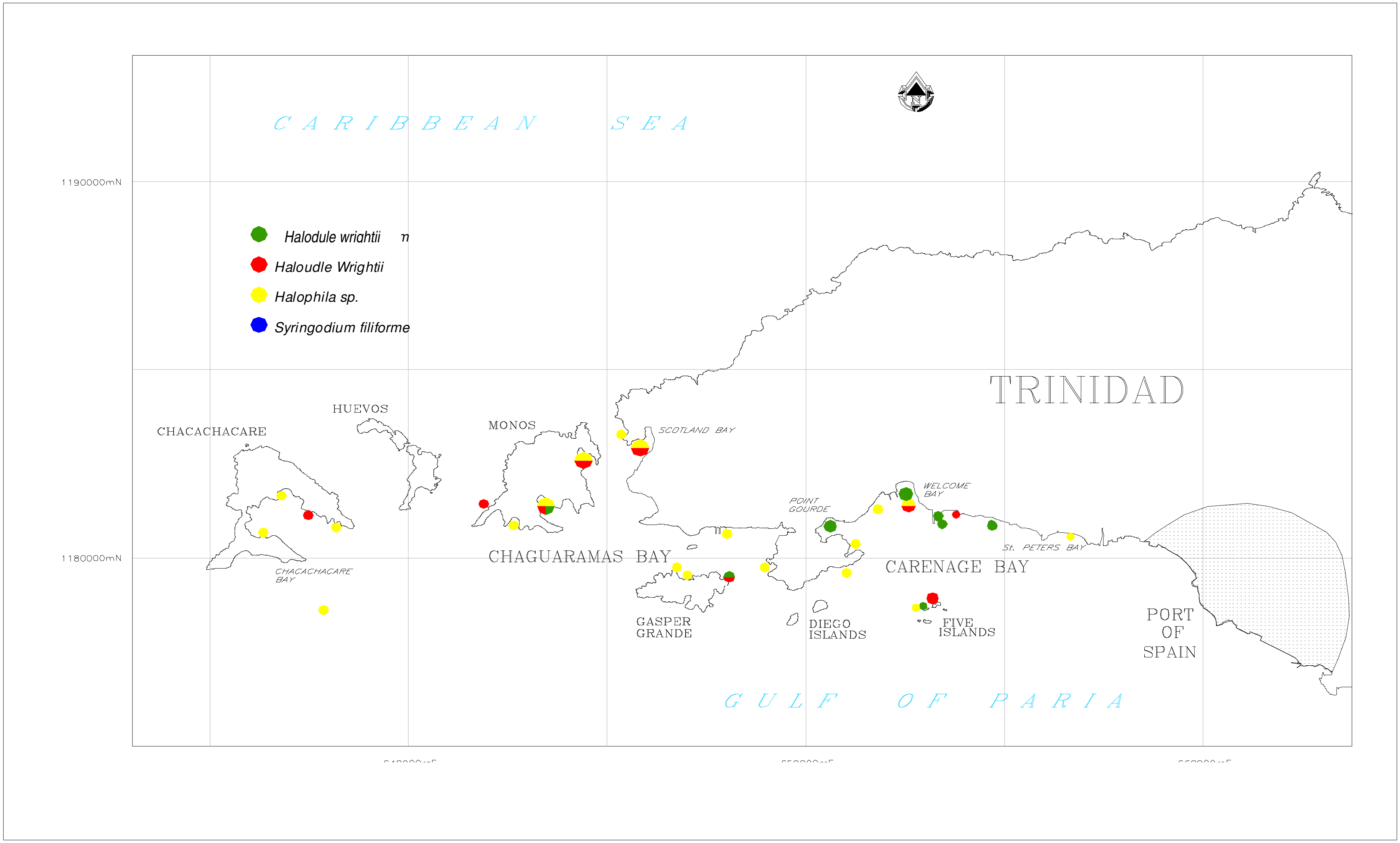
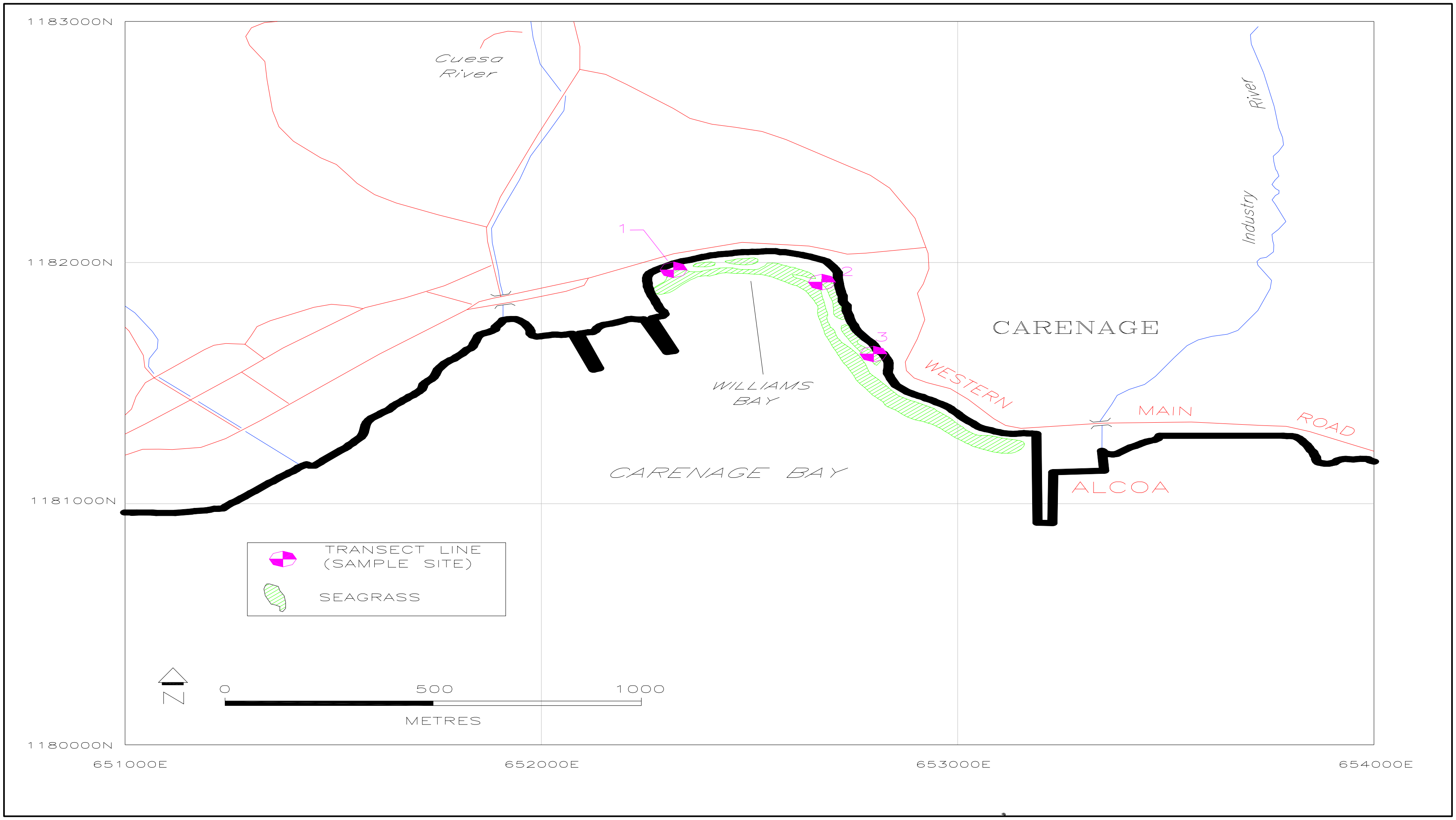
[11] Information on seagrass beds in Trinidad and Tobago was taken from Juman, R., and J.K. James-Alexander. *An Inventory of Seagrass Communities around Trinidad and Tobago.* Coastal Conservation Project, IMA, 2006.

MAP 9.5: LOCATION OF SEA GRASS BEDS ALONG THE NORTHWEST PENINSULA OF TRINIDAD



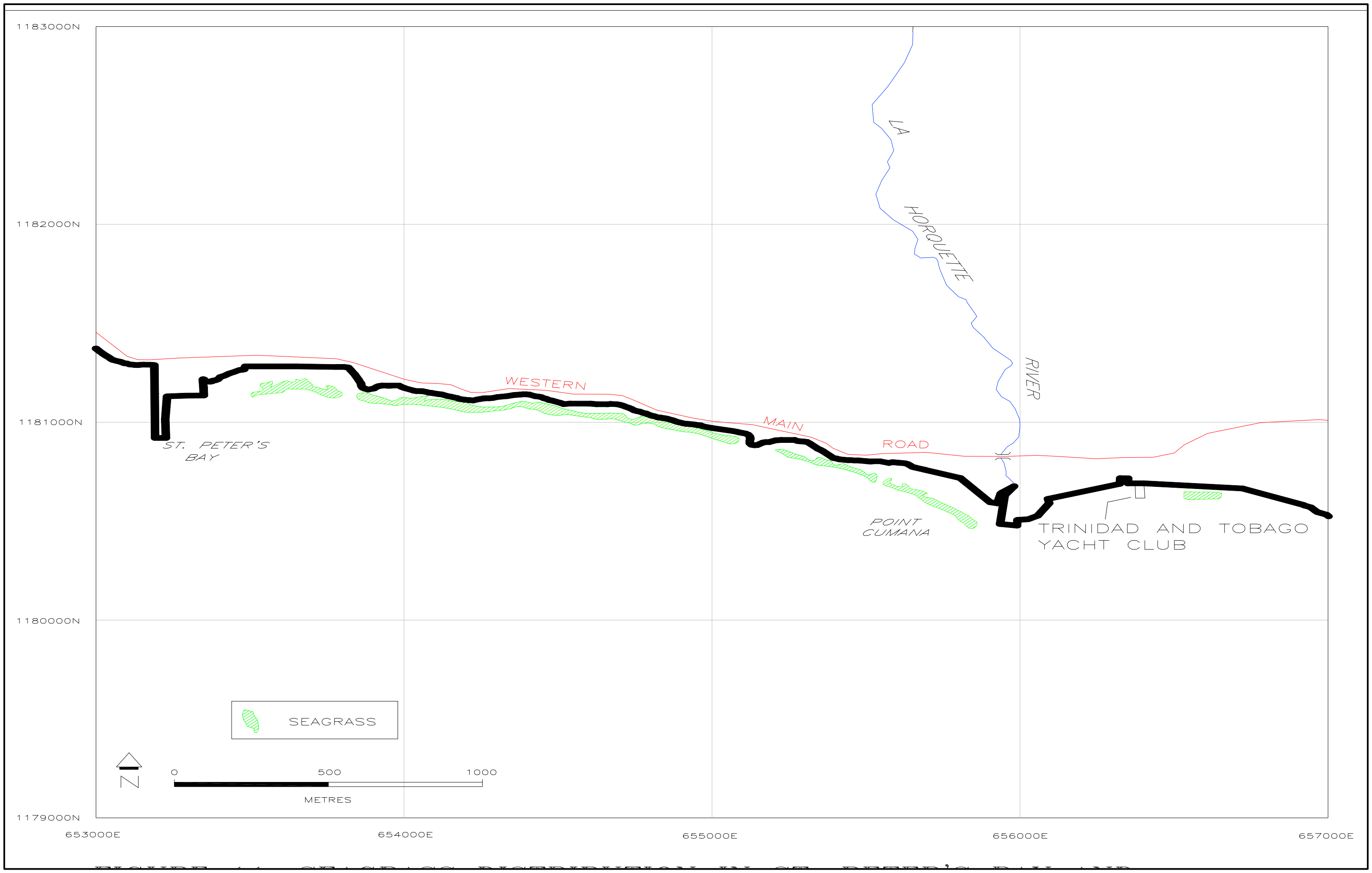
Source: - Juman, R., and J.K. Alexander-James. *An Inventory of Sea grass Communities around Trinidad and Tobago.* Coastal Conservation Project, IMA, 2006.

MAP 9.6: THALASSIA DOMINATED SEA GRASS COMMUNITY IN WILLIAM'S BAY



Source: Juman, R., and J.K. Alexander. *An Inventory of Sea grass Communities around Trinidad and Tobago.* Coastal Conservation Project, IMA, 2006

MAP 9.7*: THALASSIA* DOMINATED SEA GRASS BEDS IN ST. PETER'S BAY, TRINIDAD



Source: Juman, R., and J.K. Alexander. An Inventory of Sea grass Communities around Trinidad and Tobago. Coastal Conservation Project, IMA, 2006

9.3.1 THALASSIA DOMINATED SEA GRASS BEDS

Thalassia communities once found in Scotland Bay, Grand Fond Bay (Monos Island), the Five Islands, Cocorite, North Claxton Bay and Balandra Bay are no longer present. These areas, with the exception of Balandra Bay, now have sparse *Halodule* communities (< 50 shoots per m^2) interspersed with *Halophila*. Sparse communities of *Halodule* and *Halophila* are found in bays around Monos, Chachachacare, Gasparee and Five Islands and are interspersed with various macroalgal species. *Halophila* were also observed in small patches among the mangroves at the mouth of the Blue River (*Juman and James-Alexander, 2006).*

The *Halodule wrightii* bed in the northeastern side of Guayaguayare is the largest and densest *Halodule* community reported for Trinidad and Tobago (Photograph 9.1). In the southeastern end, *Halodule* shoot density ranged from 4150 to 8050 shoots per m^2, with a mean of 5831 ± 1579 shoots per m^2. In the northwestern side, *Halodule* shoot density ranged from 600- 2150 shoots per m^2, with a mean of 1569 ± 473 shoots per m^2. The overall density of the bed was 3422 ± 2273 shoots per m^2 (n=20) (*Juman and James-Alexander, 2006)*

PHOTOGRAPH 9.1: LOCATION OF SEA GRASS COMMUNITY IN GUAYAGUAYARE BAY

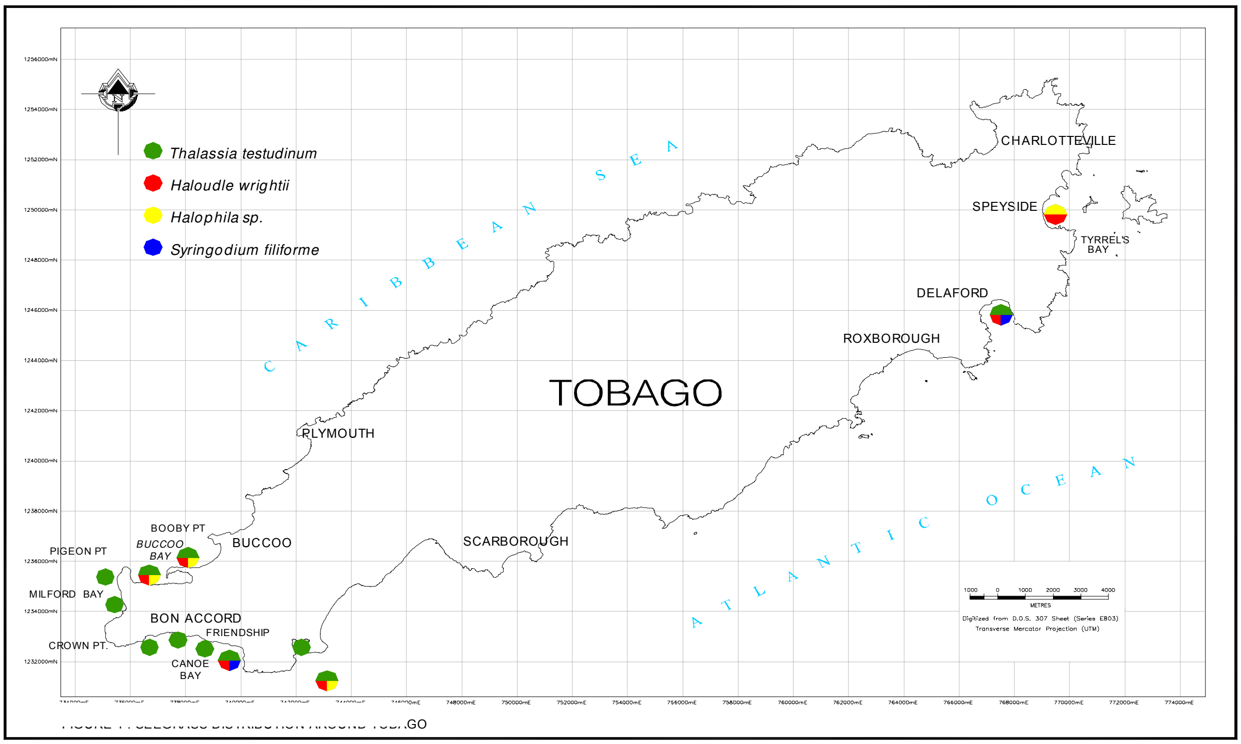
Source: - Juman and Alexander, 2006[12]

[12] **Juman, R., and J.K. James-Alexander. *An Inventory of Sea grass Communities around Trinidad and Tobago.* Coastal Conservation Project. IMA, 2006.**

9.4 Tobago

In addition to the three seagrass species recorded in Trinidad, a fourth species *Syringodium filiforme* (manatee grass) was found in Tobago. *S. filiforme* was found in mixed communities in King's Bay and Canoe Bay (Map 9.8). However, the most extensive *Thalassia* dominated seagrass communities in the country are found in southwest Tobago.

MAP 9.8: SEA GRASS COMMUNITIES AROUND TOBAGO



Source: Juman, R., and J.K. James-Alexander. *An Inventory of Sea grass Communities around Trinidad and Tobago.* Coastal Conservation Project . IMA, 2006.

The seagrass community within and adjacent to the Bon Accord Lagoon covers approximately 0.5 km^2 (Map 9.9). The sea grass beds extend in some places to a depth of approximately six metres. They are found in three main areas: north of Sheerbird's Point in the back reef area, south of Sheerbird's Point and in the Lagoon extending from east of Gibson's Jetty straight toward the south eastern end of Pigeon Point. *T. testudinum,* was the dominant sea grass species in the lagoon, comprising 80% of the community. Smaller areas of *Halophila decipiens* and *Halodule wrightii* were also found interspersed among the *T. testudinum*[13].

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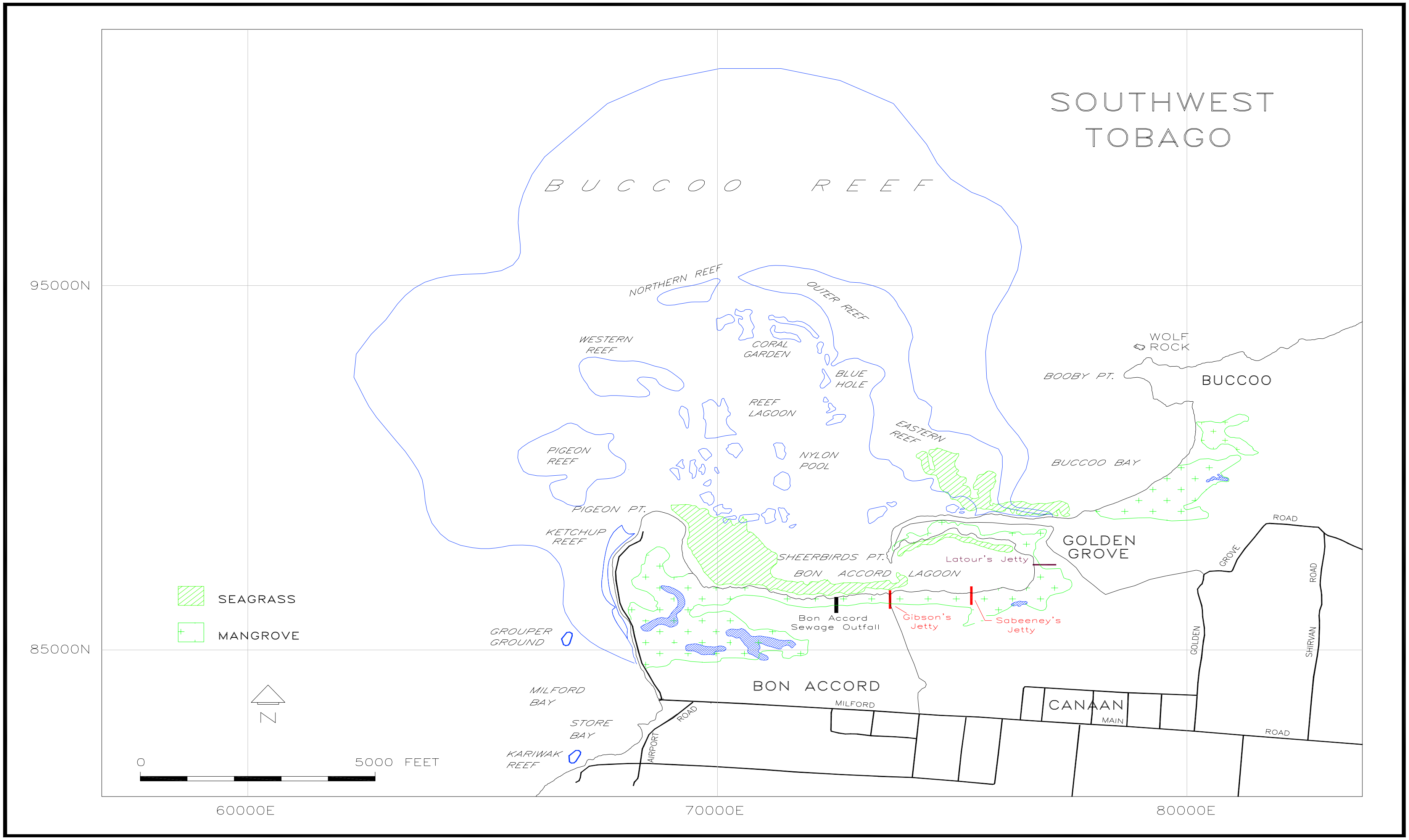
[13] Juman, R., and J.K. James-Alexander. *An Inventory of Seagrass Communities around Trinidad and Tobago.* Coastal Conservation Project. IMA, 2006.

MAP 9.9 SEA GRASS COMMUNITY IN BON ACCORD LAGOON/ BUCCOO REEF COMPLEX



Source: Juman, R., and J.K. Alexander. *An Inventory of Sea grass Communities around Trinidad and Tobago.* Coastal Conservation Project. IMA, 2006.

9.5 Coral Reefs

Trinidad and Tobago are the southern-most islands in the Caribbean chain and coral reefs and coral communities exist in our coastal waters. The coastal waters of Trinidad are largely influenced by the Orinoco River in Venezuela, which brings large quantities of sediment, nutrients and fresh water which affect coral growth and inhibit reef formation.

Only one coral reef can be reported in Trinidad and that is the Salybia Reef in Toco, although there are many patches of reef communities along the north and northwestern coasts including Gasparee and Monos Islands. These communities are mostly composed of soft corals such as sea fans (*Gorgonia ventilina*), hydrocorals (*Millepora sp.*) and hard corals such as the finger coral (*Porites porites*) (IMA 1999).[14]

The water conditions in Tobago are less variable than in Trinidad and coral reefs can be found around the island (Map 9.10). The reef system in Tobago includes the Buccoo Reef (Protected), Flying Reef, the Speyside Reef, Man-of-War Bay Reef, Culloden Bay Reef and the Arnos Vale Reef.

Coral reefs protect the coastline from erosion and storm surges. They act as nurseries for commercial fish species and as significant sources of food. Reefs are important recreational and aesthetic attractions forming the basis of dive tourism (Map 9.11), providing employment and income. They also contribute to the white sandy beaches. Some specific threats to coral reefs are: nutrient enrichment, siltation from storm run-off, human activities on reefs and climate change.

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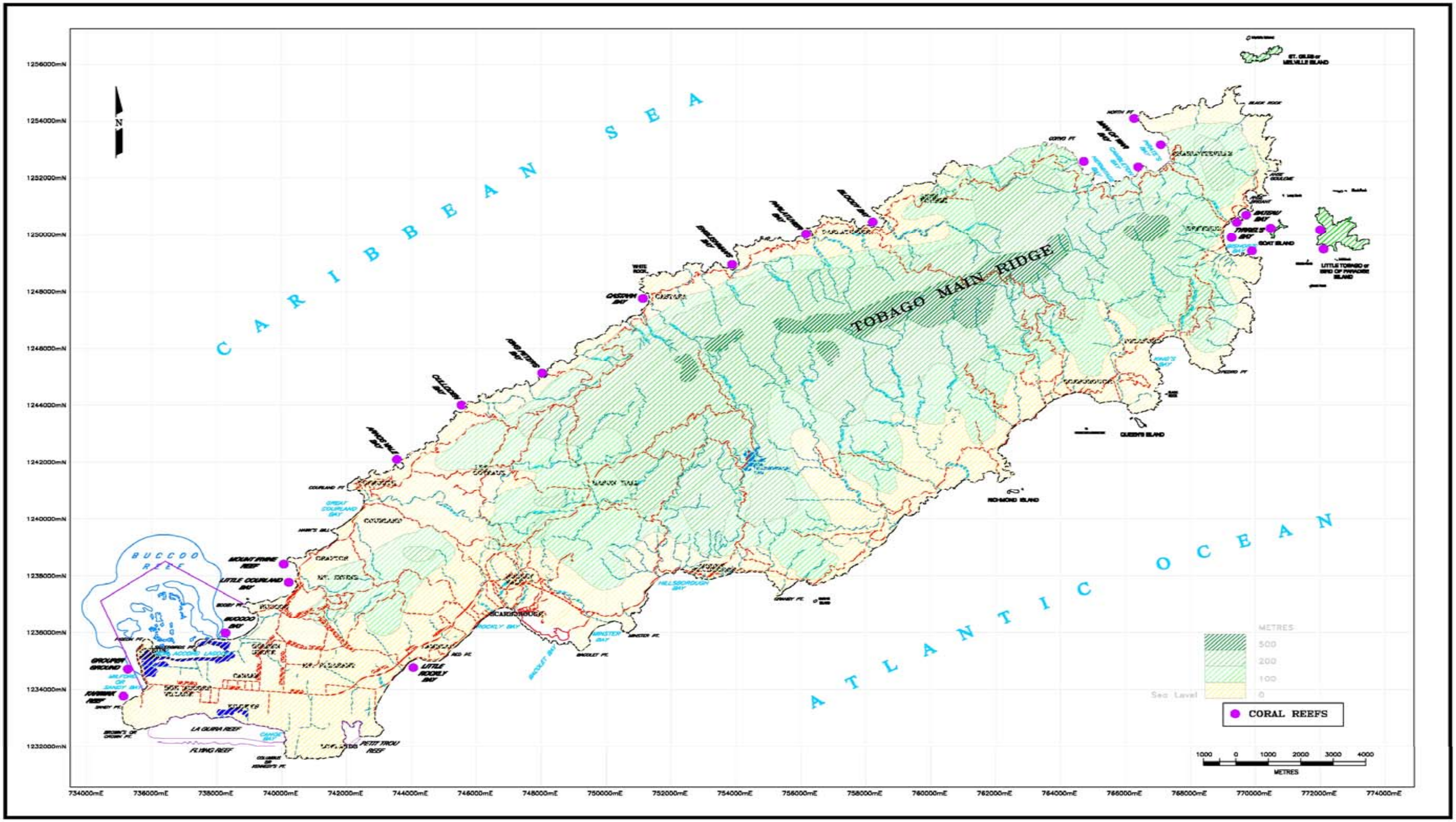
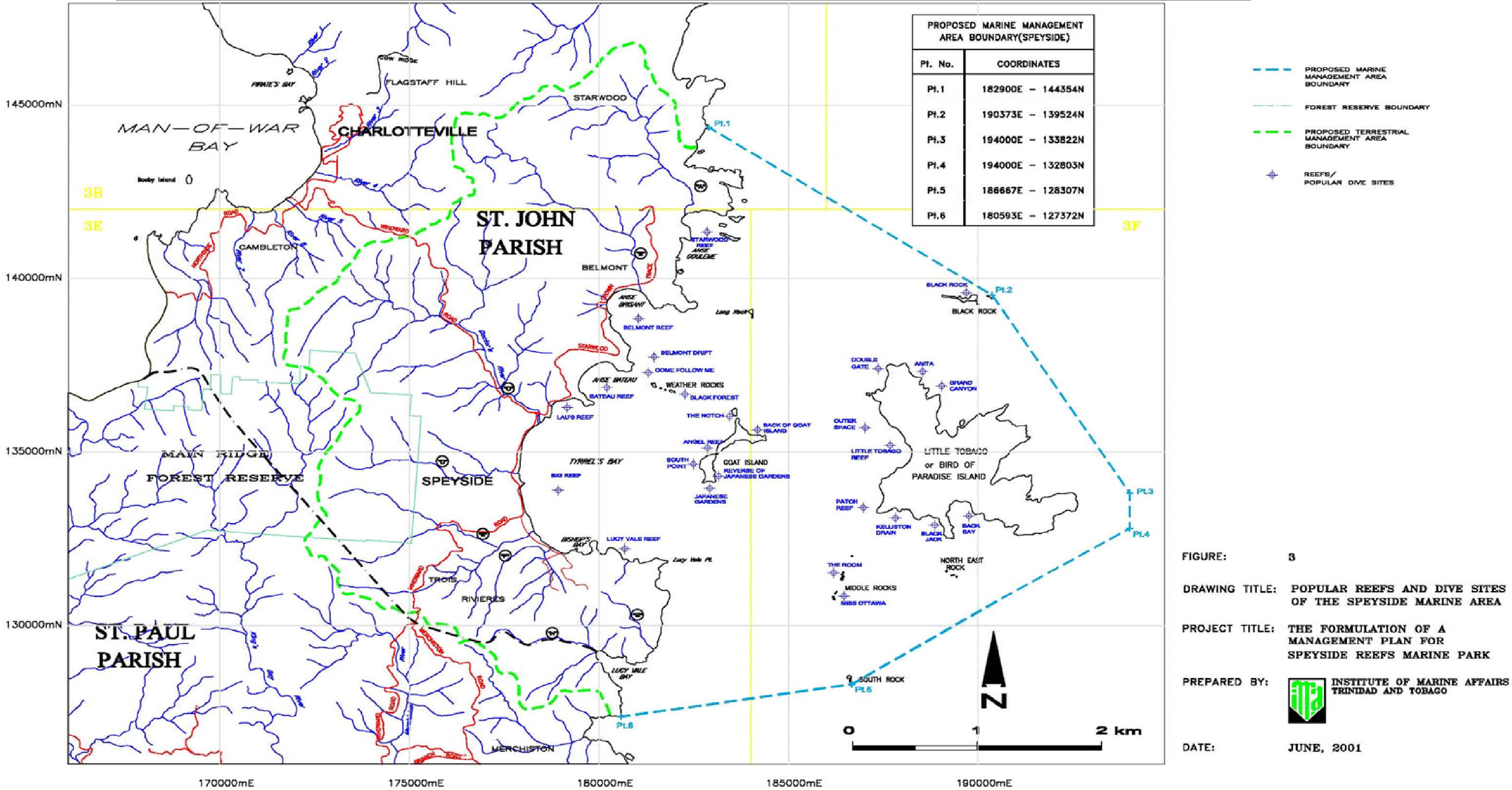
[14] Taken from: The Institute of Marine Affairs. "State of the Marine Environment Report." CEPNET/IDB



LOCATION OF CORAL REEFS AROUND TOBAGO

MAP 9.11 POPULAR REEFS AND DIVE SITES OF THE SPEYSIDE MARINE AREA



Photograph courtesy Ministry of Works and Transport

Photograph courtesy Caribbean Airlines

CHAPTER 10

TRANSPORTATION

Photograph courtesy Ministry of Works and Transport

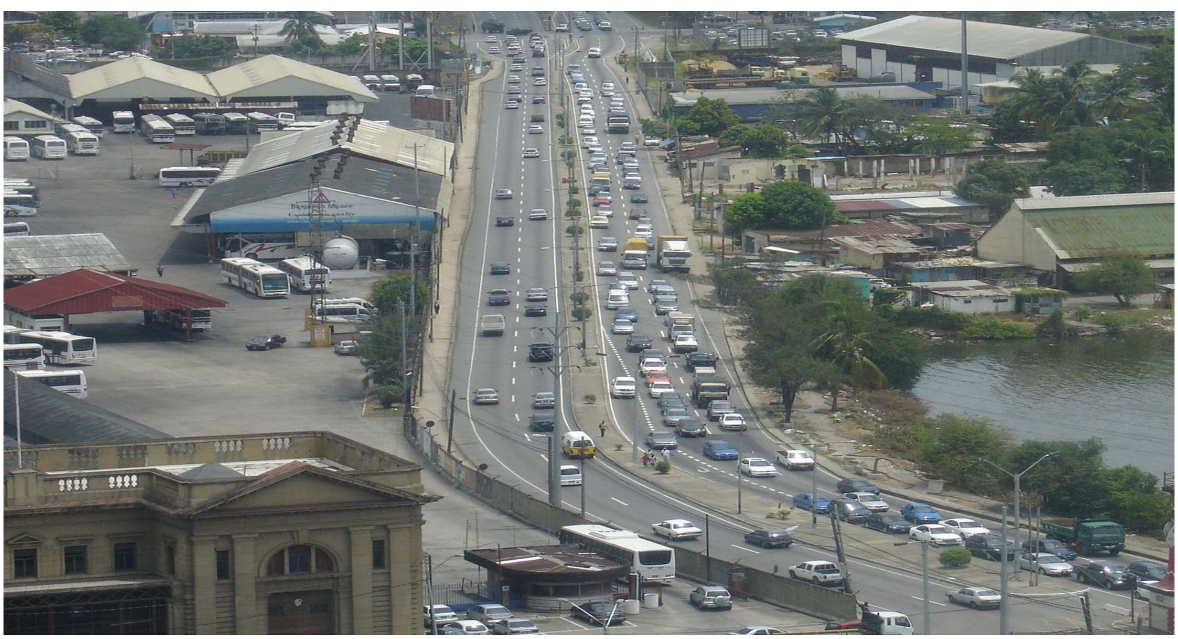
10 TRANSPORT

A. LAND TRANSPORTATION

Introduction

One of the most distinctive characteristics of a developing country is its eternal grappling with the planning process. Invariably, and in spite of a full appreciation of how valuable a tool it is, planning for the future lags the other “essential” activities. It is seldom comprehensive or complete and, even when it is properly done, it is not strictly followed. In Trinidad and Tobago, and especially in the Transport Sector, the experience has been typical. The Trinidad and Tobago's road system is mainly concentrated along the industrial ports of Trinidad's West Coast. Trinidad’s road system is constrained by three corridors of mountains. In the late 1980s, only two large east-west roads were in place, making travel through the center of the country more difficult. In Trinidad, the Churchill Roosevelt Highway which was the country’s first highway was built in 1941 by the Americans. In Tobago, one major loop road existed from Scarborough to Roxborough to Plymouth, with one major offshoot to the Crown Point Airport on the southwestern tip of the island.

Transport is one of the universal essentials to the well being of societies and their economies. Whether it is the transportation of goods or people, every civilization has responded to the demand by providing the means and as the demand grows, so does the supply of the means.



Incoming Traffic – Port of Spain, Trinidad

It is only in retrospect does it become obvious where the decisions to provide the various means would lead us. The first time an automobile appeared on the streets of Trinidad was on 24 March 1900. Over the last century, there has been a clear reliance and investment on the "automobile culture". As a result, the motor vehicle has saddled Trinidad and Tobago with attendant threats to the physical and psychological environment, which include:

- Carcasses of vehicles that are no longer in use;
- Dumping of parts that are routinely replaced (e.g. batteries and tyres);
- Dumping of chemicals that are replaced (e.g. lubricants and pneumatic fluids);
- Chemical leaks and spills (e.g. fuels, lubricants and detergents);
- Poisonous exhaust fumes;
- Noise;
- Effects of road and highway building (e.g. invasion of forested areas, wildlife sanctuaries and wetlands, defacement of landmarks, interference with coastal and tidal patterns by land reclamation, interference with natural runoff and drainage patterns);
- Threats to life and limb;
- Psychological pollution by subjecting thousands to hours of waiting in traffic jams daily.

To some degree, initiatives have been pursued, or are being pursued, to address these factors. For example, Trinidad and Tobago built its first Noise Barrier as part of the 1.2 km Diego Martin Highway Extension (from Sierra Leone Road to Wendy Fitzwilliam Boulevard) to protect residents on its eastern side. That highway also features safety elements which have now become standard in Trinidad and Tobago (e.g. wider lanes of 3.6 metres, New Jersey Barriers as the median, reflective road studs and full overhead highway lighting), but which were not included in the previous sections of the Diego Martin Highway. The aim is to, over time; bring all highway infrastructure up to the new standard.

Where the effect on the aesthetics of environment is concerned, the Ministry of Works and Transport partners with the private business community to carry out landscaping of verges, medians, roundabouts, bridges and flyovers, through its Highway Beautification Programme.

Trinidad Rail Project

The first railway was the Cipero Tramroad, opened on 5 March 1859. The Trinidad Government Railway (TGR) operated on a rail network of 109 route miles. The three main lines connected the capital city of Port-of-Spain, San Fernando and Siparia to the south and Rio Claro in the south-east. Since 1968 there has been no major railroad, but a small loop of railroad operated for agricultural purposes in San Fernando.The most significant undertaking affecting the land transport environment, however, is the Trinidad Rail Project. The project is to be implemented in stages and is planned to provide rail transport, linking communities from Diego Martin in the West to Sangre Grande in the East and San Fernando in the South and serving all districts in-between. Since the system is to be electrically powered, it will provide for the transport needs of the commuting public without the fume, chemical and other hazards associated with the current modes. Construction is expected to begin in 2007 with a segment opened to the public five years later.

Notwithstanding the potential impact of the Trinidad Rail Project, the Ministry of Works and Transport is also examining a number of other strategies aimed at immediately reducing vehicle usage and, in so doing, reducing its destructive effects on the environment. They are looking at:

- Exclusive High Occupancy Vehicle Lanes, which favour car-pooling, reinforced by legal restrictions to single-occupant vehicles in selected areas;

- Officially established park-and-ride facilities, coupled with an increased bus fleet;

- A ferry service (“water taxis”) between San Fernando and Port of Spain;

- Telecommuting in the Public Sector (the largest employer) and the provision of Government Services to the public via the Internet;

- Limitations to the importation of foreign used vehicles, in quantity, type and age (the foreign used market was liberalised in 1997, leading to a sharp rise in vehicle ownership).

Staggered working hours are also being considered to spread out the morning and evening peaks and, thereby, minimize the wait in traffic.

Carcasses of derelict vehicles which pose a threat to the physical environment

LAND TRANSPORTATION TABLES

TABLE 10.1: IMPORTS OF MOTOR VEHICLE BATTERIES BY COUNTRIES, 1999 - 2004

Country of Origin	Quantity						Total (By Country)
	1999	2000	2001	2002	2003	2004	
Belgium	-	-	-	-	-	2	2
Canada	-	114	1,035	681	2	3	1,835
China	7,095	1,414	61	150	4,306	1,295	14,321
Chech Republic	2	-	2	30	68	-	102
Czechoslovakia	-	-	-	-	-	10	10
France	34	-	4	25	-	21	84
Germany	6	107	170	544	176	247	1,250
Indonesia	2	-	11,969	13,718	21,206	15,332	62,227
Italy	-	-	-	1	-	1	2
Japan	82	1,914	26	-	4	13	2,039
Kenya	-	-	-	-	954	-	954
Korean Republic	18,593	17,052	17,999	17,245	27,491	27,338	125,718
Mexico	2,395	1,093	1,304	201	-	-	4,993
Philippines	-	-	-	-	1,646	3,166	4,812
South Africa	9,949	-	-	-	-	-	9,949
Taiwan	185	23,526	2	-	-	342	24,055
Thailand	11,916	-	-	-	-	4,368	16,284
Trinidad &Tobago	-	-	-	-	-	281	281
United Kingdom	-	48	29	7	-	-	84
U.S.A.	13,730	13,996	9,236	1,896	1,533	2,008	42,399
Venezuela	-	729	96	-	-	-	825
Total	**63,989**	**59,993**	**41,933**	**34,498**	**57,386**	**54,427**	**312,226**

Source: Central Statistical Office Trade Unit

10.1 Imports of Motor Vehicle Batteries

Motor vehicle batteries were imported from a range of twenty-one (21) countries during the period 1999 – 2004. The Korean Republic, China and U.S.A. have been consistent suppliers throughout the period while most significant quantities were imported from the Korean Republic, U.S.A. and Indonesia. The statistics revealed a declining trend between 1999 and 2002, with an upsurge in the total number of imported motor vehicle batteries in 2003, followed by a decline in 2004.

TABLE 10.2 IMPORTS OF MOTOR VEHICLE TYRES[1] BY COUNTRIES, 1999-2004

Country of Origin	Number Of Units					
	1999	2000	2001	2002	2003	2004
Australia	-	-	-	1,318	1,575	-
Barbados	-	-	-	280	-	-
Belgium	-	-	-	1,376	3,669	200
Brazil	1,114	1,109	565	393	517	4,793
Canada	55,820	41,443	45,860	26,648	29,701	1,924
Chile	-	-	-	-	-	482
China	-	-	1,108	60	300	40,979
Colombia	-	-	-	-	-	215
Costa Rica	-	-	379	342	297	-
Czechoslovakia (Former)	-	-	-	-	-	400
Denmark	-	3,047	-	-	-	-
Dominica	3,910	-	-	-	-	-
France	47,632	161	82	278	132	1,063
Germany	129	80,917	50,503	81,412	74,279	2,096
Guatemala	-	942	98	-	-	-
Hong Kong	-	-	-	25	-	-
India	150,616	59	-	20	-	220
Ireland	-	-	-	200	-	-
Israel	24	145,707	38,163	2,012	1,425	-
Indonesia	-	-	-	-	-	3,016
Italy	97,766	32	2	-	-	86
Japan	20,881	89,623	73,258	74,488	41,053	93,203
Korea (Republic of)	4,609	14,305	7,746	11,820	3,553	63,488
Korea D.P. Republic	2,335	4,120	970	-	-	6,233
Malaysia	30,264	-	-	-	-	-
Mexico	-	-	-	-	-	3,480
Morocco	-	-	-	-	3	-
Netherlands	-	5,778	3,456	8,334	7,849	-
Panama	-	-	-	-	-	16
Peru	-	-	-	-	1,506	-
Philippines	-	-	-	-	-	1,298
Poland	-	-	-	-	-	828
Romania	-	-	-	-	-	627
Russian Federation	-	-	-	-	-	182
Singapore	-	-	-	-	-	1,318
South Africa	207	33,540	30,443	506	-	-
Spain	30	41	84	52	18	278
St. Lucia	5,350	-	-	-	-	-
Swaziland	-	-	1,553	2,619	-	-
Taiwan	-	-	-	-	-	24,711
Thailand	106,492	1,500	912	-	952	1,450
U.S.A.	6,908	124,102	72,658	86,117	76,930	43,955
United Arab Emirates	-	-	-	-	-	1,192
United Kingdom	240	11,725	23,263	14,885	7,941	191
Venezuela	-	-	-	-	-	20,068
Total	**534,327**	**558,151**	**351,103**	**313,185**	**251,700**	**317,992**

Source: Central Statistical Office Trade Unit

[1] – New and retreaded tyres.

10.2 Imports of Motor Vehicle Tyres

During the period 1999 – 2002, vehicle types were imported from a wide range of approximately forty-eight (48) developed and developing countries. Overall there was a significant decrease 60 % in the total number of types imported between 1999 – 2004. While there are several consistent sources of imported motor vehicle types including Japan, U.S.A., Korea, U.K., Germany, Canada and Brazil, the statistics reveal no clear trend.

TABLE 10.3: MOTOR VEHICLES REGISTERED BY TYPE, 1995 – 2004

Vehicle Type	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Private	2,210	7,681	10,309	18,904	14,641	12,176	13,956	17,514	16,668	17,292
Hired	56	138	242	1,190	1,675	1,075	1,043	896	792	800
Motorcycle	81	168	134	214	162	149	214	265	277	187
Rented	442	719	457	543	441	457	366	525	292	407
Goods	775	1,551	2,440	3,316	2,777	2,603	2,830	3,187	3,745	4,014
Omnibus	-	1	-	3	45	28	5	2	1	1
Tractor	71	50	129	129	199	237	161	121	165	144
Trailer	99	253	308	426	644	602	520	475	346	365
Other	2	19	22	24	55	69	31	45	34	28
TOTAL	3,736	10,580	14,041	24,749	20,639	17,396	19,126	23,030	22,320	23,238
Cumulative Total[1]	212,735	223,315	237,356	262,105	282,744	300,140	319,266	342,296	364,616	387,854

Source: Computer Department, Licensing Office, Ministry of Works and Transport

[1] The Cumulative Total is the total number of vehicles on the register as at year end, the total refers to the number of vehicles registered for the year.

10.3 Motor Vehicles Registered by Type

The total number of motor vehicles on register between1995 – 2004 shows continuous annual increases. Private vehicles accounted for the vast majority of motor vehicles throughout the period while the omnibus accounted for the smallest share.

TABLE 10.4: IMPORTS OF TYRES BY TYPE, 1999 - 2004

Type[1]	Years					
	1999	2000	2001	2002	2003	2004
New Tyres	398,119	397,707	321,164	388,596	418,374	385,178
Retreaded Tyres	12,359	5,172	2,517	5,928	1,602	478
Used Tyres	534,327	574,394	378,010	341,198	277,782	311,167
Total	**944,805**	**977,273**	**701,691**	**735,722**	**697,758**	**696,823**

Source: Central Statistical Office - Trade Unit

[1] Includes motor vehicle tyres, tractors, lorries, buses, motorcycles, bicycles, agricultural machinery, etc

10.4 Imports of Tyres by Type

The importation of tyres between 1999 – 2004 reveals an overall declining trend from 944,805 to 696,823 although there are fluctuations within the five-year period. The number of imported retreaded tyres and used tyres both reveal a similar trend with drastic decreases of 77% and 48% respectively, in spite of fluctuations within the period. The importation of new tyres, however, remained fairly constant except in 2001 where a decline to 321,164 was observed.

TABLE 10.5: IMPORTS OF MOTOR VEHICLES BY TYPE, 1993-2004

Year	Quantity (Numbers)			
	Motor Cars	Other Passenger Vehicles [1]	Commercial Vehicles[2]	Other Vehicles[3]
1993	2,771	114	509	158
1994	2,510	37	7,076	18
1995	3,895	40	1,299	43
1996	6,423	90	9,909	30
1997	6,679	141	2,680	87
1998	9,710	121	2,931	60
1999	26,393	188	2,438	139
2000	10,461	117	2,286	65
2001	10,806	111	2,576	75
2002	14,020	149	2,617	51
2003	16,452	212	3,042	64
2004	19,743	211	4,295	92
Total	**129,863**	**1,531**	**41,658**	**882**

Source: Central Statistical Office - Trade Unit

[1]Includes motor vehicles for the transport of more than 10 persons e.g. maxis, minibuses, buses, coaches etc

[2] Includes motor vehicles for the transport of goods e.g. trucks, 3- ton trucks and dumpsters

[3] Includes Cranes, Lorries, Concrete Mixers etc.

B. AVIATION TRANSPORTATION

Introduction

The wealth of aviation expertise in Trinidad and Tobago was brought to the forefront during the First World War, when many locals joined the British, Royal Flying Corps and distinguished themselves in service. In 1929-1930, the Venezuelan commercial airline, Campaign General Aeropostale ventured to begin a scheduled landplane service to Trinidad and on 8th January 1931, Piarco's first 3000 ft. runway was ready to receive its first aircraft. In Tobago, Crown Point Airport was built in 1940, when the Works Department laid a 670 meter landing strip on the south-western tip of the island.

In the late 1980s, Trinidad and Tobago had a total of six (6) airfields, five of which were usable and three (3) of which had permanent surface runways. Piarco International Airport's 3600 - meter runway could accommodate the largest of commercial aircrafts in the 1980s and was a busy airport because of the great number of North American and South American flights that connected via the airport. A new passenger terminal and a 2700-meter runway were being built in the late 1980s at Crown Point Airport in an effort to upgrade that airport to international status. Trinidad and Tobago in the late 1980s maintained some fourteen (14) major transportation aircrafts. Several major West European, North American, and South American airlines operated regular flights to Trinidad, and many other carriers transited the island. Tobago was expected to be the site of more regular routes as the island's airport gained international status. Caricargo, a joint venture between the governments of Trinidad and Tobago and Barbados, offered air freight services from Piarco International Airport.

One of the planes in the fleet of BWIA;
this was the national airline of Trinidad and Tobago as at 31st December 2006

The Aviation Transport Industry consists of a range of physical and social infrastructure, which has attendant environmental considerations. In relation to the Aviation Sector there are the static physical facilities such as Airports and Heliports and the transient activities of moving people via aircrafts themselves and the heliport and helicopter systems which all contribute to the environmental melee. However, the sector is one that is highly regulated internationally in all areas including the environment. Typical environmental issues that emanate from the activities of the air transport industry at airports, include:

- waste management
- water quality
- energy management
- bird hazard
- sewage and effluent
- noise and vibrations
- air quality
- hazardous materials
- landscape and ecological issues

Of the areas identified above, probably the best known and most frequently debated are the issues of noise and air pollution, caused by the activities of the aviation transport industry. It is generally agreed that Aviation's impact on the environment can be immense. Jet engines directly emit greenhouse gases by burning kerosene. They also produce powerful, yet little understood—polluting contrails and high-altitude clouds known as 'radiative forcing'. Their exact effect is uncertain.

The activities within the Trinidad and Tobago Aviation Transport Sector generate all the environmental issues identified above. While there are international guidelines in place, the aspects of monitoring and the consequent enforcement are not generally undertaken.

A typical example of this is in the area of noise operating restrictions. These exist globally and are also linked to the rating of the airport. However, noise monitoring, noise penalty and noise related charges are not exercised and enforced locally.

The Aviation trends within the Trinidad and Tobago context, as shown by the tables provided, indicate a growing Aviation Sector and increases in the movement of people domestically, regionally and internationally. Cargo movement has been somewhat volatile, in some ways reflective of international trends. The construction of the new terminal in Piarco has resulted in the availability of increased capacity to meet the anticipated continued growth. In Tobago, there are proposals for the expansion and modification of the Crown Point International Airport to address the ever-growing problem of space brought about by the steady growth in tourism on the island.

All these developments have brought with them attendant environmental concerns. It is now the responsibility of the Government, via its institutional and operational arms in the aviation sector, to work towards the development of an Environmental Management Plan for the Transportation Sector.

In addition, it should be noted that new systems being introduced into the Air Transport Sector are also introducing new environmental performance improvements. These include world-wide fleet efficiency which is improving at an estimated 1% per year, Air Traffic Management Systems, Continuous Descent Approach techniques to reduce aircraft noise, fuel burn and emissions and the introduction of Reduced Vertical Separation Minimum (RVSM), resulting in reductions in fuel burn and emissions. Locally, RVSM has already been introduced.

Onle of the Caribbean Airlines plane which has scheduled flights in the Caribbean Region

AVIATION TRANSPORTATION TABLES

This sub-section contains several tables on the movement of cargo, passengers and aircrafts between Piarco International Airport (PIA) in Trinidad and Crown Point International Airport in Tobago (CPIA).

TABLE 10.6: PASSENGER AND AIRCRAFT MOVEMENT – CPIA TOBAGO, 2002-2004

Year	International			Domestic			Intransit
	Arriving	Departing	Total	Arriving	Departing	Total	Total
2002							
Aircraft	1,999	1,797	3,796	5,269	5,531	**10,800**	**39,299**
Passengers	56,576	54,359	110,935	228,131	223,375	**451,506**	
2003							
Aircraft	1,977	1,952	3,929	6,146	6,109	**12,255**	**59,817**
Passengers	68,548	67,839	136,387	289,689	279,206	**568,895**	
2004							
Aircraft	2,331	2,336	4,667	8,341	8,349	**16,690**	**66,317**
Passengers	85,775	82,923	168,698	359,684	350,342	**710,026**	

Source: Airports Authority of Trinidad and Tobago - Statistical Unit Information Department
N.B. Domestic data indicates movement between Crown Point and Piarco

10.6 Passenger and Aircraft Movement at Crown Point International Airport

The statistics on both international and domestic aircraft and passenger movement revealed an increase between 2002 and 2004 in the number of arriving and departing aircrafts and passengers.

International movements revealed a greater amount of arriving aircraft and passengers as opposed to departing movement for 2002, 2003 and 2004. Domestic movement showed a similar trend in 2003, but in 2002, the number of departing domestic aircrafts was greater than the number of domestic arriving aircrafts and this is the same for 2004 aircraft movement. Domestic passenger movement however indicated more passenger arrivals than departures in 2004.

TABLE 10.7: CARGO[1] MOVEMENT AT (CPIA) TOBAGO BY WEIGHT, 2002-2004

Year	International (Kg)			Domestic (Kg)		
	Unloaded	Loaded	Total	Unloaded	Loaded	Total
2002	95,695	19,237	114,932	667,060	240,191	**907,251**
2003	74,474	17,945	92,419	380,246	76,636	**456,882**
2004	109,799	23,106	132,905	331,999	47,565	**379,564**

Source: Airports Authority of Trinidad and Tobago – Statistical Unit Flight Information Department

[1]Cargo = Freight + Mail

10.7 Cargo Movement at (CPIA) Tobago

Between 2002 and 2003, there was a notable decline in the total volume of international and domestic cargo movement at Crown Point International Airport. For both international and domestic cargo, unloaded cargo far exceeded loaded cargo in 2002, 2003 and 2004.

TABLE 10.8:
NUMBER OF DOMESTIC PASSENGERS MOVED BETWEEN PIA (TRINIDAD) AND CPIA (TOBAGO), 2002-2004

Airline Carrier	2002	2003	2004
Tobago Express	316,350	408,460	486,430
BWIA	132,309	103,234	199,870
Caribbean Star	2,847	57,201	13,054
Total	**451,506**	**568,895**	**699354**

Source: Airports Authority of Trinidad and Tobago – Statistical Unit Flight Information Department

10.8 Domestic Passengers moved between Trinidad and Tobago

Three airline carriers accounted for the domestic passenger movement between Crown Point and Piarco Airport in the period 2002 – 2004. Tobago Express dominated the passenger movement market and there was an increase of approximately 54% in the total number of domestic passenger movements from 2002-2004. Only one carrier, BWIA recorded a decline during this period. BWIA recorded a decline of 22% in 2003, but between 2003 and 2004, a 94% increase in passenger movement was observed.

TABLE 10.9:
NUMBER OF LANDINGS AND TAKE-OFFS BETWEEN (PIA) TRINIDAD (CPIA) TOBAGO, 2002-2004

Aircraft	Number of Landings and Take-offs
Landings	
2002	5,269
2003	6,146
2004	8,341
Take-Offs	
2002	5,531
2003	6,109
2004	8,349
Total Aircraft Movements	
2002	10,800
2003	12,255
2004	16,690

Source: Airports Authority of Trinidad and Tobago – Statistical Unit Flight Information Department

10.9 Total Landings and Take-offs between Trinidad and Tobago

Between the period 2002 – 2004, there was an increase from 10,800 to 16,690 in the total number of domestic aircraft movements recorded with increases in both landings and takeoffs in each consecutive year.

TABLE 10.10:
TOTAL LANDINGS PLUS TAKE-OFFS BETWEEN PIA (TRINIDAD) AND CPIA (TOBAGO) BY AIR CARRIERS SCHEDULED, 2002 - 2004

	Years	Air Carriers Scheduled				
		Tobago Express	*BWIA*	*Caribbean Star*	*LIAT*	**Total Scheduled Airlines**
January	2002	507	254	-	..	**761**
	2003	749	79	110	..	**938**
	2004	936	84	62	60	**1,142**
February	2002	457	329	-	..	**786**
	2003	740	88	112	..	**940**
	2004	920	109	63	57	**1,149**
March	2002	483	295	-	..	**778**
	2003	858	131	123	..	**1,112**
	2004	1,030	78	65	63	**1,236**
April	2002	582	259	-	..	**841**
	2003	713	125	124	..	**962**
	2004	1,051	99	60	60	**1,270**
May	2002	740	178	-	..	**918**
	2003	806	93	126	..	**1,025**
	2004	988	72	58	59	**1,177**
June	2002	662	205	-	..	**867**
	2003	126	112	806	..	**1,044**
	2004	951	66	60	60	**1,137**
July	2002	851	256	-	..	**1,107**
	2003	890	126	128	..	**1,144**
	2004	982	97	63	62	**1,204**
August	2002	918	266	-	..	**1,184**
	2003	880	193	124	..	**1,197**
	2004	966	574	70	62	**1,672**
September	2002	731	137	-	..	**868**
	2003	790	92	76	..	**958**
	2004	708	729	60	57	**1,554**
October	2002	711	92	65	..	**868**
	2003	836	100	-	..	**936**
	2004	722	956	63	62	**1,803**
November	2002	722	84	60	..	**866**
	2003	833	86	-	..	**919**
	2004	842	681	68	59	**1,650**
December	2002	755	85	116	..	**956**
	2003	987	93	-	..	**1,080**
	2004	974	603	57	62	**1,696**
Total	**2002**	**8,119**	**2,440**	**241**	**..**	**10,800**
	2003	**9,208**	**1,318**	**1,729**	**..**	**12,255**
	2004	**11,070**	**4,148**	**749**	**723**	**16,690**
Market Share	2002	75.18%	22.59%	2.23%	..	**100.00%**
	2003	75.10%	10.80%	14.10%	..	**100.00%**
	2004	66.33%	24.85%	4.49%	4.33%	**100.00%**

Source: Airports Authority of Trinidad and Tobago - Statistical Unit Flight Information Department

10.10 Scheduled Air Carriers Landings and Takeoffs between Trinidad and Tobago

Total domestic aircraft movements for the period 2002-2004 showed monthly variations for each airline carrier. Tobago Express remained consistent and dominated the total market share during the period accounting on average for over 72% over this period, as compared with the other three carriers.

TABLE 10.11: TOTAL LANDINGS PLUS TAKE-OFFS BETWEEN PIA (TRINIDAD) AND CPIA (TOBAGO) BY MONTHS, 2002 - 2004

	Months												TOTAL
	January	February	March	April	May	June	July	August	September	October	November	December	
Landings													
2002	355	366	355	402	458	433	528	592	434	436	433	477	**5,269**
2003	470	470	555	482	516	521	572	598	478	471	473	540	**6,146**
% Change	**32.40%**	**28.40%**	**56.30%**	**19.90%**	**12.70%**	**20.30%**	**8.30%**	**1.00%**	**10.10%**	**8.00%**	**9.20%**	**13.20%**	**16.60%**
2003	470	470	555	482	516	521	572	598	478	471	473	540	**6,146**
2004	570	574	618	630	588	568	600	833	781	903	829	847	**8,341**
% Change	**21.30%**	**22.10%**	**11.40%**	**30.70%**	**14.00%**	**9.00%**	**4.90%**	**39.30%**	**63.40%**	**91.70%**	**75.30%**	**56.85%**	**35.70%**
Take Offs													
2002	406	420	423	439	460	434	579	592	434	432	433	479	**5,531**
2003	468	470	557	480	509	523	572	599	480	465	446	540	**6,109**
% Change	**15.30%**	**11.90%**	**31.70%**	**9.30%**	**10.70%**	**20.50%**	**-1.20%**	**1.20%**	**10.60%**	**7.60%**	**3.00%**	**12.70%**	**10.50%**
2003	468	470	557	480	509	523	572	599	480	465	446	540	**6,109**
2004	572	575	618	640	589	569	604	839	773	900	821	849	**8,349**
% Change	**22.20%**	**22.30%**	**11.00%**	**33.30%**	**15.70%**	**8.80%**	**5.60%**	**40.10%**	**61.00%**	**93.50%**	**84.10%**	**57.22%**	**36.70%**
Total Aircraft Movements													
2002	761	786	778	841	918	867	1,107	1,184	868	868	866	956	**10,800**
2003	938	940	1,112	962	1,025	1,044	1,144	1,197	958	936	919	1,080	**12,255**
% Change	**23.30%**	**19.60%**	**42.90%**	**14.40%**	**11.70%**	**20.40%**	**3.30%**	**1.10%**	**10.40%**	**7.80%**	**6.10%**	**13.00%**	**13.50%**
2003	938	940	1,112	962	1,025	1,044	1,144	1,197	958	936	919	1,080	**12,255**
2004	1,142	1,149	1,236	1,270	1,177	1,137	1,204	1,672	1,554	1,803	1,650	1,696	**16,690**
% Change	**21.70%**	**22.20%**	**11.20%**	**32.00%**	**14.80%**	**8.90%**	**5.20%**	**39.70%**	**62.20%**	**92.60%**	**79.50%**	**57.04%**	**36.20%**

Source: Airports Authority of Trinidad and Tobago - Statistical Unit Flight Information Department

10.11 Monthly Landings and Take-offs between Trinidad and Tobago

Total aircraft movements for the period 2002 – 2004 show monthly variances with landings and takeoffs, which can be attributed to seasonal demands. Between 2002 – 2003, the greatest variance was recorded in March for both landings and takeoffs while the greatest variance for 2003 – 2004 was recorded in October. Overall, for each corresponding month between 2002 and 2004, there was been an increase in the number of landings and takeoffs.

TABLE 10.12:
DOMESTIC CARGO MOVEMENT BETWEEN AND (PIA) TRINIDAD AND (CPIA) TOBAGO BY WEIGHT AND AIR CARRIERS, 2002 - 2004

Months	Years	Air Carriers Scheduled (Kg)			
		Tobago Express	***BWIA***	***Caribbean Star***	**Total**
January	2002	53,762	20,520	-	**74,282**
	2003	32,264	10,553	7,853	**50,670**
	2004	10,613	4,462	..	**15,075**
February	2002	47,109	18,648	-	**65,757**
	2003	27,397	830	9,377	**37,604**
	2004	33,242	6,640	..	**39,882**
March	2002	61,438	41,654	-	**103,092**
	2003	28,435	9,392	10,354	**48,181**
	2004	25,923	2,906	..	**28,829**
April	2002	66,343	26,297	-	**92,640**
	2003	18,861	6,880	11,882	**37,623**
	2004	43,673	4,812	..	**48,485**
May	2002	64,322	20,502	-	**84,824**
	2003	31,543	5,521	12,748	**49,812**
	2004	28,130	235	..	**28,365**
June	2002	67,748	22,179	-	**89,927**
	2003	10,503	14,564	13,929	**38,996**
	2004	33,829	2,888	..	**36,717**
July	2002	50,279	18,122	-	**68,401**
	2003	28,186	13,570	11,343	**53,099**
	2004	22,872	8,763	..	**31,635**
August	2002	42,221	13,931	-	**56,152**
	2003	20,698	6,334	-	**27,032**
	2004	4,080	9,065	..	**13,145**
September	2002	58,914	14,273	-	**73,187**
	2003	24,650	4,322	10,726	**39,698**
	2004	3,701	36,851	..	**40,552**
October	2002	73,591	5,418	-	**79,009**
	2003	19,324	6,650	-	**25,974**
	2004	1,058	22,536	..	**23,594**
November	2002	58,728	6,078	-	**64,806**
	2003	22,164	12,442	-	**34,606**
	2004	18,600	11,589	..	**30,189**
December	2002	32,790	5,611	16,775	**55,176**
	2003	8,342	5,245	-	**13,587**
	2004	39,508	4,036	..	**43,544**
Total	**2002**	**677,245**	**213,233**	**16,775**	**907,251**
	2003	**272,367**	**96,303**	**88,212**	**456,882**
	2004	**265,229**	**114,783**	**..**	**379,564**
	2002	74.65%	23.50%	1.85%	**100.00%**
	2003	59.61%	21.08%	19.31%	**100.00%**

Source: Airports Authority of Trinidad and Tobago - Statistical Unit Flight Information Department

Note: *Cargo = Freight +Mail*

10.12 Domestic Cargo Movement between Trinidad and Tobago

The total domestic cargo movement between 2002 and 2003 showed a drastic decrease of almost 50% from 907,253 kgs in 2002 to 456,882 kgs in 2003. Cargo movements fell even further to 380,012kgs in 2004. Tobago Express maintained a market share majority but Caribbean Star was able to reduce the margin in 2003, taking 19.31% of the market share as compared with 1.85% in 2002. The statistics revealed a tendency towards greater domestic cargo movement during the first half of the year.

TABLE 10.13.1: NUMBER OF PASSENGERS MOVED AT PIA (TRINIDAD) 1985-2004
Scheduled and Non Scheduled

Year	International	Intransit	Domestic	Total Passengers	% Change
1985	876,292	37,721	492,910	1,406,923	
1986	908,724	99,169	488,541	1,496,434	**6.4%**
1987	978,643	76,187	476,812	1,531,642	**2.4%**
1988	1,028,047	94,608	399,524	1,522,179	**-0.6%**
1989	949,107	93,827	359,838	1,402,772	**-7.8%**
1990	948,411	76,688	343,631	1,368,730	**-2.4%**
1991	1,051,499	131,630	388,815	1,571,944	**14.8%**
1992	970,875	115,300	357,996	1,444,171	**-8.1%**
1993	962,039	88,124	271,321	1,321,484	**-8.5%**
1994	920,951	69,498	272,444	1,262,893	**-4.4%**
1995	918,633	105,677	307,290	1,331,600	**5.4%**
1996	958,943	106,703	338,639	1,404,285	**5.5%**
1997	1,023,901	126,258	365,288	1,515,447	**7.9%**
1998	1,066,048	152,611	368,531	1,587,190	**4.7%**
1999	1,202,309	180,915	392,055	1,775,279	**11.9%**
2000	1,329,911	160,808	439,053	1,929,772	**8.7%**
2001	1,317,811	153,165	417,300	1,888,276	**-2.2%**
2002	1,358,644	158,981	451,506	1,969,131	**2.0%**
2003	1,446,288	144,703	568,895	2,159,886	**9.7%**
2004	1,544,286	152,798	710,026	1,697,084	**-21.0%**
Total	**21,761,362**	**21,761,362**	**8,210,415**	**31,587,122**	

Source: Airports Authority of Trinidad and Tobago - Statistical Unit Flight Information Department Commercial Movements only.

TABLE 10.13.2:
NUMBER OF DOMESTIC PASSENGERS MOVED BETWEEN (PIA) TRINIDAD AND (CPIA) TOBAGO 2002-2004

Months	Years	Air Carriers Scheduled				
		Tobago Express	*BWIA*	*Caribbean Star*	*LIAT*	Total Scheduled Airlines
January	2002	19,413	14,113	1,336	..	34,862
	2003	30,098	4,277	1,248	..	35,623
	2004	42,316	5,605	1,336	1,020	50,277
February	2002	18,034	18,337	..	..	36,371
	2003	31,563	6,002	1,328	..	38,893
	2004	40,249	7,947	1,391	842	50,429
March	2002	20,276	19,504	..	..	39,780
	2003	37,301	10,690	2,659	..	50,650
	2004	48,056	5,316	1,635	1,248	56,255
April	2002	21,933	12,721	..	..	34,654
	2003	31,152	11,267	2,936	..	45,355
	2004	47,409	6,799	1,652	1,257	57,117
May	2002	28,229	8,836	..	..	37,065
	2003	37,179	6,479	2,791	..	46,449
	2004	46,186	4,777	1,336	934	53,233
June	2002	25,636	9,839	..	..	35,475
	2003	3,307	8,541	36,814	..	48,662
	2004	45,577	4,146	1,549	1,201	52,473
July	2002	31,439	13,701	..	..	45,140
	2003	41,872	9,660	3,816	..	55,348
	2004	47,694	5,352	1,874	1,661	56,581
August	2002	38,435	16,376	..	..	54,811
	2003	41,095	20,037	4,732	..	65,864
	2004	43,869	41,442	1,344	1,164	87,819
September	2002	26,476	5,719	..	..	32,195
	2003	33,561	6,245	877	..	40,683
	2004	26,385	28,647	175	331	55,538
October	2002	26,465	3,968	519	..	30,952
	2003	37,293	7,305	..	..	44,598
	2004	26,567	32,545	75	235	59,422
November	2002	28,495	4,245	536	..	33,276
	2003	37,671	6,044	..	..	43,715
	2004	32,080	28,723	277	371	61,451
December	2002	31,519	4,950	1,792	..	38,261
	2003	46,368	6,687	..	..	53,055
	2004	40,042	28,571	410	408	69,431
Total	**2002**	**316,350**	**132,309**	**4,183**	**..**	**452,842**
	2003	**408,460**	**103,234**	**57,201**	**..**	**568,895**
	2004	**486,430**	**199,870**	**13,054**	**10,672**	**710,026**
Market Share	2002	69.86%	29.22%	0.63%	..	100.00%
	2003	71.80%	18.10%	10.10%	..	100.00%
	2004	68.51%	28.15%	1.84%	1.50%	100.00%

Source: Airports Authority of Trinidad and Tobago – Statistical Unit Flight Information Department
Caribbean Star started flights between Trinidad and Tobago in October 2002.

TABLE 10.13.3:
MONTHLY DOMESTIC PASSENGER MOVEMENTS BETWEEN (PIA) TRINIDAD AND (CPIA) TOBAGO 2002- 2004

Passengers	Months												Annual[1] Total
	January	February	March	April	May	June	July	August	September	October	November	December	
Embarked													
2002	17,660	18,894	17,932	19,871	17,024	17,585	22,784	28,306	15,735	14,724	15,795	17,733	**223,375**
2003	17,607	18,408	25,140	21,667	22,037	24,395	29,381	33,389	19,974	21,233	20,641	25,334	**279,206**
%Change	**- 0.30%**	**- 2.60%**	**40.20%**	**9.00%**	**29.40%**	**38.70%**	**29.00%**	**18.00%**	**26.90%**	**44.20%**	**30.70%**	**42.90%**	**25.00%**
2003	17,607	18,408	25,140	21,667	22,037	24,395	29,381	33,389	19,974	21,233	20,641	25,334	**279,206**
2004	25,223	24,814	27,512	27,914	25,720	25,921	28,083	45,824	27,161	29,264	30,026	32,880	**350,342**
%Change	**43.30.%**	**34.80%**	**9.40%**	**28.80%**	**16.70%**	**6.30%**	**-4.40%**	**37.20%**	**36.00%**	**37.80%**	**45.50%**	**29.79%**	**25.48%**
Disembarked													
2002	17,202	17,477	21,848	14,783	20,041	17,890	22,356	26,505	16,460	16,228	17,481	20,528	**228,131**
2003	18,016	20,485	25,510	23,688	24,412	24,267	25,967	32,475	20,709	23,365	23,074	27,721	**289,689**
%Change	**4.73%**	**17.20%**	**16.80%**	**60.20%**	**21.80%**	**35.60%**	**16.20%**	**22.50%**	**25.80%**	**44.00%**	**32.00%**	**35.00%**	**27.00%**
2003	18,016	20,485	25,510	23,688	24,412	24,267	25,967	32,475	20,709	23,365	23,074	27,721	**289,689**
2004	25,054	25,615	28,743	29,203	27,513	26,552	28,498	41,995	28,377	30,158	31,425	36,551	**359,684**
%Change	**39.10%**	**25.00%**	**12.70%**	**23.30%**	**12.70%**	**9.40%**	**9.70%**	**29.30%**	**37.00%**	**29.10%**	**36.20%**	**31.85%**	**24.16%**
Total[1]													
2002	34,862	36,371	39,780	34,654	37,065	35,475	45,140	54,811	32,195	30,952	33,276	38,261	**452,842**
2003	35,623	38,893	50,650	45,355	46,449	48,662	55,348	65,864	40,683	44,598	43,715	53,055	**568,895**
%Change	**2.18%**	**6.90%**	**27.30%**	**30.90%**	**25.30%**	**37.20%**	**22.60%**	**20.20%**	**26.40%**	**44.10%**	**31.40%**	**38.70%**	**25.63%**
2003	35,623	38,893	50,650	45,355	46,449	48,662	55,348	65,864	40,683	44,598	43,715	53,055	**568,895**
2004	50,277	50,429	56,255	57,117	53,233	52,473	56,581	87,819	55,538	59,422	61,451	69,431	**710,026**
%Change	**41.1%**	**29.7%**	**11.1%**	**25.9%**	**14.6%**	**7.8%**	**2.2%**	**33.3%**	**36.5%**	**33.2%**	**40.6%**	**30.87%**	**24.81%**

Source: Airports Authority of Trinidad and Tobago - Statistical Unit Flight Information Department

[1] Total equals embarked plus disembarked passengers

10.13.1 - 10.13.3 Passenger Movement in Trinidad and Tobago

For each corresponding month between 2002 – 2004 there was a general increase in the total domestic passenger movement with the annual total number of passengers disembarking remaining slightly higher than the number of embarking passengers in 2002 and 2003. The greatest variation during this period was observed in November (2004/2003) and October (2003/2002) for embarking passengers. The greatest variation for disembarking passengers occurred in January (2004/2003) and in April (2003/2002).Overall the total domestic passenger movement between 2002 – 2004 revealed an increase trend in each consecutive year from a total of 452,842 to 568,895 followed by 710,026. These movements indicate a 26% increase for the period 2003/2002 and a 25% increase for the period 2004/2003.

TABLE 10.14 MONTHLY DOMESTIC MAIL MOVEMENTS AT CPIA (TOBAGO), 2002-2004

Mail	Months												Total
	January	February	March	April	May	June	July	August	September	October	November	December	
Loaded													
2002	1,209	682	1,084	1,297	1,068	591	392	359	727	424	721	421	**8,975**
2003	338	1,202	498	541	437	715	1,660	115	223	458	407	65	**6,659**
%Change	**-72.00%**	**76.20%**	**-54.10%**	**-58.30%**	**-59.10%**	**21.00%**	**323.50%**	**-68.00%**	**-69.30%**	**8.00%**	**-43.60%**	**-84.60%**	**-25.80%**
2003	338	1,202	498	541	437	715	1,660	115	223	458	407	65	**6,659**
2004	70	170	307	332	220	1,538	350	60	117	**-**	73	230	**3,467**
%Change	**-79.30%**	**-85.90%**	**-38.40%**	**-38.60%**	**-49.70%**	**115.10%**	**-78.90%**	**-47.80%**	**-47.50%**	**-100.00%**	**-82.10%**	**353.85%**	**- 51.40%**
Unloaded													
2002	4,455	2,627	3,973	5,466	5,526	2,895	2,089	2,015	1,525	714	2,014	23	**33,322**
2003	2,133	592	537	1,047	783	783	321	639	411	2,276	692	645	**10,859**
%C	**-52.10%**	**-77.50%**	**-86.50%**	**-80.80%**	**-85.80%**	**-73.00%**	**-84.60%**	**-69.30%**	**-73.00%**	**218.80%**	**-65.60%**	**2704.30%**	**-67.40%**
2003	2,133	592	537	1,047	783	783	321	639	411	2,276	692	645	**10,859**
2004	**-**	1,247	887	1,342	807	1,163	921	701	1,545	829	934	421	**10,797**
%Change	**-100.00%**	**110.60%**	**65.20%**	**28.20%**	**3.10%**	**3.10%**	**186.90%**	**9.70%**	**275.90%**	**63.60%**	**35.00%**	**-35.00%**	**-4.40%**
Total[1]													
2002	5,664	3,309	5,057	6,763	6,594	3,486	2,481	2,374	2,252	1,138	2,735	444	**42,297**
2003	2,471	1,794	1,035	1,588	1,220	1,498	1,981	754	634	2,734	1,099	710	**17,518**
%Change	**-56.40%**	**-45.80%**	**-79.50%**	**-76.50%**	**-81.50%**	**-57.00%**	**-20.20%**	**-68.20%**	**-71.80%**	**140.20%**	**-59.80%**	**59.90%**	**-58.60%**
2003	2,471	1,794	1,035	1,588	1,220	1,498	1,981	754	634	2,734	1,099	710	**17,518**
2004	70	1,417	1,194	1,674	1,027	2,701	1,271	761	1,662	829	1,007	651	**14,264**
%Change	**-97.20%**	**-21.00%**	**15.40%**	**5.40%**	**-15.80%**	**80.30%**	**-35.80%**	**0.90%**	**162.10%**	**-69.70%**	**-8.40%**	**-8.31%**	**-22.30%**

Source: Airports Authority of Trinidad and Tobago - Statistical Unit Flight Information Department

[1] Total equals loaded mail plus unloaded mail

10.14 Monthly Domestic Mail Movement in Tobago

The total domestic airmail movements between 2002 and 2004 decreased dramatically, by approximately 68%, from 42,297 kgs in 2002 to 14,264 kgs in 2004.

TABLE 10.15 MONTHLY DOMESTIC FREIGHT MOVEMENT AT (CPIA) TOBAGO, 2002-2004

Cargo	Months												Total
	January	February	March	April	May	June	July	August	September	October	November	December	
Loaded													
2002	20,938	9,441	16,687	25,876	13,107	71,414	16,116	9,631	20,130	17,123	9,920	835	**231,218**
2003	8,725	2,917	4,918	4,707	18,028	8,174	2,015	3,242	7,845	6,892	2,446	68	**69,977**
%Change	**-58.30%**	**-69.10%**	**-70.50%**	**-81.80%**	**37.50%**	**-88.60%**	**-87.50%**	**-66.30%**	**-61.00%**	**-59.80%**	**-75.30%**	**-91.90%**	**-69.70%**
2003	8,725	2,917	4,918	4,707	18,028	8,174	2,015	3,242	7,845	6,892	2,446	68	**69,977**
2004	1,626	2,776	2,581	3,539	1,610	10,728	7,192	454	4,771	2,074	1,739	5,008	**44,098**
%Change	**-81.40%**	**-4.80%**	**-47.50%**	**-24.80%**	**-91.10%**	**31.20%**	**256.90%**	**-86.00%**	**-39.20%**	**-69.90%**	**-28.90%**	**7364.71%**	**-36.98%**
Unloaded													
2002	47,680	53,007	81,348	60,001	65,123	15,027	49,804	44,147	50,805	60,748	52,151	53,897	**633,738**
2003	39,474	32,893	42,228	31,328	30,564	29,324	49,103	23,036	31,219	16,348	31,061	12,809	**369,387**
%Change	**-17.20%**	**-37.90%**	**-48.10%**	**-47.80%**	**-53.10%**	**95.10%**	**-1.40%**	**-47.80%**	**-38.60%**	**-73.10%**	**-40.40%**	**-76.20%**	**-41.70%**
2003	39,474	32,893	42,228	31,328	30,564	29,324	49,103	23,036	31,219	16,348	31,061	12,809	**369,387**
2004	13,379	35,689	24,604	43,272	25,728	23,288	23,172	11,930	34,121	20,691	27,443	37,885	**321,202**
%Change	**-66.10%**	**8.50%**	**-41.70%**	**38.10%**	**-15.80%**	**-20.60%**	**-52.80%**	**-48.20%**	**9.30%**	**26.60%**	**-11.60%**	**295.77%**	**-13.04%**
Total[1]													
2002	68,618	62,448	98,035	85,877	78,230	86,441	65,920	53,778	70,935	77,871	62,071	54,732	**864,956**
2003	48,199	35,810	47,146	36,035	48,592	37,498	51,118	26,278	39,064	23,240	33,507	12,877	**439,364**
%Change	**-29.80%**	**-42.70%**	**-51.90%**	**-58.00%**	**-37.90%**	**-56.60%**	**-22.50%**	**-51.10%**	**-44.90%**	**-70.20%**	**-46.00%**	**-76.50%**	**-49.20%**
2003	48,199	35,810	47,146	36,035	48,592	37,498	51,118	26,278	39,064	23,240	33,507	12,877	**439,364**
2004	15,005	38,465	27,185	46,811	27,338	34,016	30,364	12,384	38,892	22,765	29,182	42,893	**365,300**
%Change	**-68.90%**	**7.40%**	**-42.30%**	**29.90%**	**-43.70%**	**-9.30%**	**-40.60%**	**-52.90%**	**-0.40%**	**-2.00%**	**-12.90%**	**333.10%**	**- 16.86%**

Source: Airports Authority of Trinidad and Tobago - Statistical Unit Flight Information Department

[1] Total equals loaded freight plus unloaded freight

10.15 Monthly Domestic Freight Movement in Tobago

The total domestic freight movements between 2002 and 2004 decreased drastically, by approximately sixty-three percent (63%) from 864,956 kgs in 2002 to 365,300 kgs in 2004. The unloaded freight represented a great majority of the movement, approximately eight-one percent (81%) of the total freight movements. The statistics revealed a monthly fluctuation in the domestic freight movements with a slight tendency for greater movement during the first half of each year presented.

TABLE 10.16: MONTHLY DOMESTIC CARGO[1] MOVEMENT AT (CPIA) TOBAGO, 2002-2004

Cargo (Kg)	Months												Total
	January	February	March	April	May	June	July	August	September	October	November	December	
Loaded													
2002	22,147	10,123	17,771	27,173	14,175	72,005	16,508	9,990	20,857	17,547	10,641	1,256	**240,193**
2003	9,063	4,119	5,416	5,248	18,465	8,889	2,336	3,357	8,068	7,350	2,853	133	**75,297**
%Change	**-59.10%**	**-59.30%**	**-69.50%**	**-80.70%**	**30.30%**	**-87.70%**	**-85.80%**	**-66.40%**	**-61.30%**	**-58.10%**	**-73.20%**	**-89.40%**	**-68.65%**
2003	9,063	4,119	5,416	5,248	18,465	8,889	2,336	3,357	8,068	7,350	2,853	133	**75,297**
2004	1,696	2,946	2,888	3,871	1,830	12,266	7,542	514	4,888	2,074	1,812	5,238	**47,565**
% Change	**-81.30%**	**-28.50%**	**-46.70%**	**-26.20%**	**-90.10%**	**38.00%**	**222.90%**	**-84.70%**	**-39.40%**	**-71.80%**	**-36.50%**	**3938.35%**	**-43.80%**
Unloaded													
2002	52,135	55,634	85,321	65,467	70,649	17,922	51,893	46,162	52,330	61,462	54,165	53,920	**667,060**
2003	41,607	33,485	42,765	32,375	31,347	30,107	50,763	23,675	31,630	18,624	31,753	13,454	**381,585**
%Change	**-20.20%**	**-39.80%**	**-49.90%**	**-50.50%**	**-55.60%**	**68.00%**	**-2.20%**	**-48.70%**	**-39.60%**	**-69.70%**	**-41.40%**	**-75.00%**	**-42.80%**
2003	41,607	33,485	42,765	32,375	31,347	30,107	50,763	23,675	31,630	18,624	31,753	13,454	**381,585**
2004	13,379	36,936	25,491	44,614	26,535	24,451	24,093	12,631	35,666	21,520	28,377	38,306	**331,991**
% Change	**-67.80%**	**10.30%**	**-40.40%**	**37.80%**	**-15.40%**	**-18.80%**	**-52.50%**	**-46.60%**	**12.80%**	**15.50%**	**-47.60%**	**284.72%**	**-13.00%**
Total													
2002	74,282	65,757	103,092	92,640	84,824	89,927	68,401	56,152	73,187	79,009	64,806	55,176	**907,253**
2003	50,670	37,604	48,181	37,623	49,812	38,996	53,099	27,032	39,698	25,974	34,606	13,587	**456,882**
%Change	**-31.80%**	**-42.80%**	**-53.30%**	**-59.40%**	**-41.30%**	**-56.60%**	**-22.40%**	**-51.90%**	**-45.80%**	**-67.10%**	**-46.60%**	**-75.40%**	**-49.60%**
2003	50,670	37,604	48,181	37,623	49,812	38,996	53,099	27,032	39,698	25,974	34,606	13,587	**456,882**
2004	15,075	39,882	28,379	48,485	28,365	36,717	31,635	13,145	40,554	23,594	30,189	43,544	**379,564**
% Change	**-70.20%**	**6.10%**	**-41.10%**	**28.90%**	**-43.10%**	**-5.80%**	**-40.40%**	**-51.40%**	**2.20%**	**-9.20%**	**-12.80%**	**320.48%**	**-16.92%**

Source: Airports Authority of Trinidad and Tobago - Statistical Unit Flight Information Department

[1]Cargo = Freight + Mail

10.16 Monthly Domestic Cargo Movement

The total domestic cargo movements for the period 2002 to 2004 declined drastically by approximately 63% from 907,253 kg in 2002 to 379,564kg in 2004. The data set showed that the unloaded cargo represented a greater majority of the movement, approximately 81% of the total cargo movement. The statistics revealed a monthly fluctuation in the domestic cargo movements with a general decrease as the year proceeded and a tendency for greater movement during the first half of the year.

C. MARINE TRANSPORTATION

Introduction

There were seven major ports in Trinidad and one in Tobago. The central shipping location for the nation was Port-of-Spain. Port- of-Spain's modern facilities included advanced handling equipment, extensive warehousing, ancillary sheds, refrigeration areas, bunkering, and freshwater facilities. The port contained only eight berths in the late 1980s, however, and congestion was common because of the high number of ships bunkering in Port-of-Spain en route to North America or South America. Port development was an ongoing activity. Other major ports were specific-use facilities and included Point Lisas, Pointe-à-Pierre, Chaguaramas, Point Fortin, Brighton, Tembladora, and Scarborough. Point Lisas specialized in fertilizers, chemicals, petrochemicals, and sugar. Pointe-à-Pierre and Chaguaramas were ports of entry, and the latter also served as a timber and bauxite transshipment site. Point Fortin handled primarily oceangoing oil tankers, Brighton served the asphalt industry, and Tembladora was a privately owned port used as a transshipment point for Guyanese and Surinamese bauxite. Numerous shipping companies made port calls to the country, and Trinidad and Tobago was a member of the regional West Indies Shipping Corporation (WISCO) (World Factbook 2006).

The Panorama – one of the inter-island ferries of Trinidad and Tobago

Marine pollution has been defined as “the introduction by man, directly or indirectly, of substances or energy into the marine environment including estuaries, resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities including fishing, impairment of quality for use of sea water and reduction amenities.” (United Nations).
There are six forms of marine pollution in Trinidad and Tobago: -

- Ship-generated pollution or vessel-source pollution (navigation);
- Pollution by dumping (the disposal of wastes at sea);
- Land-based pollution (the discharge of a wide range of shore-generated effluents);
- Pollution from or through the atmosphere (the dissemination of emissions on land);
- Pollution from sea-bed activities (offshore petroleum exploration and exploitation); and
- Pollution from activities in the area (deep-ocean mining).

The marine environment has many uses which can be identified as follows:-

- Fish Propagation/Harvesting
- Shellfish propagation/Harvesting
- Swimming
- Waste Disposal
- Cooling water
- Drinking water
- Ecological life support system
- Transportation
- Sea-bed mining
- Hydrocarbon exploration
- Aesthetic

Ten years ago it was identified that the administrative, legal and regulatory frameworks, inclusive of marine pollution, needed to be revamped. This led to the creation of the Environmental Management Authority (EMA), the Environmental Management Commission and the Environmental Management Act. Their jurisdiction also deals with pollution prevention in rivers and waterways.

A primary concern of regulatory agencies such as the Maritime Services Division is ship-generated waste. Trinidad and Tobago has witnessed the growth of a number of light and heavy industries in its thrust towards economic development. The abundance of oil and natural gas also led to the establishment of new industries to exploit these natural resources. Given that 90% of our imported goods are transported by sea and due to our economic prosperity there has been an increase in the number of vessels traversing our waters within recent years, with the attendant risk of accidental or deliberate pollution. In addition, this country is very close to major sea lanes. The legislative and regulatory framework needs to be updated.

Trinidad and Tobago is a party to a number of international conventions relating to the marine environment. A Shipping Marine Pollution Act has been drafted and seeks to establish a framework for the creation of offences as it relates to shipping and the marine environment, penalties in relation to those offences and compensation by the offending party. The provisions of this Bill are under review by a special select Committee of the House of Representatives.

The International Convention for the prevention of Pollution from ships, 1973, as modified by the protocol of 1978 relating to (MARPOL 73/78) is one of the most important international agreements on the subject of marine pollution. Detailed regulations covering the various sources of ship-generated pollution are contained in five Annexes to the Convention. Annex V contains regulations for the prevention of pollution by garbage from ships.

Circa 1993, the wider Caribbean including the Gulf of Mexico and the Caribbean Sea was declared a special area. The other areas include the Black Sea area, Mediterranean Sea area, the Baltic Sea area, the Red Sea area, the "Gulfs area", the North Sea area and the Antarctic area. In order to give effect to this provision, countries must provide adequate reception facilities and notify the International Maritime Organization that this measure has been implemented. Data needs to be collected with respect to the disposal of waste by ships, which are alongside ports, and their means of disposal. Data is also needed to indicate the major source of pollution of this country's marine environment, i.e. whether it is land-based or vessel-based pollution.

There has been a proliferation of the number of yachts visiting the waters of Trinidad and Tobago. A Steering Committee was established in 2005 to coordinate the implementation of the recommendations arising from the "Strategic Plan for the Development of the Yachting Industry of Trinidad and Tobago – Final Report: March 2005". This will address inter-alia the issue of marine pollution as it relates to yachts. In this regard it will examine the use of the "***Code of conduct for the prevention of pollution from small yachts in the marinas and anchorages.***"

It should be noted that the marine pollution concerns in Trinidad are not the same as Tobago.

All of the above concepts, and more, are also part of the **Comprehensive National Transportation Study**, which commenced in February 2005 and was scheduled to conclude in July 2006. The work of the consultant in this area is expected to cover all the transport sectors of Land, Air and Sea to develop integrated environmental management plans. In relation to land, the study is intended to develop a template for Government's investments in the Transport Sector over the next twenty years. It must treat with (among other things) environmental impacts and the standards to be employed in the provision of all transport facilities and systems (including the transportation of hazardous substances). Accordingly, it is required to pronounce on the initiatives already taken or under consideration as well as those which are yet to be. It is also very likely that the study will make recommendations to establish statistical databases in a fashion that does not currently exist.

With respect to aviation, the Comprehensive National Transportation Study, currently being conducted for the Government of Trinidad and Tobago (GOTT), has identified a number of environmental considerations to be reviewed:

- the need for specific GOTT environmental guidelines for aviation
- typical existing public issues of noise, land use compatibility, exhaust emissions, water quality and lost wetlands
- the need to strike a balance between emerging nation status vs. overly stringent regulatory standards
- the need to meet/maintain minimum ICAO and IATA environmental standards

With specific reference to the sea sector, the Consultants have been requested to examine existing environmental legislation/international practices that may be best suited to Trinidad and Tobago. They are to produce guidelines with respect to the environmental impact of proposed port development and also on vessel acquisition, which may also adversely impact the environment, e.g. damages to the shoreline. The establishment of port reception facilities will also be examined.

Marine Transportation of Industrial Products

The following tables represent aspects of land, aviation and marine transportation which has environmental implications:

MARINE TRANSPORTATION TABLES

TABLE 10.17: PASSENGER ARRIVALS AND DEPARTURES BY (SEA) BETWEEN TRINIDAD AND TOBAGO, 1992–2004

Year	Sea	
	Port of Spain to Scarborough	Scarborough to Port of Spain
1992	103,921	103,742
1993	107,803	111,936
1994	123,105	115,578
1995	141,566	124,560
1996	147,626	141,001
1997	147,503	144,421
1998	150,728	144,506
1999	160,481	158,759
2000	138,517	138,663
2001	180,901	176,457
2002	204,324	203,790
2003	220,477	204,923
2004	186,022	197,608

Source: Central Statistical Office

[1] The MV Beauport commenced sailing on December 10th 2000. The MF Panorama was taken out of service on December 14th 2000. The passenger capacity of the Beauport is 820.

10.17 Passengers Arriving and Departing by Sea between Trinidad and Tobago

There was a steady increase in the number of passengers traveling by sea between Trinidad and Tobago during the period 1992 – 2004, with a tendency for the number of passenger departures from Port of Spain to be slightly higher that the number of passenger arrivals to Port of Spain. There is no distinct trend for passengers traveling by air; figures fluctuated but again the number of passenger arrivals and departures were very similar. Travel by air was the more popular mode of transport between Trinidad and Tobago with the only exception occurring in 2000 when more passengers travelled by sea.

Sea passengers awaiting departure in Trinidad to Tobago

TABLE 10.18 IMPORTS AND EXPORTS OF GOODS BY QUANTITY VIA SEAPORTS TO TRINIDAD AND TOBAGO, 1991- 2004

IMPORTS VIA SEAPORTS	***YEARS***						
	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
	QUANTITY (kgs)						
Port of Spain	3,847,934,380	2,800,449,291	359,3608,604	815,977,692	800,683,316	892,142,458	1,009,113,997
San Fernando	23,210	1,145	2,828,673	26,879	10,681	18,838	102,724
Scarborough	1,022,297	314,244	182,356	744,775	620,734	4,900,104	12,566,702
Brighton	-	-	2,374	2,331	4,006,138	5,126,505	12,352,759
Port Tembladora	-	-	250,857	60,779	396,730	260,518	2,601,666
Port Chaguaramas	80	-	31,618,821	26,917,753	94,093,928	125,605,045	198,851,689
Pointe a Pierre	49,570,373	34,707	56,312	2,689,688	1,493,931,710	2,889,617,927	2,785,637,301
Point Fortin	-	359,135	1,990		2,395	65,861,294	71,483,787
Point Lisas	13,427,704	-	271,530,678	2,109,088,889	2,147,636,086	1,834,379,942	1,904,894,443
Port Pointe Gourde	-	-	767	7,712	82,062	44,300	71,736
Queens Wharf	-	-	7,756,169	18,738,969	27,429,009	30,694,441	37,255,780
Point Galeota	-	-	4,062,493	2,150,499	6,899,356	1,445,442	15,028,573
TOTAL	3,911,978,044	2,801,158,522	3,911,900,094	2,976,405,966	4,575,792,145	5,850,096,814	6,049,961,157

IMPORTS VIA SEAPORTS	***YEARS***						
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
	QUANTITY (kgs)						
Port of Spain	1,061,116,250	1,161,655,454	991,903,425	1,005,780,790	1,146,032,939	1,315,633,832	1,036,922,622
San Fernando	119,002	50,841	35,065	37,653	1,693,963	91,355	316,878
Scarborough	29,629,447	4,084,457	8,983,503	5,109,463	9,276,206	394,901	1,436,126
Brighton	26,304	3,273,308	-	154,729	8,849	43,864,103	25,681,119
Port Tembladora	469,043	52,222	1,109,261	1,485,559	30,071	275,131	1,186,055
Port Chaguaramas	269,183,023	96,641,313	98,922,358	176,100,760	238,178,188	274,168,194	83,230,847
Pointe a Pierre	4,108,459,660	4,754,354,458	5,338,617,355	5,369,528,798	4,712,211,163	4,710,647,320	4,035,790,814
Point Fortin	9,697,876	335,982	28,409,221	55,922,542	12,836,270	72,953,757	67,375,466
Point Lisas	2,021,650,227	935,845,003	1,594,188,053	1,027,063,081	2,521,217,470	3,957,309,588	2,660,424,162
Port Pointe Gourde	100,058,491	96,165	30,331	39,537	189,377	32,894	9,109
Queens Wharf	33,124,843	39,935,380	102,748,119	26,523,272	16,832,470	18,136,163	22,811,921
Point Galeota	8,176,277	4,275,468	93,369	14,714,030	61,151,045	4,607,314	6,235,998
TOTAL	7,641,710,443	7,000,600,051	8,165,040,060	7,682,460,214	8,719,658,011	10,398,114,552	7,941,421,117

EXPORTS VIA SEAPORTS	YEARS						
	1991	1992	1993	1994	1995	1996	1997
	QUANTITY (kgs)						
Port of Spain	3,032,396,174	2,635,337,400	1,251,151,678	469,938,470	374,426,323	525,207,451	398,047,839
San Fernando	3,459,510,215	3,078,408,813	1,859,934,022	14,747,599	119,748	652,264	40,947
Scarborough	120,394	76,212	71,097	43,572	69,238	1,430,245	1,149,567
Brighton	-	-	-	-	9,932	33,770	22,536
Port Tembladora	1,948,727	2,705,184	3,053,391	4,707,630	1,028,112	850,124	49,080
Port Chaguaramas	240	34,490	8,017,185	12,093,671	28,782,605	38,582,008	35,352,280
Point a Pierre	3,794,568,841	3,985,390,145	3,789,687,742	4,123,532,260	5,302,014,205	5,018,694,078	4,217,168,959
Pointe Fortin	1,355,584,559	1,538,581,571	1,047,144,176	630,024,692	44,865,663	6,383,145	4,876,395
Point Lisas	1,237,051,689	1,518,062,047	2,103,570,114	4,250,945,807	4,281,086,530	4,303,077,624	5,142,499,663
Port Pointe Gourde	-	-	-	100,000	255	867	3,238
Queens Wharf	-	-	39,827,448	144,583,206	93,197,812	90,478,594	182,639,568
Point Galeota	-	-	1,283,775,757	2,408,223,343	2,987,013,747	2,657,401,974	2,836,008,082
TOTAL	12,881,180,839	12,758,595,862	11,386,232,610	12,058,940,250	13,112,614,170	12,642,792,144	12,817,858,154
EXPORTS VIA SEAPORTS	YEARS						
	1998	1999	2000	2001	2002	2003	2004
	QUANTITY (kgs)						
Port of Spain	1,115,860,488	780,836,129	552,635,039	511,065,410	346,480,962	394,838,543	762,843,043
San Fernando	29,025	16,294	169,192	21,390	19,031	29,682	26,954
Scarborough	22,049	1,853,141	84,299,142	5,853,076	1,111,679	351,322	3,571,400
Brighton	1,816,555	1,084,890	868,571	559,436	1,094,572	398,989	4,858,206
Port Tembladora	28,585	3,198,935	102,165	82,270	637,465	437,315	555,553
Port Chaguaramas	73,893,627	36,780,666	33,301,802	45,657,209	52,935,245	59,983,924	27,323,236
Pointe a Pierre	6,023,983,964	7,674,331,050	7,579,683,507	7,735,208,831	5,719,833,721	6,431,983,001	3,999,941,622
Point Fortin	8,552,919	1,090,562,773	1,957,022,818	1,901,410,182	2,509,213,966	5,681,528,773	7,956,341,763
Point Lisas	5,520,708,073	7,618,138,348	7,257,545,762	8,392,551,022	8,524,098,636	7,418,807,395	10,479,819,334
Port Pointe Gourde	22,321	621	135	41,516	416,121	27,082	950,054
Queens Wharf	126,585,205	95,245,226	279,981,447	67,835,079	120,687,408	42,782,080	73,999,468
Point Galeota	2,359,366,823	2,640,520,277	2,331,417,959	2,204,927,306	3,416,191,202	3,496,368,366	2,174,989,577
TOTAL	15,230,869,634	19,942,568,350	20,077,027,539	20,865,212,727	20,692,720,008	23,527,536,472	25,485,220,210

Source: Central Statistical Office; Trade and Travel Statistics

Goods in Trinidad and Tobago are imported and exported at twelve different ports as seen in Table 10.18. During the period 1991 to 1993 Port-of-Spain was the dominant port of entry for imported goods. This changed to Point Lisas in 1994-1995 and was then followed by Pointe-a-Pierre in 1996 to 2004. The volume of goods imported during the period above, ranged from 3.9 billion kgs in 1991 to 7.9 billion in 2004.

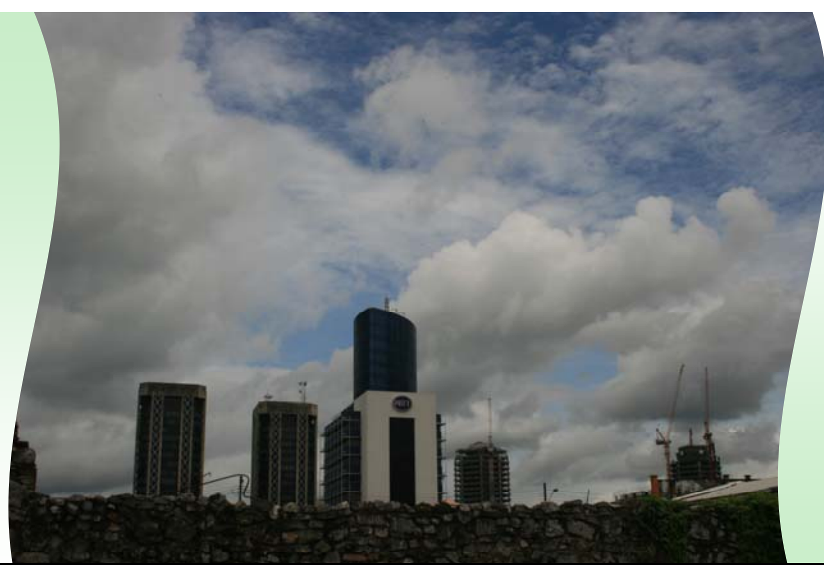
The main exporting seaport in Trinidad and Tobago was Pointe-a- Pierre from 1991 to 1996, with the exception of Point Lisas as the leading exporting seaport in 1994. From 1997 to 2000, Pointe-a–Pierre dominated with the largest volume of exports, but Point Lisas became the leading exporting seaport subsequently, from 2001 to 2004. During the period 1991-2004, the total quantity of goods exported increased from 12.8 billion kgs to 25.5 billion kgs.

CHAPTER 11

CLIMATE

Photograph courtesy Richard Edwards

Photograph courtesy Satee Boodoo



Photograph courtesy Richard Edwards

11 CLIMATE

11.1 Climate

Trinidad and Tobago the two most southerly islands of the Eastern Caribbean have two distinct and seasonal climatic types:

1. **Tropical Maritime**: - warm days and cool nights with rainfall mostly in the form of showers due to daytime convection. This typifies the dry season months of January to May.

2. **Modified Moist Equatorial**: - low wind speeds with hot humid days and nights and a marked increase in rainfall, not always convective. During this period, the islands come repeatedly under the influence of equatorial weather systems.

The two climatic types result in two distinct seasons – a dry season from January to May and a wet season from June to December. Tobago, the more northerly of the two islands, experiences drier seasons in comparison to Trinidad.

11.1.2 Climatic Determinants

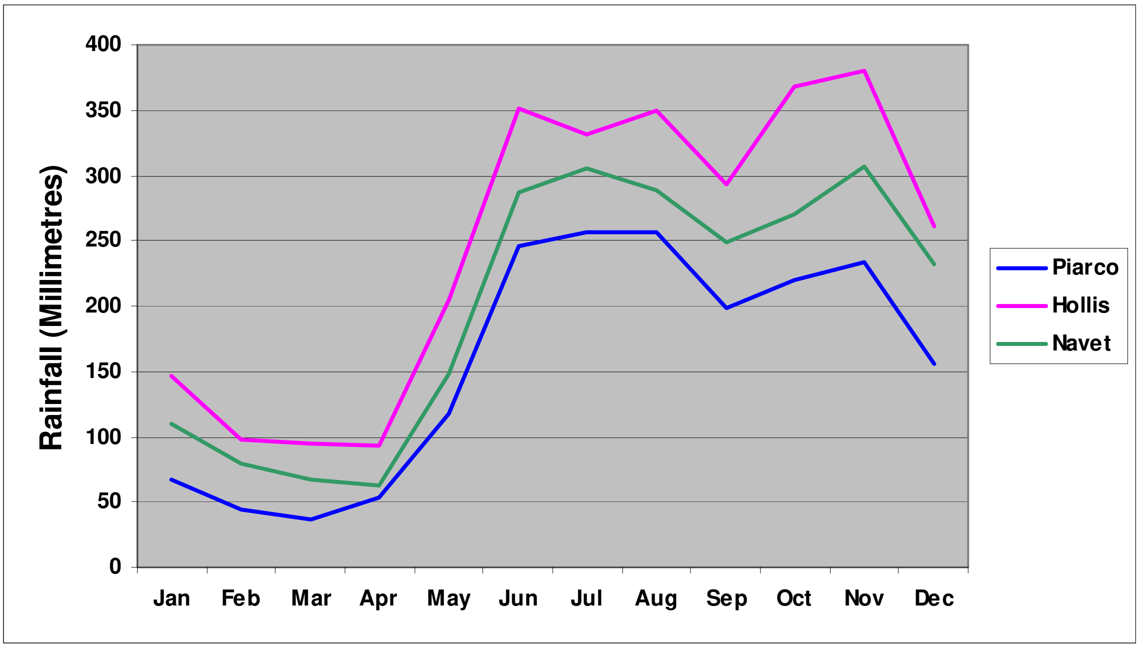
The main climatic determinants of Trinidad and Tobago are:

1. The latitudinal position and strength of the sub-tropical high pressure (Bermuda-Azores High) and semi-permanent northern hemispheric feature.
2. The Inter-Tropical Convergence Zone (ITCZ) – a major rainfall producing system, which is responsible for the rainy season.
3. The Mid-Atlantic Upper-level Trough – an upper tropospheric feature which assume prominence during the months of October to December.
4. Orography, Land size and sea breeze effect
5. Tropical waves and cloud clusters

11.2 Rainfall

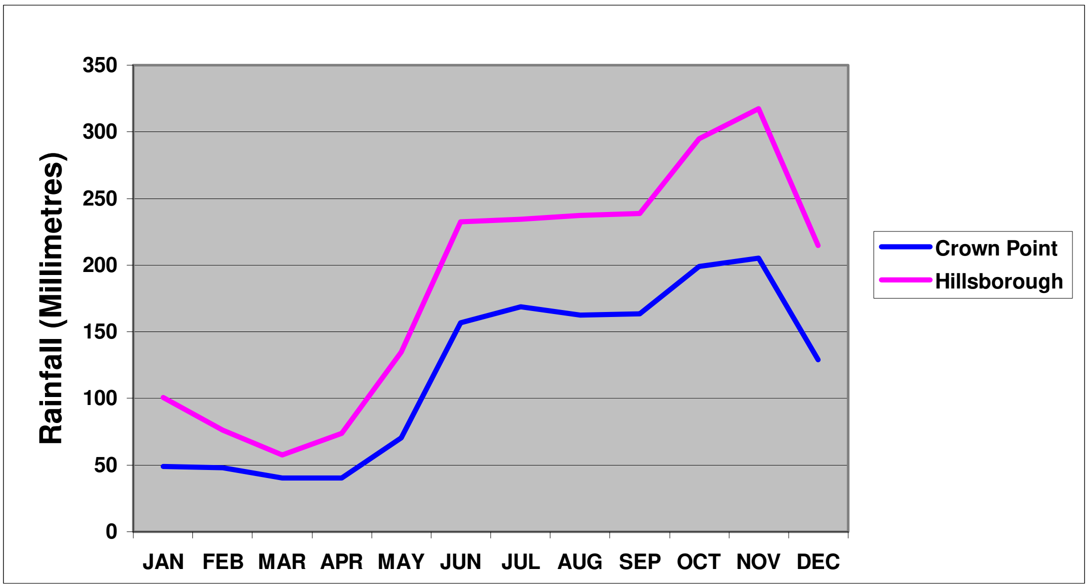
The annual rainfall pattern in Trinidad is bimodal in distribution (see Figure 11.1). In an average over the period 1971-2000, the first major peak occurred during June or July and was associated with the northward movement of the ITCZ. The second peak occurred in November. Tobago also has a bimodal rainfall distribution, however, the major peak occurred in November and the secondary peak occurred in June (see Figure 11.2)

FIGURE 11.1: COMPARISON OF THE LONG-TERM MONTHLY AVERAGES OF RAINFALL FOR THE STATIONS AT HOLLIS, NAVET AND PIARCO IN TRINIDAD, 1971- 2000



Source: Meteorological Services Division

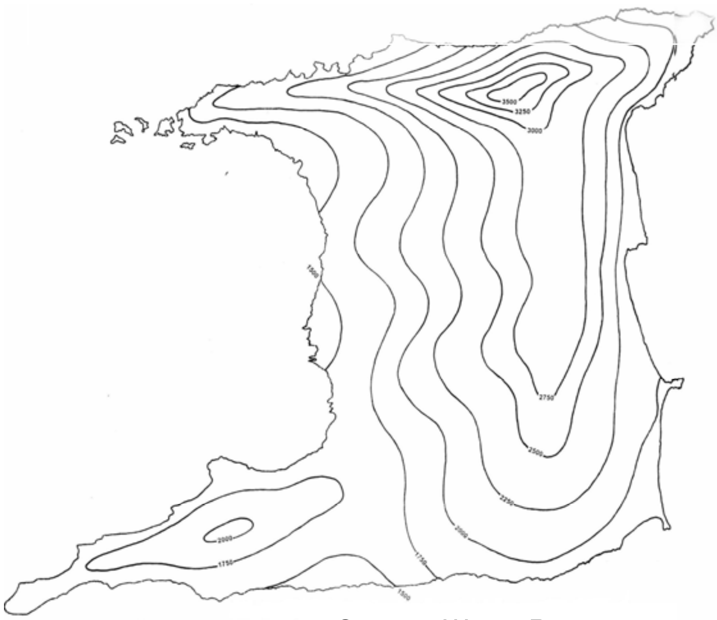
FIGURE 11.2: COMPARISON OF THE LONG-TERM MONTHLY AVERAGES OF RAINFALL FOR THE STATIONS AT CROWN POINT AND HILLSBOROUGH DAM IN TOBAGO 1971 - 2000



Source: Meteorological Services Division

11.2.1 Mean Annual Rainfall (Trinidad 1961 to 1990)

Map 11.1: Mean Annual Rainfall for Trinidad, 1961-1990



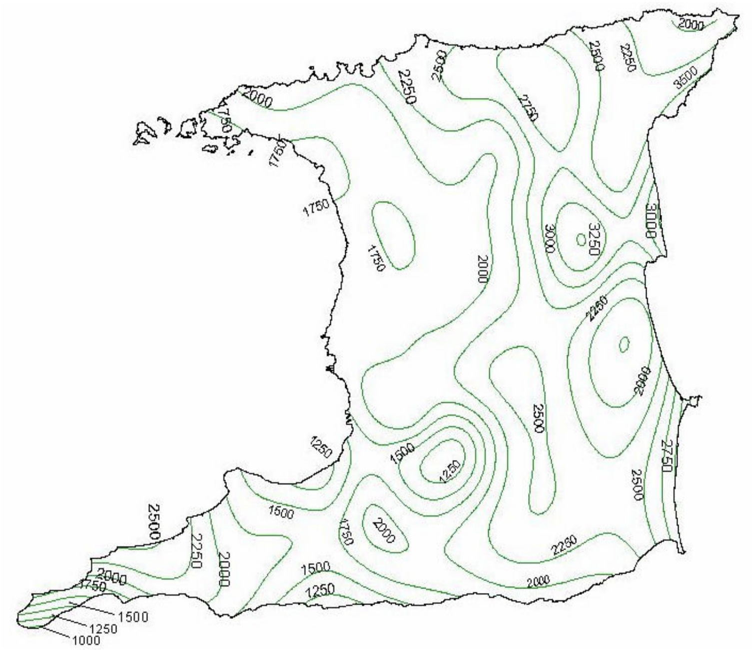
Source: Water Resources Agency/MET Office

Climatologically, Trinidad had a mean annual rainfall (1961 to 1990) maximum along the eastern Northern Range, with the centre on the eastern part of the range between Sangre Grande and Arima. The maximum also extends southward on the eastern side of the island through Rio Claro, towards Moruga. The western side of Trinidad is relatively dry in comparison to the eastern side (see Map 11.1), especially in the southwestern peninsula.

The mean annual rainfall ranges from in excess of 3500mm centred in the Northern Range, to values below 1500mm along the western coast of the island and along the south coast to the south east of Siparia.

11. 2. 2 Trinidad (1999)

Map 11.2: Isohyetal Map for Trinidad, 1999

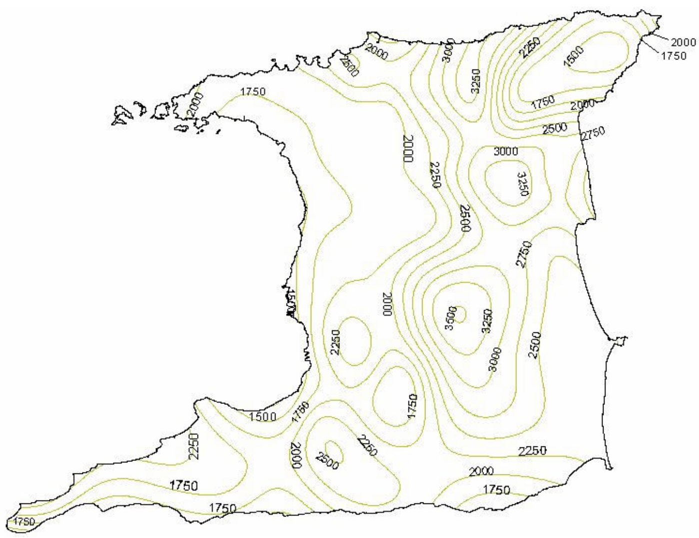


Source: Water Resources Agency/MET Office

The rainfall pattern for 1999 differs slightly from the mean annual rainfall pattern. The major difference is a minimum, which was located to the south east of San Fernando and on the eastern side of the island to the north west of Point Radix. (see Map 11.2). Further an area of maximum rainfall was located to the north east of Point Fortin.

11. 2. 3 Trinidad (2000)

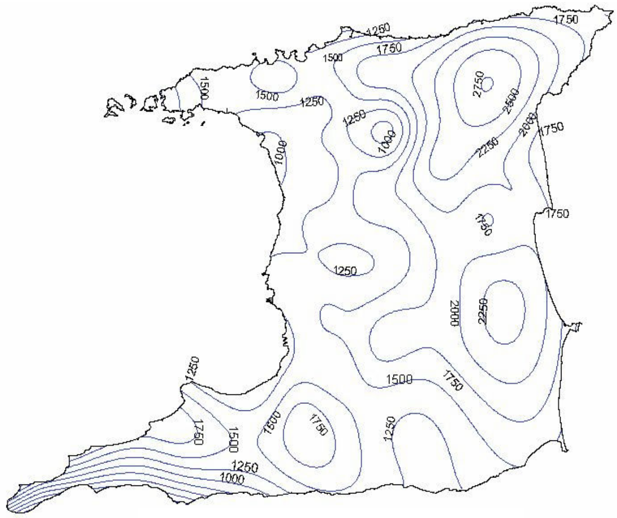
Map 11.3: Isohyetal Map for Trinidad, 2000



Source: Water Resources Agency/MET Office

Trinidad, during the year 2000, experienced similar rainfall patterns to that of 1999, albeit with higher values. The location of the maximum shifted to the Central Range, where the precipitation exceeded 3500mm (see Map 11.3).

Map 11.4: Isohyetal Map for Trinidad, 2001



Source: Water Resources Agency/MET Office

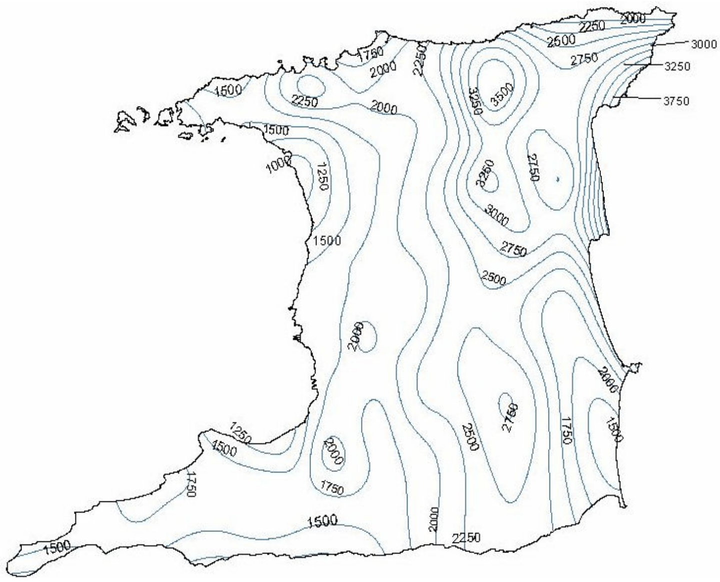
11. 2. 4 Trinidad (2001)

During the year 2001, the rainfall maximum shifted to the eastern Northern Range as per the mean annual pattern.However, due to the extremely arid dry season, precipitation totals for the year were lower than the mean especially on the western side of the island (see Map 11.4).

11. 2. 5 Trinidad (2002)

Rainfall during 2002 was quite similar to the mean in its major features. The maximum was located along the eastern Northern Ranges and its axis was along the range. The western side of the island continued to have lower rainfall values in comparison to eastern areas (see Map 11.5).

Map 11.5: Isohyetal Map for Trinidad, 2002



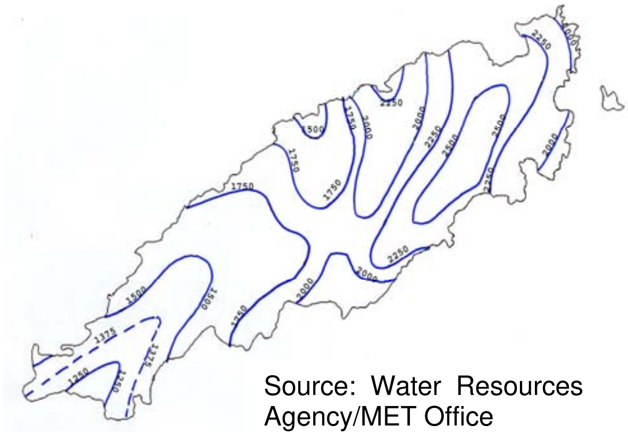
Source: Water Resources Agency/MET Office

11.2.6 Mean Annual Rainfall (Tobago 1971 to 2000)

Tobago had much lower rainfall than Trinidad; the mean annual maximum rainfall for the island exceeds 2500mm compared to 3500mm maximum in Trinidad.

The maximum was along the Main Ridge to the north of Roxborough. Along the southwest it was relatively dry in comparison to the northeast (see Map11.6)

Map 11.6: Mean Annual Rainfall for Tobago, 1971- 2000

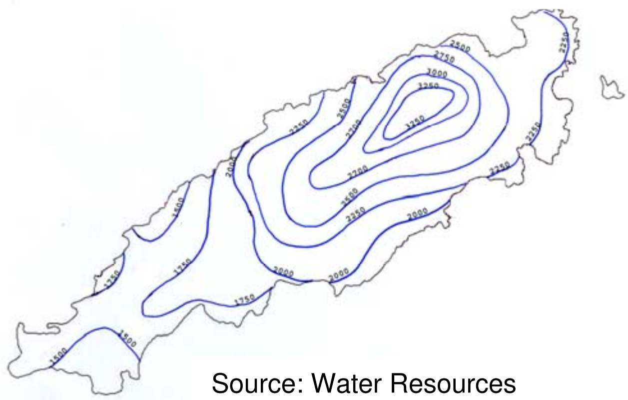


Source: Water Resources Agency/MET Office

11. 2.7 Tobago (1999)

There was more precipitation during 1999 when compared to the mean annual rainfall for the island. During 1999, Tobago measured in excess of 3250mm in areas along the Main Ridge. The precipitation tapered in the southwest but the values were higher, with measurements in excess of 1300mm (see Map 11.7)

Map 11.7: Annual Isohyetal Map for Tobago, 1999

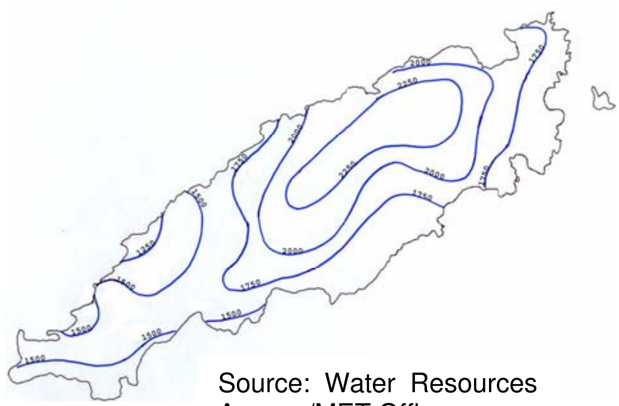


Source: Water Resources Agency/MET Office

11.2.8 Tobago (2000)

The maximum during 2000 was lower than the maximum of 1999 and the mean, which was indicative of a drier regime in Tobago during that year. The maximum precipitation recorded was in excess of 2250mm, which was much lower than the value above 3250mm recorded in the previous year and the mean in excess of 2500mm (see Map 11.8)

Map 11.8: Annual Isohyetal Map for Tobago, 2000

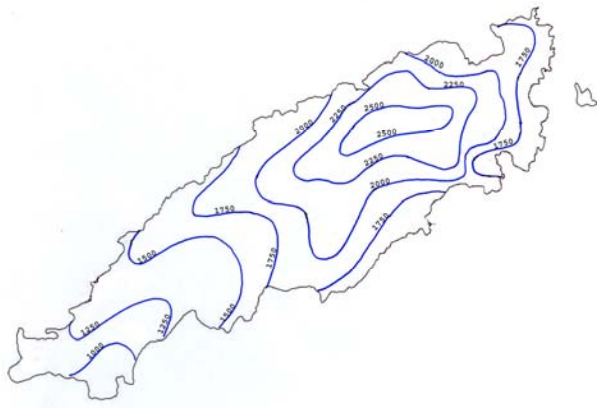


Source: Water Resources Agency/MET Office

11. 2. 9 Tobago (2001)

During 2001, the location and amount of maximum rainfall was almost the same as the mean. However, in the south west of Tobago precipitation was much less than the mean (see Map11.9)

Map 11.9: Annual Isohyetal Map for Tobago, 2001



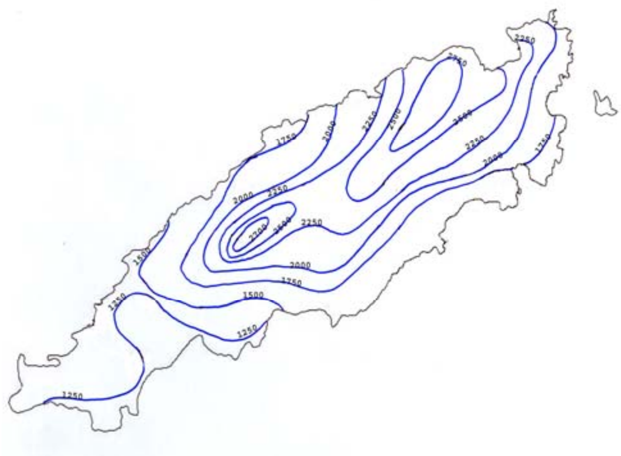
Source: Water Resources Agency/MET Office

11. 2. 10 Tobago (2002)

There was an abundance of precipitation during 2002, which enlarged the area of higher than normal accumulation. This maximum was spread over a larger area when compared to the mean (1971 to 2000) or in any of the previous three (3) years.

In the southwest of Tobago, the amount of precipitation was much less than along the Main Ridge, however, the areal extent was smaller than the mean (see Map11.10).

Map 11.10: Annual Isohyetal Map for Tobago, 2002



Source: Water Resources Agency/MET Office

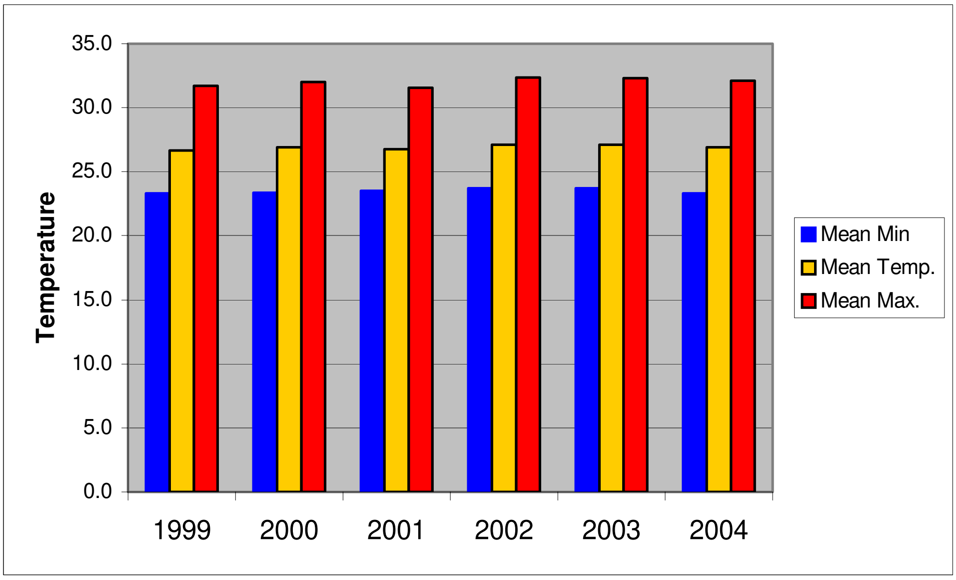
11.3 Temperature

11.3.1 (Trinidad, 1999 to 2004)

Climatologically, the long-term mean maximum temperature measured at Piarco, for the period 1971 to 2000 is 31.3ºC, whereas the long-term mean minimum temperature for the same period is 22.7ºC and the mean daily temperature for the same period is 26.5ºC.

During the period 1999 to 2004, the mean annual maximum, minimum and average daily temperatures were consistently above the long-term (1971 to 2000) average. The average yearly maximum for the period 1999 to 2004 was 0.3ºC to 1.0ºC above the long-term mean maximum. The yearly mean minimum temperature ranged between 0.6ºC to 1.0ºC higher than the long-term mean minimum, the same was true for the daily average temperature, but the range was smaller from 0.2ºC to 0.6ºC higher than the long-term daily average temperature (see Figure 11.3)

FIGURE 11.3: BAR CHART OF THE MEAN MAXIMUM, MINIMUM AND MEAN TEMPERATURES FOR PIARCO, TRINIDAD, 1999-2004



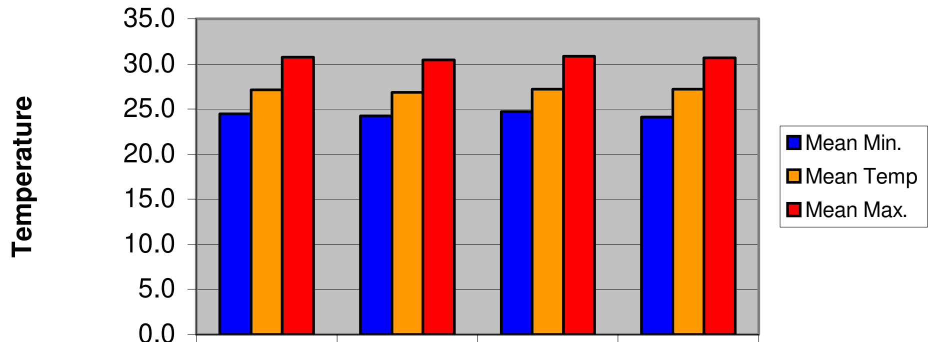
Source: Meteorological Office

11.3.2 Temperature (Tobago, 1999 to 2002)

The long-term mean maximum temperature measured at Crown Point, Tobago, for the period 1971 to 2000 was 30.5ºC, whereas the long-term mean minimum temperature for the same period was 23.7ºC and the mean daily temperature for the same period was 26.8ºC.

The mean maximum temperature for the period 1999 to 2002 exceeded the long-term mean maximum (1971 to 2000) in every year, except in 2000, when the mean was 0.1ºC lower. The mean minimum temperature for the period was higher than the long-term mean minimum temperature (Figure 11.4), as was the mean temperature except in 2000, when the mean yearly temperature equalled the long-term average.

FIGURE 11.4: BAR CHART OF THE MEAN MAXIMUM, MINIMUM AND MEAN TEMPERATURES FOR CROWN POINT, TOBAGO, 1999-2002



	1999	2000	2001	2002
Mean Min.	24.5	24.2	24.7	24.1
Mean Temp	27.2	26.8	27.2	27.2
Mean Max.	30.7	30.4	30.9	30.7

Year

Source: Meteorological Office

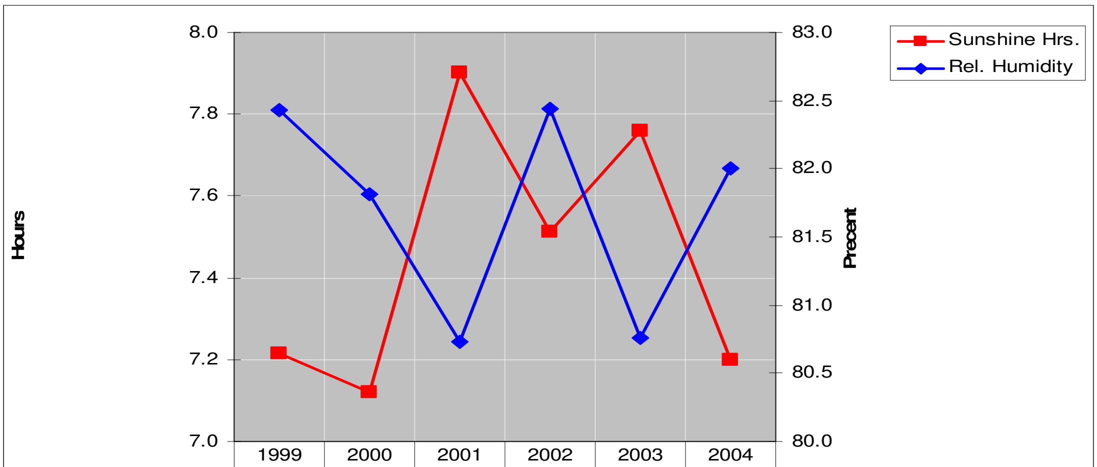
11.4 Relative Humidity and Sunshine Hours

11.4.1 Trinidad (1999 to 2004)

Trinidad has an average (1971 to 2000) relative humidity of 82.2% and the average number of sunshine hours per day is 7.2. The period 2001 to 2003 had more sunshine hours per day than the average (see Figure 11.5), whereas the years of 2000, 2001, 2003 and 2004 were relatively drier than average.

Generally, relative humidity and sunshine hours have an inverse relationship; higher numbers of sunshine hours leads to lower relative humidity values as shown in Figure 11.5. The year with the most sunshine hours (2001) had the lowest relative humidity. Concomitantly, the dry season of 2001 was extremely arid, with rainfall stations reporting little or no rainfall in the period January to April.

FIGURE 11.5: AVERAGE SUNSHINE HOURS PER DAY AND AVERAGE RELATIVE HUMIDITY PER DAY FOR PIARCO, TRINIDAD, 1999-2004



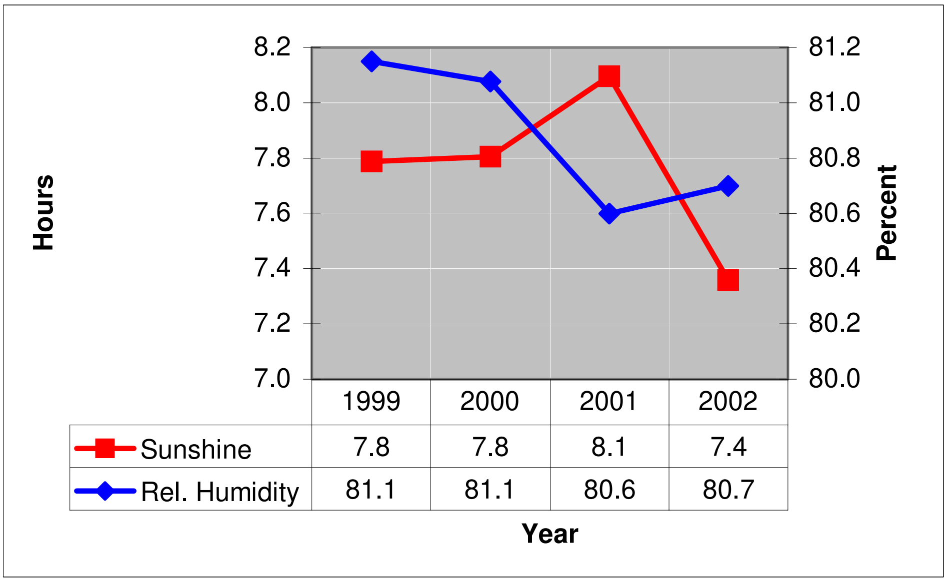
	1999	2000	2001	2002	2003	2004
Sunshine Hrs.	7.2	7.1	7.9	7.5	7.8	7.2
Rel. Humidity	82.4	81.8	80.7	82.4	80.8	82

Source: Meteorological Office

Sunset in North Trinidad

Tobago had an average (1971 to 2000) relative humidity of 79.5% while the average number of sunshine hours was 7.7%. Compared to the period 1971 to 2000, the period 1999 to 2001 had more sunshine hours per day than the average at Crown Point, as well as a higher humidity than average (see Figure 11.6).

FIGURE 11.6: A COMPARISON OF AVERAGE SUNSHINE HOURS PER DAY TO AVERAGE RELATIVE HUMIDITY PER DAY FOR CROWN POINT, TOBAGO, 1999-2002



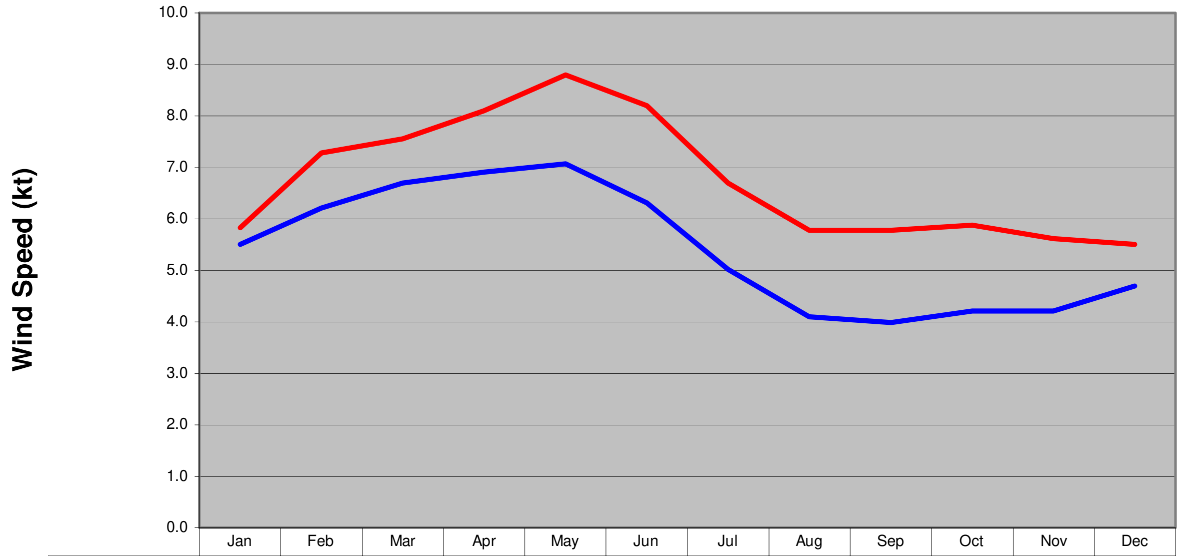
Source: Meteorological Office

11.5 Wind Direction and Wind Speed

Generally, the average wind speed over Trinidad and Tobago shows a pattern consistent with the establishment of the sub-tropical high pressure closer to tropical latitudes during the northern hemisphere winter/spring months and a northward migration of the high-pressure system as the northern hemisphere moves into summer and autumn.

Figure 11.7 shows that during the months of January to May, Piarco and Crown Point experienced a steady increase in the mean wind speed, with the peak in May. Thereafter, there was a steady decrease in the wind speed until December when the mean wind started to increase.

FIGURE 11.7: MEAN WIND SPEED FOR PIARCO (TRINIDAD) 1961-1990 AND CROWN POINT (TOBAGO) 1971-1990



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Piarco	5.5	6.2	6.7	6.9	7.1	6.3	5.0	4.1	4.0	4.2	4.2	4.7
Crown Point	5.8	7.3	7.6	8.1	8.8	8.2	6.7	5.8	5.8	5.9	5.6	5.5

Month

Source: Meteorological Office

Trinidad and Tobago experiences a northward migration of the Equatorial Trough during the month of August to November, which is characterized by weak easterly wind speeds, high temperatures and localized torrential rainfall. During this period, a sea breeze develops blowing from the Gulf of Paria inland. At times, the sea breeze penetrates to the east of Arima. (see Appendix 11.1 for Wind Roses; Piarco -Trinidad and Crown Point -Tobago)

CHAPTER 12

NATURAL HAZARDS

Photograph courtesy Town and Country Planning Division

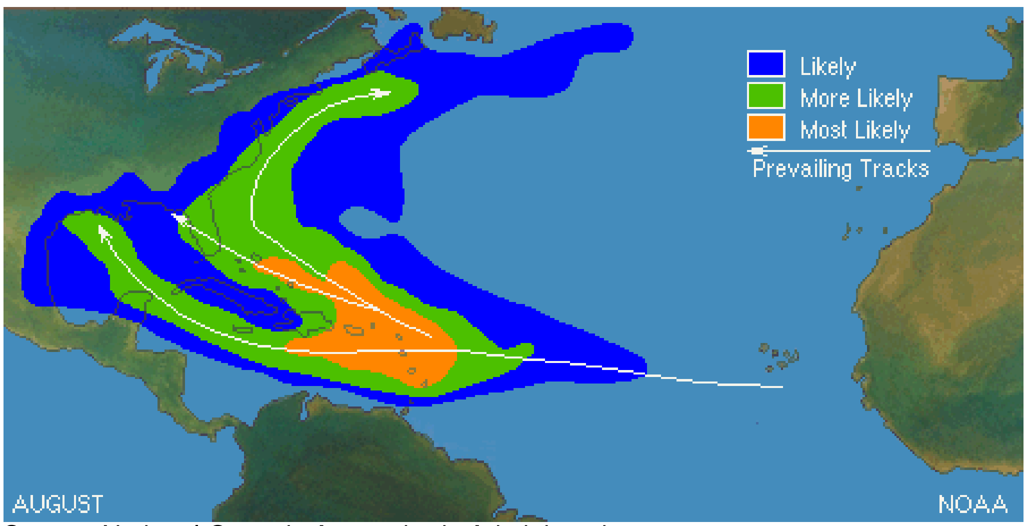
Photograph courtesy Richard Edwards

12 NATURAL HAZARDS

12.1 Tropical Cyclones Affecting Trinidad and Tobago

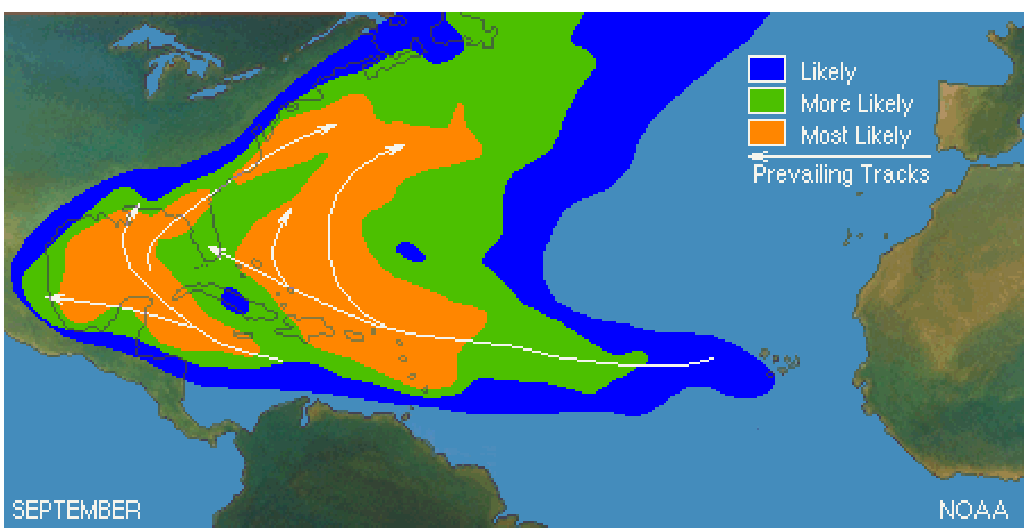
The official Atlantic Hurricane Season extends from June 1st through to November 30th. However, the cyclones favour certain areas at different times of the season and Trinidad and Tobago is most likely to be affected during the months of August and September as shown in Figures 12.1 and 12.2. Statistically, in any given year, an average of ten tropical storms form in the Atlantic Hurricane Season with six of these reaching hurricane strength.

FIGURE 12.1: TROPICAL CYCLONE TRACKS FOR AUGUST IN THE CARIBBEAN REGION



Source: National Oceanic Atmospheric Administration

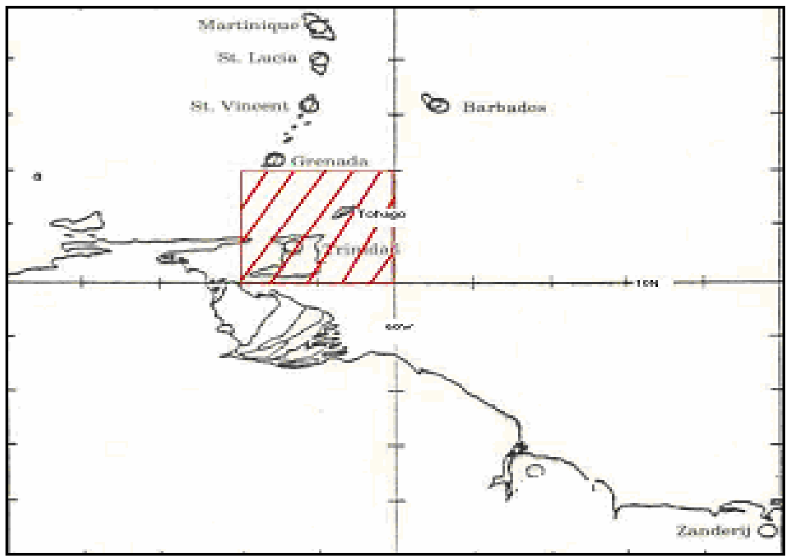
FIGURE 12.2: TROPICAL CYCLONE TRACKS FOR SEPTEMBER IN THE CARIBBEAN REGION



Source: National Oceanic Atmospheric Administration

The centre of a tropical cyclone does not have to pass over an area for that area to be affected by the cyclone. Cyclones passing to the north of Trinidad and Tobago have adversely affected Trinidad and Tobago. Table 2 list those cyclones, which have passed within the area labeled as “close” given in Figure 12.3.

FIGURE 12.3: TROPICAL CYCLONE AREA DEFINED AS “CLOSE” (HATCHED AREA) FOR TRINIDAD AND TOBAGO



Source: Meteorological Office

TABLE 12.1: TROPICAL CYCLONES[1] AFFECTING TRINIDAD AND TOBAGO, 1878-2000

Designated No. for the year	Date of Passage	Intensity	Area of Centre Passage
3	1878 Sept. 1-2	TS	NE Tobago
5	1886 Aug. 12th	H	30km N of Tobago
6	1886 Aug. 16th	H	70km N of Tobago
8	1888 Nov. 1st	H	70km N of Tobago
10	1891 Oct. 12th	H	100km N of Trinidad
7	1892 Oct. 6th	H	Between Trinidad and Tobago
1	1928 Aug. 3rd	TS	Northern Tobago
2	1933 June 27th	H	Cedros, Trinidad
6	1933 Aug. 12th	TS	60km NE of Tobago
7	1933 Aug. 16th	TS	30km NE of Tobago
2	1938 August 9th	TS	25km N of Tobago
2	1944 July 24th	TS	60km N of Tobago
ANNA … 1	1961 July 20th	TS	30km N of Tobago
FLORA … 7	1963 Sept. 30th	H	Tobago
FRANCELLA … 6	1969 August 20th	TS	80km NNW of Port of Spain
EDITH … 6	1971 Sept. 5th	TS	40km N of Tobago
IRENE … 10	1971 Sept. 13th	TS	100km NW of Tobago
ALMA … 4	1974 Aug 14th	TS	Southern Trinidad
GRETA … 8	1978 Aug. 10th	TS	70km N of Tobago
CORA … 4	1978 Sept. 13th	TS	30km WNW of Port of Spain
DANIELLE … 4	1986 Sept. 8th	TS	90km NE of Tobago
JOAN … 11	1988 Oct. 14th	TS	70km N of Tobago
ARTHUR … 1	1990 July 25th	TS	Tobago
FRAN … 6	1990 Aug. 14th	TS	Southern Trinidad
BRET … 2	1993 Aug. 7th	TS	Northern Trinidad
JOYCE … 10	2000 Oct. 1st	TS	Tobago

Source: National Emergency Management Agency (NEMA 2001) and Trinidad &Tobago Meteorological Service, 2001

TS – Tropical Storm
H – Hurricane

[1] All Tropical Cyclones are numbered as they form; however, only cyclones, which attain tropical storm intensity, are named. See Appendix for intensity scale.

12.2 Earthquake History

In Trinidad and Tobago an earthquake may be felt as often as once per month. These felt earthquakes are only about 2-6% of the earthquakes, which are recorded by seismometers. Earthquakes occur in the region because the Eastern Caribbean forms the eastern margin of the Caribbean Plate, which is moving eastwards at the rate of 2 cm/yr and riding over the North and South American Plates, which are subducted.

Although earthquakes occur within the earth's rigid crust, which in the region is about 35 km thick, the depths at which they are located in the Eastern Caribbean range from less than 10 km to about 200 km. This is possible because the subducted plate material maintains its rigidity as it descends and can still allow earthquakes to be generated within the descending slab.

Prior to 1982 most of the earthquakes were concentrated in two significant zones west of Trinidad. One zone is north of the Paria Peninsula with events trending northeast- southwest. The other is in the Gulf of Paria where events have a northwest-southeast trend. In March 1982 however, a swarm of earthquakes (several hundred tremors) occurred off the southwest coast of Tobago. The largest of these was a magnitude of 5.26 on the Richter scale.

Similarly, during March 1988, the area east of Trinidad, which up to that time had been the location of few, low magnitude events, generated a magnitude 6.2[10], which was followed by hundreds of aftershocks over a period of years.

Between 1926 and 1960, thirteen (13) earthquakes exceeded magnitude 6.2 in the south-eastern Caribbean. Table 12.2 lists some of the large earthquakes to have affected the islands of Trinidad and Tobago.

TABLE 12.2: EARTHQUAKES GREATER THAN MAGNITUDE 5 OR MMI VIII, 1766-2000

DATE	MAGNITUDE	INTENSITY	NOTE
21 October, 1766	-	7.9	Capital San Jose destroyed
20 September, 1825	VIII	-	
24 February, 1918	VIII		
04 December, 1954	VIII	> 6.5	One death; several injured
September, 1968	V - VII	5.1	Damages to churches
March, 1982		5.4	Tobago swarm
March, 1983		5.8	Several injured at the coast
March, 1988		6.2	East Coast swarm
01 January, 1996	VI	5.0	
02 April, 1997		5.6	One home destroyed; several damaged
22 April, 1997		5.9	Over $ 18 million TT in estimated damage in Tobago
09 July, 1997		5.7	
04 October, 2000		5.8	

Source: http://nema.gov.tt/resources/downloads/earthquakeriskintrinidadandtobago.pdf

The largest earthquake on historical record directly affecting Trinidad and Tobago was the 1766 event. There have been eight (8) earthquakes of magnitude greater than 6.0 between 1899 and 1952 within 250 km of Trinidad. One of these on 23 January1910 was of magnitude 7.2. The 1825 and 1954 earthquakes also caused severe damage. The former affected all the buildings in Port-of-Spain, which at that time, were a maximum of 2 storeys and of un-reinforced masonry. The earthquake swarm of 1988 and the aftershocks did little damage because the focal point was at some depth (56 km within the earth) and some distance off shore.

The inverse relationship between hypo-central distance from populated centres and damage was demonstrated by the fact that there was damage in the two largest Tobago events of 1997 where the focal points were shallow (approx. 28 km and < 5 km) and the epicentres were only 30 km and 15 km from Scarborough.

Whereas the July 1997 Venezuela earthquake, which was of similar magnitude and also shallow in depth, occurred some distance from Trinidad (a full 2 degrees longitude to the west), while traumatic, caused little damage. In Venezuela, the area in immediate proximity to the source suffered many collapsed buildings and more than 80 deaths.

12.3 Major Flooding in Trinidad

Major flooding in Trinidad generally occurs in the Caroni, Caparo and Santa Cruz basins.However, flooding can occur with devastating effect in smaller basins such as the Diego Martin Valley, San Fernando, Barrackpore, Sangre Grande and Penal.

The Major causes of flooding in Trinidad include but are not limited to:

- Topography
- Land use practices
- Rainfall
- Soil types

Flooding in the Caroni basin usually has its genesis in rainfall along the Northern Range and within the basin. The run-off on the slopes of the Northern Range, which is generally over 2000 feet, is swift. However, the floodplains in the Caroni basin are less than 100 feet above sea level and consist of alluvium and hydromorphic soils with low permeability, which inhibit infiltration.

The Caparo basin has a similar soil structure as the Caroni basin and in both basins, the land use practices on the slopes increases swift run-off into the flood plains into watercourses prone to siltation.

TABLE 12.3: MAJOR FLOODING IN TRINIDAD AND TOBAGO, 1981-2004

YEAR	MONTH	DATE/S	AREA AFFECTED	SEVERITY OF DAMAGE
1981	October	9 – 11	Island-wide	Severe floods, Caroni divided north from south
1984	Mid January & November		Across country	Moderate floods
1985	December	2 – 05	Island-wide	Severe floods, Caroni divided north from south
1986	October	14 & 15	Caroni	Severe floods
1986	November	2		500 houses damaged – destructive flooding
1988	September	6	Central and Southern Trinidad	Severe flooding
1988	September – October	30 – 01	Northern Trinidad	Destroyed food crops and caused extreme property damage
1988	November	3	Maracas, St. Joseph Belmont Hills	Mudslide (1 child buried) Raging floodwaters from Belmont hills (1 child swept away)
1988	November	13, 19, 24	Island-wide	Widespread flooding
1989	November	15	Central Trinidad	Damaging floods
1990	December	15	Debe, Penal, Siparia, Barrackpore, Mafeking	$7,000,000 in losses, 2 persons lost lives
1991	August	16	Caroni	Widespread flooding. Thousands of dollars of crops were lost, poultry drowned and several persons were prisoners in their homes
1992	July	8 – 12	Central and Southern Trinidad	Flooding on large scale. Losses of livestock, crops
1993	August	7	South Western Trinidad East West corridor, Port of Spain and Western peninsula	Widespread flooding. Damage to houses and other building Damage from strong gusts (**Tropical Storm Bret)**

YEAR	MONTH	DATE/S	AREA AFFECTED	SEVERITY OF DAMAGE
1993	September	6 - 13 9 & 10	8 - Sangre Grande Arena, Caparo, Montrose Arena/St. Helena	Flash flooding Flash flooding
1993	November	19 - 22	Central Trinidad Diego Martin and Barataria	Flooding, Caroni and Caparo rivers overflowed their banks Flash flooding
1994	November	23/25	Tobago Caparo, Longdenville, Lange Park	Flash flooding Severe flooding
1998	May	28/29	Barrackpore, Penal	Flooding along Cipero River
1998	June	2	South Trinidad	Flash flood. Cipero River overflowed its banks and bridge partly collapsed.
1998	June	13-15	Central Trinidad	Riverine flooding. Caroni River Basin and Caparo River Basin flooded. Both rivers overflowed their banks.
1999	January	24	Central and South	Caroni (1975) forced to scale down operations
1999	June	28/29	Central	Caparo River overflowed
1999	August	16	Port of Spain to Aranguez	9-year old boy drowned in flooded drain, heavy losses to Aranguez framers
1999	December	14	North Trinidad	Severe flooding in El Socorro Extension. Flooding and landslides in Diego Martin. Landslides on North Coast Road
2000	March	24 - 26	North Trinidad	Mild flooding in Barataria, Malick, San Juan, Santa Cruz and Barrackpore. Landslides in Matelot destroyed a house (26th)

YEAR	MONTH	DATE/S	AREA AFFECTED	SEVERITY OF DAMAGE
2000	November	26 - 30	North and Central Trinidad	Extensive flooding from Curepe to Manzanilla in the north to Caparo Basin. Landslides in
				Santa Cruz, Mt. Lambert, Lopinot and Arima
2000	December	1	South Trinidad	Penal, Barrackpore, Debe, Gasparillo and Marabella
2001	December	14 - 15	North-eastern, Central and Southern Trinidad	Massive flooding in Sangre Grande, Valencia, Caparo, Caroni, Barrackpore, San Fernando
2002	September	18	South Trinidad	Flash floods in San Fernando, Green Acres and Marabella. Mudslides in San Fernando.
2002	September	27 - 29	South Trinidad	Flooding in St. Mary's Village Moruga, Barrackpore and Woodlands
2002	November	5	North Trinidad	Massive Flooding from Aranguez in the west to Tacarigua
2002	November	13 - 15	Central Trinidad	The Caroni and Caparo rivers overflowed their banks. Flooding in St. Helena, El Carmen, Kelly Village and Las Lomas
2003	June	23	South West Tobago	Flooding in areas such as Bon Accord, Lowlands Trace, Hampden, Milford Road, Scipio Trace and Canaan
2003	July	12	South and Central Trinidad	Flooding in Cedar Hill, Forrest Park Road, Lalloo Trace, Macaulay Road Claxton Bay, Gasparillo,
2003	July	24	Central Trinidad	Flooding in Caparo Valley Area
2003	August	13	South Trinidad	Flooding in Tarouba, Macaulay Road and Claxton Bay

YEAR	MONTH	DATE/S	AREA AFFECTED	SEVERITY OF DAMAGE
2003	August	17	Southwest Trinidad	Flooding Reid Road, Point Fortin
2003	September	1	South Trinidad	Flooding in Macaulay Junction, Claxton Bay
2003	September	3	Northwest Trinidad	Flash flooding in Morne Coco Road, Diego Martin
2003	September	18	South Trinidad	Flooding in Green Acres, Marabella and Cocoyea, Circular Road, San Fernando
2003	September	27	South Trinidad	Flooding in Moruga
2003	September	28	South Trinidad	Flooding in Woodland, Barrackpore, Clarke Road, Rochard Douglas, Monkey Town and surrounding areas
2003	October	3	Central Trinidad	Street and Flash Flooding in Chaguanas
2003	October	11	North West Trinidad	Street and Flash Flooding in North West Trinidad
2003	October	15	South Trinidad	Flooding in Harmony Hall, Gasparillo, San Fernando and Marabella
2003	November	19	North Trinidad	Flooding in East /West Corridor
2003	November	20	Central Trinidad	Flooding in Caparo and Todds Road areas
2003	November	21	North Trinidad	Flooding in South Quay and Sea Lots areas of Port of Spain
2003	November	25	North Trinidad	Flooding in Western Main Road Cocorite

YEAR	MONTH	DATE/S	AREA AFFECTED	SEVERITY OF DAMAGE
2003	December	3 & 4	Central Trinidad	Flooding in Caparo Basin at Todds Road, Caparo valley Road and Caparo Main Road
2003	December	12	South Tobago	Flooding in Scarborough Tobago
2004	April	10	North Trinidad	Flooding in Diego Martin Area
2004	May	4	South Trinidad	Flooding in Rochard Douglas
2004	May	30	Central Trinidad	Flooding in Main Road
2004	June	7 & 8	East and Central Trinidad	Flooding in Cumuto, Caparon Valley, Talparo
2004	July	8	North Trinidad	Flooding in Port of Spain
2004	August	9 - 10	Northwest Trinidad	Flooding in NW Trinidad, Street Flooding in Port of Spain and Belmont
2004	August	11	Northwest Trinidad	Flooding in parts of Port of Spain and St. Anns
2004	August	18		Grandville
2004	September	8	Central and South Trinidad	Flooding in Caparo Basin areas and Penal
2004	October	2	South Trinidad	Flooding in Various Parts of Trinidad Including Claxton Bay and Couva
2004	October	3	Central Trinidad	Flooding in Caparo Valley
2004	October	7	Central Trinidad	Flooding in South Bound High Way in Vicinity of Freeport Fly Over
2004	November	2	Tobago	Flooding in Lowlands
	November	8	North Trinidad	Flooding in Trinidad
2004	November	12	South Trinidad	Severe Flooding in South Trinidad, in areas such as Rochard Road, Barrackpore, Ghandi Village, Debe, Lothians Road, PrincesTown, Siparia Road, Fyzabad, Green Acres, San Fernando

YEAR	MONTH	DATE/S	AREA AFFECTED	SEVERITY OF DAMAGE
2004	November	12	Tobago	Severe Mudslides and Flooding in Windward Tobago particular in areas such as Delaford to Charlotteville, also Lambeau, along Claude Noel Highway, Canaan, Bon Accord, Carnbee, Mt Pleasant
2004	November	21	North Trinidad	Flooding in Barataria, Port of Spain, Maraval, Debe Road Long Circular,San Juan along East/West Corridor to Aranguez
2004	November	22	Central Trinidad	Flooding in parts of Central Trinidad
2004	December	5 & 6	Central Trinidad	Flooding in Caparo, Todd's Road and Chickland, Parts of Caparo Main Road, Points on the Brasso Caparo Valley Road
2004	December	11	Central Trinidad	Flooding in Caparo

Source: Trinidad and Tobago Meteorological Service, Flood Data (1981 – 2004)

CHAPTER 13

TOURISM

Photograph courtesy Tyrone Gopaul

Photograph courtesy Tyrone Gopaul

13 TOURISM

Introduction

In all countries involved in tourism, the natural and cultural diversity provide the basis for the tourist experience. The reliance of tourism upon the natural and cultural resources means that its development induces changes, which can either be positive or negative. With the development of industries, infrastructure, housing etc. the natural landscape is being continuously eroded in the wake of economic progress. On a global scale therefore, the natural environment is becoming a scare resource which if not preserved, would be depleted in the future. The natural environment is now invaluable and one of the advantages of tourism, if managed properly, is that conservation efforts are assisted by the protection of biodiversity and fragile eco-environments.

As a nation, the cultural diversity mix includes the East Indians, Africans, French, Spanish, Chinese and Syrian/Lebanese. Tourism in Tobago contributes more to the island's economy as compared with Trinidad's main economic revenue earner - the energy sector. Tobago is well known for its coral reefs and beaches around the island. The tourist interest in Trinidad however is different and more connected with the annual Carnival as well as the eco-tourism in places such as the Caroni Bird Sanctuary Nariva Swamp and Asa Wright Nature Centre as well as the beaches of the North Coast. Geologically, the twin-island state is an extension of the South American mainland, hence the lush rain forests which attracts the ecological adventurers.

Tourists from a cruise ship walking on the Brian Lara Promenade. Port-of Spain, Trinidad

13.1 Arrivals and Departures

Total number of passenger arrivals increased to a total of 982,971 in 2000, an increase of 12.2 % over the previous year. In 2001 though, the events of 9/11, the subsequent downturn in travel demand and the weakness of the euro against the US dollar caused a downturn in arrivals (Tourism Development Company Ltd., 2005).

The total number of Departures increased to a total of 881,711 in 1999, an increase of 6.4% over the previous year. There are no data for 2000 onwards 2001 on departures due to the fact that the immigration officers no longer interface with passengers directly. Departure card are now handled by the airline carrier staff.

Since 1995, there has been a constant growth in total halt passengers to Trinidad and Tobago, except for 2001, which experienced a slight drop in arrivals, as a result of the worldwide decline in travel and tourism. Temporary halt passengers increased to 268,883, up from 217,845 in 2000. Air transport is dominant for arriving, departing and halt passengers (see Table 13.1)

TABLE 13.1: ARRIVALS AND DEPARTURES OF PASSENGERS BY AIR AND SEA TO TRINIDAD AND TOBAGO, 1992-2004

Year	Arrivals			Departures[1]			Temporary halt passengers		
	Air	Sea	Total	Air	Sea	Total	Air	Sea	Total
1992	620,262	22,742	**643,004**	623,182	21,911	**645,093**	137,398	19,215	**156,613**
1993	583,994	28,349	**612,343**	590,726	28,629	**619,355**	98,242	22,150	**120,392**
1994	581,195	53,121	**634,316**	584,961	53,991	**638,952**	101,441	44,958	**146,399**
1995	622,701	28,991	**651,692**	630,487	31,469	**661,956**	141,436	21,873	**163,309**
1996	646,281	30,871	**677,152**	644,871	30,727	**675,598**	145,340	22,022	**167,362**
1997	714,995	39,036	**754,031**	693,415	35,766	**729,181**	136,702	24,110	**160,812**
1998	889,841	46,797	**936,638**	781,745	46,660	**828,405**	195,473	38,654	**234,127**
1999	841,863	34,219	**876,082**	847,809	33,902	**881,711**	197,939	28,654	**226,593**
*2000	918,683	64,288	**982,971**	**…**	**…**	**…**	155,856	61,989	**217,845**
2001	603,215	82,243	**685,494**	**…**	**…**	**…**	186,640	82,243	**268,883**
2002	882,612	60,047	**942 659**	**…**	**…**	**…**	178,462	60,047	**238,509**
2003	942,764	55,532	**998 296**	**…**	**…**	**…**	190,845	55,532	**246,377**
2004	1,038,521	54,254	**1, 092,775**	**…**	**…**	**…**	206,513	38,295	**244,808**

Source: CSO Trade/Travel Statistics

[1]Departures were discontinued as of 2000 due to the fact that Immigration Officers no longer interface with passengers directly.
Departure cards are now handled primarily by the airline carrier staff.

13.2 Departures

In Table 13.2 the country's largest share of departures falls into the category of other departing persons. Departing residents are the next largest category. Closely following the Departing residents are the temporary halt passenger's category. With exception of 2000 there has been a constant growth in total number departures. The increase in 1999 in comparison with 1998 was 6%.

TABLE 13.2: TOTAL DEPARTURES[1] BY CATEGORY OF PASSENGERS, 1992-2000

Category	1992	1993	1994	1995	1996	1997	1998	1999	2000[e]
Departing residents excluding (emigrants and students)	**208,394**	**198,161**	**192,650**	**207,848**	**234,258**	**247,562**	**227,057**	**252,695**	**280,491**
Emigrants	**1,700**	**1,839**	**35**	**42**	**24**	**22**	**41**	**11**	**…**
Permanent	1,700	1,839	19	10	9	9	14	7	**…**
Temporary	-	-	16	32	15	13	27	4	**…**
Students	**2,079**	**2,179**	**1,240**	**753**	**408**	**181**	**60**	**45**	**…**
Residents	45	30	8	89	3	-	60	45	**…**
Non-Residents	2,034	2,149	1,232	664	405	181	-	-	**…**
Other departing persons (mainly visitors)	**235,204**	**248,690**	**254,701**	**260,984**	**247,618**	**303,372**	**364,629**	**400,583**	**…**
Intransit Passengers	**37,963**	**45,320**	**42,313**	**27,663**	**24,707**	**16,288**	**2,109**	**1,456**	**…**
Temporary Halt Passengers	**156,613**	**120,392**	**146,399**	**163,309**	**167,362**	**160,812**	**234,127**	**226,593**	**217,845**
Air	137,398	98,242	101,441	141,436	**145,340**	136,702	195,473	197,939	**155,856**
Sea	19,215	22,150	44,958	21,873	**22,022**	24,110	38,654	28,654	**61,989**
Diplomats	**2,078**	**1,811**	**764**	**506**	**390**	**284**	-	**3**	**…**
Refused Leave to Land	**1,062**	**963**	**850**	**851**	**831**	**660**	**382**	**325**	**…**
Grand Total	**645,093**	**619,355**	**638,952**	**661,956**	**675,598**	**729,181**	**828,405**	**881,711**	**498,336**

Source: Annual Statistical Digest - CSO

[1]Departures were discontinued as of 2000 due to the fact that Immigration Officers no longer interface with passengers directly. Departure cards are now handled primarily by the airline carrier staff.

13.3 Purpose of visit

According to Table 13.3 the country's largest share of arrivals falls into the returning residents category. Temporary halt passengers are the next largest category. Closely following the halt travellers are the private home holiday visitors. Traditionally, the majority of the visitors to Trinidad fall into the returning residents and private home holiday visitors group. However, in Tobago, the leisure/beach/holiday visitor is dominant.

A family enjoying the Vessigny Beach, Trinidad

TABLE 13.3: TOTAL ARRIVALS BY CATEGORY OF PASSENGERS, 1992-2004

Category	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Visitors Total	**234 ,759**	**248 ,815**	**253,153**	**259,784**	**265,900**	**324,293**	**334,037**	**358,193**	**398,559**	**383,101**	**450,115**	**483,116**	**522,850**
Hotel holiday visitors	35,721	36,252	36 101	35,627	38,212	49,060	57,045	53,658	52,487	57, 074	89, 127	103, 673	110,117
Private home holiday visitors	137,932	149,726	151,189	146,037	145,428	169,703	177,484	199,221	229,613	210,657	240,241	255,506	277,489
Business visitors	41,189	45,127	45 308	50,164	48 106	64,864	60,351	61,452	67,465	69,229	65,901	74,047	80,254
Guest House	5,937	7,585	8 328	11,468	12,808	15,339	16,697	23,267	25,812	23,739	17,339	21,671	19,855
All other visitors	13,980	10,125	12 227	16,488	21,346	25,327	22,460	20,595	23,182	22,402	37,507	28,219	35,135
Temporary halt passengers	156,613	120,392	146,399	163,309	167,362	160,812	234,127	226,593	217,845	268,883	238,509	246,377	244,808
Air	137,389	98,242	101,441	141,436	145,340	136,702	195,473	197,939	155,856	186,640	178,462	190,845	206,513
Sea	19,215	22,150	44,958	21,873	22,022	24,110	38,654	28,654	61,989	82,243	60,047	55,532	54,254
Intransit passengers	37,725	45,408	44,640	28,243	34,165	34,525	34,098	31,044	40,394	33,510	38,196	38,295	45,136
Sub-total	429,097	414,615	444,192	451,336	467,427	519,630	602,262	615,830	656,798	685,494	726,820	767,788	812,794
Students	2,212	2,757	3,040	2,995	3,200	3,416	3,519	3,780	6,112	…	…	…	…
Residents	24	25	9	49	21	11	-	-	-	…	…	...	…
Non-residents	2,188	2,732	3,031	2,946	3,179	3,405	3,519	3,780	6,112	…	…	…	…
Returning residents	207,725	191,104	183,751	194,705	202,671	225,536	326,594	251,895	316,316	105,818*	281,740	304,555	344,276
Immigrants	421	635	676	481	663	1,273	1,152	1,047	1,428	…	…	…	…
Permanent	3	-	2	11	-	5	5	4	-	…	…	…	…
Temporary	418	635	674	470	663	1,268	1,147	1,043	1,428	…	…	…	…
Diplomats	2,487	2,269	1,741	1,249	2,203	3,354	2,287	2,626	2,317	…	…	…	…
Refused leave to land	1,062	963	916	926	988	822	824	877	-	…	…	…	…
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**791,312**	[illegible]	[illegible]	[illegible]

Source: Annual Statistical Digest 2001 and 2005 -CSO

* The reduction in the passenger arrivals in the year 2001 was due to the 9/11 event which occurred in the same year.

13.4 Major Markets

Most of the visitors arriving in Trinidad and Tobago are from the USA followed by the Caribbean itself. The third most important market is the UK (from 1998 up to 2000) then Canada and the rest of the world.

TABLE 13.4: VISITORS ARRIVING BY COUNTRY OF NORMAL RESIDENCE, 1993-2004

Category	1993	1994	1995	1996	1997	1998	1999	2000	2001[e]	2002	2003	2004
United States of America	93,922	92,209	92,185	90,973	112,344	114,416	118,390	132,578	118,962	133,566	138,935	159,467
Canada	34,283	33,367	33,669	36,382	38,945	39,827	43,459	47,382	43,291	41,506	43,036	43,565
United Kingdom	23,018	26,998	26,332	27,960	38,403	46,324	49,480	55,048	48,570	51,688	57,566	66,090
Venezuela	5,952	7,252	6,293	6,887	8,157	10,022	10,182	11,450	10,207	11,107	10,273	10,528
Caricom Countries	51,876	55,934	62,614	63,681	76,146	78,543	90,762	100,199	93,708	104,742	113,854	114,868
Jamaica	3,408	3,576	4,133	3,970	4,693	4,954	4,838	6,255	5,968	6,044	6,186	6,210
Guyana	17,727	15,474	15,339	15,992	17,789	17,583	21,607	32,686	20,062	22,299	22,783	22,328
Barbados	11,899	13,752	17,091	16,839	19,051	22,706	28,684	31,126	27,878	33,989	37,320	35,456
Antigua		1,728	2,513	2,484	2,486	2,930	2,729	3,249	3,110	4,233	4,334	4,351
Dominica	692	691	921	907	981	1,135	1,035	1,096	1,344	1,277	1,535	1,564
Grenada	9,413	9,301	10,379	10,200	12,159	12,216	14,050	15,492	15,130	16,539	19,220	19,575
Montserrat	270	231	365	215	241	174	166	245	310	209	220	205
St. Kitts/Nevis	459	499	558	535	861	618	1,007	1,199	1,092	1,280	1,438	1,493
St. Lucia	3,418	3,978	4,457	4,789	5,339	5,986	6,740	7,374	7,228	6,892	7,423	8,192
St. Vincent/Grenadines	4,590	6,008	6,025	6,415	11,041	8,220	8,000	8,265	8,405	9,636	11,041	11,947
Suriname[1]	-	696	833	1,335	1,505	2,021	1,906	2,212	3,181	2,344	2,354	3,547
Europe (excl. United) Kingdom	23,953	25,661	24,830	31,484	27,646	24,786	27,613	27,613	40,432	19,445	21,670	23,422
South America (excluding Venezuela, Guyana and Suriname	792	1,331	1,487	1,532	2,448	2,014	2,050	2,436	4,280	3,170	3,806	3,988
Rest of the world	15,019	12,914	11,543	13,655	16,366	15,245	19,117	21,853	2,3651	18,990	19,929	20,668
Total	**248,815**	**253,153**	**259,784**	**265,900**	**324,293**	**334,037**	**358,220**	**398,559**	**383101**	**384,213**	**409,069**	**442,596**

Source: CSO Trade/Travel Statistics

[1]Suriname is included as part as part of Caricom from 1996.

[e] Estimated figure

13.5 Cruise Ship Visitors

There has been a decline in Trinidad and Tobago cruise traffic since 2000, largely as a result of repositioning of ships away from the southern Caribbean (Tourism Development Company Ltd., 2005). The number of cruise visitors in 2003 was almost half of what it was in 2000.

TABLE 13.5: CRUISE SHIP PASSENGER ARRIVALS, 1996- 2004

Port	1996	1997	1998	1999	2000	2001	2002	2003	2004
Port of Spain									
Ship Calls	61	50	49	61	88	85	71	55	49
Passenger Arrivals	25,875	20,391	32,808	49,287	82,201	71,467	49,534	39,616	29,301
Scarborough									
Ship Calls	66	42	42	56	58	51	25	33	37
Passenger Arrivals	25,077	15,763	10,380	13,964	21,860	10,776	10,513	15,916	24,953
Total Ship Calls	**127**	**92**	**91**	**117**	**146**	**136**	**96**	**88**	**86**
Total Passenger Arrivals	**50,952**	**36,154**	**43,188**	**63,251**	**104,061**	**82,243**	**60,047**	**55,532**	**54,254**

Source: Port Authority of Trinidad and Tobago, Port of Spain Cruise Ship Complex

13.6 Accommodation Facilities

The country had an accommodation capacity of approximately 5000 rooms, in 2003. Most of the rooms in Trinidad are concentrated in the Port of Spain area, while most of the rooms in Tobago are found in the southwest region of the island. More than 70% of accommodation rooms in Tobago have a beachfront location. In contrast, only two in Trinidad offer the same (Tourism Development Company Ltd., 2005). Since 1997, there has been a constant growth in total number of rooms. The increase in 2003 in comparison with 2002 was 22.6%.

TABLE 13.6: NUMBER OF HOTEL ROOMS BY ACCOMMODATION FACILITY, 1996-2004

Accommodation	1996	1997	1998	1999[1]	2000[2]	2001[3]	2002	2003	2004
Hotels	**2,691**	**2,706**	**2,844**	**2,938**	**3,143**	**3,288**	**3,260**	**3,732**	**3,953**
All hotels	2,299	2,303	2,404	2,497	2,672	2,703	2,675	3,061	3,241
Apartments-hotels	392	403	440	441	471	585	585	671	712
Similar Establishments	**828**	**946**	**1,127**	**1,298**	**1,389**	**1,205**	**1,127**	**1,646**	**1,694**
Guest houses	595	600	705	883	945	1,205	1,127	1,646	1,694
Bed and breakfast	233	346	422	415	444	…	…	…	…
Total	**3,519**	**3,652**	**3,971**	**4,236**	**4,532**	**4,493**	**4,387**	**5,378**	**5,647**

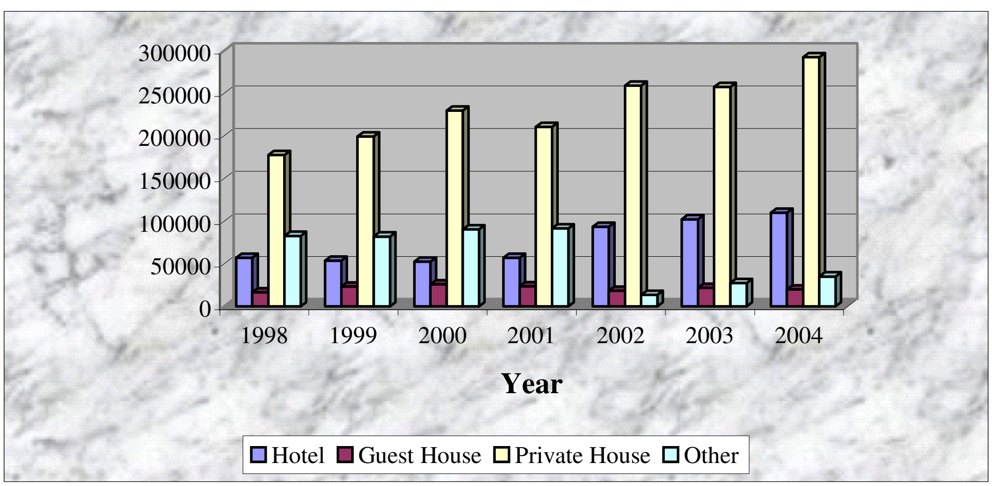
Source: Central Statistical Office

[1] & [2] Data for the years 1999 and 2000 are based on conservative projections and are not on actual data, as the Accommodation Survey was interrupted during that period.

[3] Estimates are no longer made for Bed and Breakfast from 2001

According to figure 13.2 private homes were the most dominant type of accommodation used between 1998 and 2004.

FIGURE 13.1: TOURIST ARRIVALS BY TYPES OF ACCOMMODATION 1998-2004



Source: CSO Trade/Travel Statistics

CHAPTER 14

SOLID WASTE

Photograph courtesy Satee Boodoo

Photograph courtesy
Town and Country Planning Division

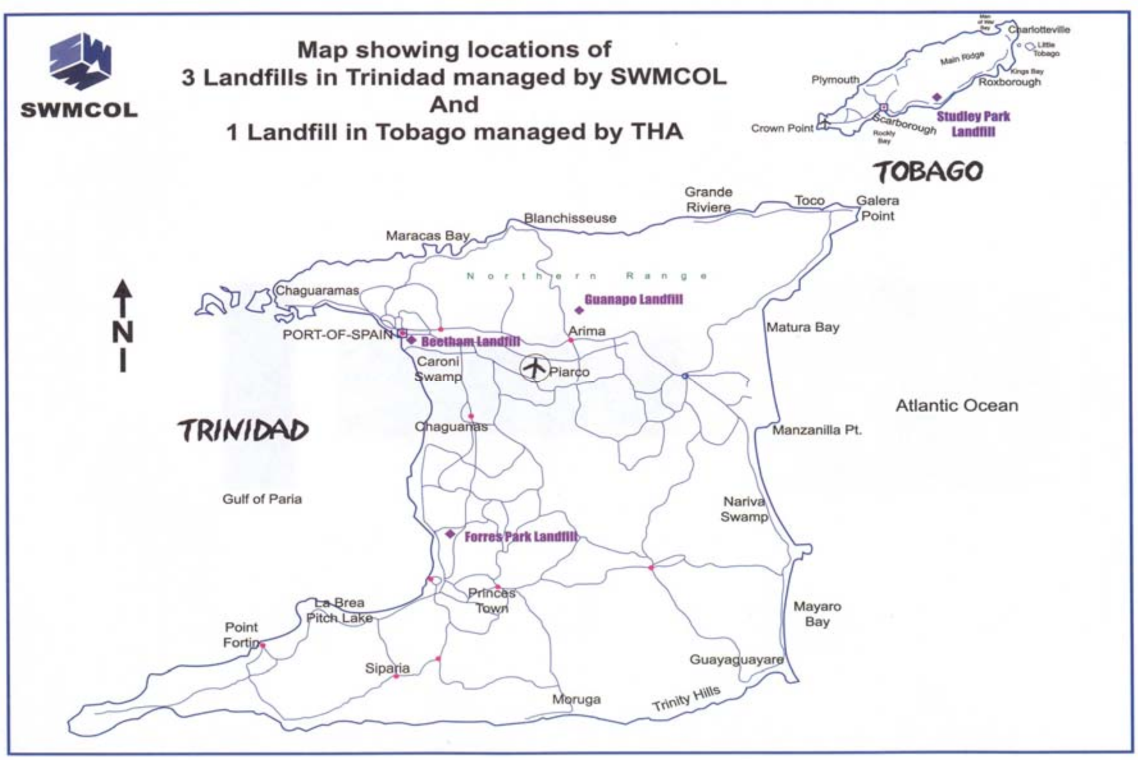
Photograph courtesy
Town and Country Planning Division

14 SOLID WASTE MANAGEMENT

Introduction

Solid Waste Management, by definition, is the administration, collection, transportation and treatment of all solid waste. The ultimate goal of solid waste management is to continuously lower the amount of waste that is generates per capita. In 1983, the Trinidad and Tobago Solid Waste Management Company Limited (SWMCOL) was mandated with the responsibility of managing the three major waste disposal sites in the country (Refer to appendix 14.1). In Trinidad and Tobago residential/ municipal waste collection is done by private companies who are sub-contracted to the various Regional Municipalities. Presently, there are five (5) operational sites on the twin-island Republic; Beetham, Guanapo and Forres Park which are managed by SWMCOL, Guapo Landfill which is operated by Earth Limited and Studley Park, Tobago which falls under the auspices of the Tobago House of Assembly (THA) (see Figure14.1). Please note however that all data in this chapter is relevant to Trinidad specifically as no data has been submitted for Tobago operations.

MAP 14.1: LOCATIONS OF THREE (3) LANDFILLS IN TRINIDAD MANAGED BY SWMCOL AND ONE (1) LANDFILL IN TOBAGO



Source: SWMCOL

14.1 Landfills in Trinidad Managed by SWMCOL

14.1.1 Beetham

The Beetham site covers an area of 0.61 km^2 (61 hectares) and is the largest landfill in Trinidad and Tobago. Established some thirty (30) years ago disposal practices at the site were unsatisfactory. In 1983 SWMCOL was mandated with the responsibility of managing the three (3) disposal sites, thus the sites were operated as controlled landfills. The Beetham accepts an average of 875 tonnes/ 875,000kg of waste per day and serves the catchment area from Chagaramas to Curepe and areas to the south of Chaguanas. In addition to landfilling of solid waste, the site also accommodates a bottle recovery facility (informal) and a faecal waste stabilization pond system. The landfill is poorly located on the outskirts of the capital city, and poses an ecological threat as it is located in a wetland environment. This landfill has officially reached its maximum storage capacity and is presently scheduled for closure.

14.1.2 Forres Park

The Forres Park landfill is the second largest site in Trinidad and Tobago. It has an area of over 0.08 km^2 (8 hectares) and accepts an average of 420 tonnes/420 000kg of waste per day. It serves the catchment area from Chaguanas to Mayaro, inclusive of many of the areas in the south-western peninsula. At Forres Park the cover material is excavated at the site and hauled to the tip, an activity that is best suited to the dry season. The site was constructed with a leachate collection system, which is still in operation but requires extensive maintenance. It is the only engineered landfill in Trinidad & Tobago.

14.1.3. Guanapo

This is the smallest of the three (3) landfills managed by SWMCOL. It has an area of approximately 0.07 km^2 (7 hectares) and accepts an average of 253 tonnes/ 253 000kg of waste per day. It serves the catchment area from St. Augustine to Toco and Southwards to areas of Mayaro. The Guanapo Landfill has the potential to have a direct impact (negative) on the underlying aquifer and all surface water downstream of the site. In addition, there are many private residences closely surrounding the site. Cover material is excavated from the hills north of the site and used to cover incoming waste. This site has exceeded its life span and should be closed and integrated as part of a reconstituted National Integrated Waste Management System (NIWMS).

14.2 WASTE DISPOSAL

Waste Disposal by Type and Site

In Trinidad and Tobago, the average person generates approximately 4lbs or 2.20kg of waste every day[1]. From 2005 estimate figures, the Beetham, Forres Park and Guanapo landfill receive 875, 420 and 253 tonnes of waste respectively each day. This accounts for approximately one thousand, five hundred and forty eight (1,548) tonnes or 1,548,000kg of waste per day from all 3 landfills. (Figures are computed by subtracting the tier weight from the maximum gross weight of the truck. The result is then multiplied by the number of vehicles entering the particular site. The International Coastal Cleanup (ICC) programme for the year 2004, targeted 5 miles of beach, and eight (8) coastal locations for a period of five weeks, from September 18 to October 17 during which the following coastlines were cleaned: Chagville (west coast), Guayaguayare (south coast), Matelot (north coast), Salybia (east coast), Las Cuevas and Tyrico (north coast) and Great Courland and offshore (Tobago). In total, two thousand eight hundred and forty-four kilograms (2,844 kg) of waste was collected. In comparison with 2003, for 11.3 miles of beach, four thousand five hundred and eighty-two kilograms (4,582 kg) of waste was collected. Apart from this, large quantities of waste are also improperly disposed of, and as a result, pollute our streets, drains, rivers, beaches and other environs.

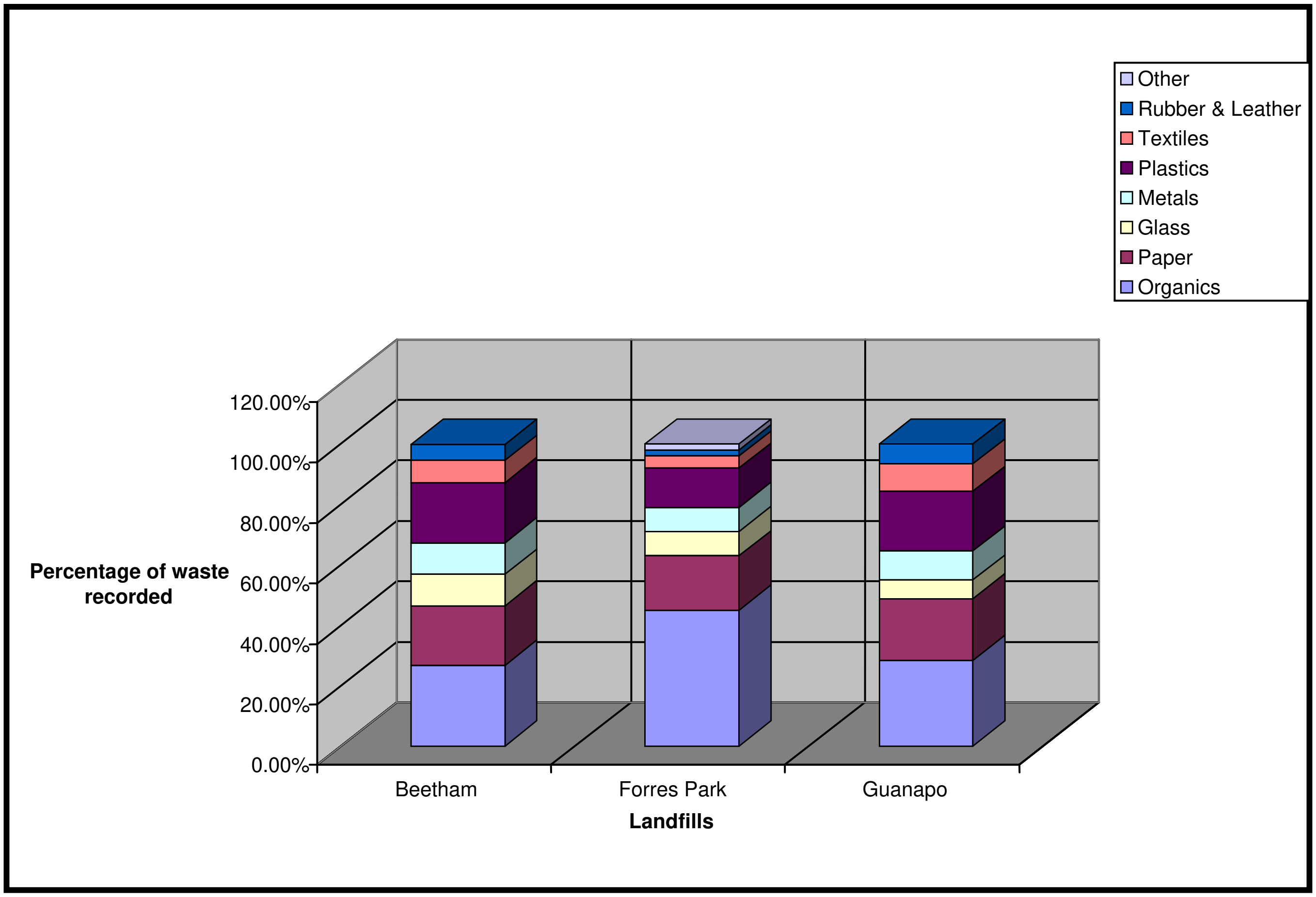
TABLE 14.1: WASTE DISPOSAL BY TYPE AND SITES, 1995

Type of Waste	Beetham	Forres Park	Guanapo
Organics	26.7%	45%	28.4%
Paper	19.7%	18%	20.3%
Glass	10.5%	8%	6.3%
Metals	10.4%	8%	9.5%
Plastics	19.9%	13%	19.6%
Textiles	7.3%	4%	9.2%
Rubber & Leather	5.3%	2%	6.6%
Other	0.2%	2%	0.1%

Source: SWMCOL

[1] **Report on the Regional Evaluation of Municipal Solid Waste Management Services in Latin America and the Caribbean**

FIGURE 14.1: WASTE DISPOSAL BY TYPE AND SITE, 1995



Source: SWMCOL

TABLE 14.2: SITE DATA, 1995 - 2004

BEETHAM LANDFILL SITE	YEARS									
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total Annual No. of Vehicles	76,653	79,422	91,774	89,753	95,039	105,692	104,901	127,192	138,706	154,661
Monthly Average No. of Vehicles	6,388	6,19	7,648	7,479	7,920	8,808	8,742	10,599	11,559	12,888
Daily Average No. of Vehicles	210	217	251	246	260	289	287	348	380	423
Total Estimated Annual Tonnes	143,101	133,722	177,434	176,949	172,263	195,967	200,527	238,540	269,440	283,456
Monthly Average Tonnes	11,925	11,144	14,786	14,746	14,355	16,331	16,711	19,878	22,453	23,621
Daily Average Tonnes	392	365	486	485	472	535	549	654	738	774
FORRES PARK LANDFILL SITE	**YEARS**									
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total Annual No. of Vehicles	40,736	45,022	44,393	54,331	63,599	96,836	54,924	52,618	67,885	76,485
Monthly Average No. of Vehicles	3,395	3,752	3,699	4,528	5,300	8,070	4,577	4,385	5,657	6,374
Daily Average No. of Vehicles	112	123	122	149	174	265	150	144	186	210
Total Estimated Annual Tonnes	70,747	77,869	79,378	98,285	113,858	178,957	104,809	103,051	131,449	149,600
Monthly Average Tonnes	5,896	6,489	6,615	8,190	9,488	14,913	8,734	8,588	10,954	12,467
Daily Average Tonnes	194	213	217	269	312	489	287	282	360	410
GUANAPO LANDFILL SITE	**YEARS**									
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total Annual No. of Vehicles	20,840	28,095	21,909	27,790	28,487	29,136	39,960	43,886	45,818	51,954
Monthly Average No. of Vehicles	1,737	2,341	1,826	2,316	2,374	2,428	3,330	3,657	3,818	4,330
Daily Average No. of Vehicles	57	77	60	76	78	80	109	120	126	142
Total Estimated Annual Tonnes	33,322	47,838	39,069	47,984	49,863	48,818	73,448	83,393	85,307	97,034
Monthly Average Tonnes	2,777	3,987	3,256	3,999	4,155	4,068	6,121	6,949	7,109	8,086
Daily Average Tonnes	91	131	107	131	137	133	201	228	234	266

Source: SWMCOL

14.3 Biomedical Waste

Pathological wastes from hospitals, clinics and veterinary clinics present a special problem[2]. The Biomedical Waste Management Study (February 2000) was carried out by SWMCOL for PAHO/WHO, to assess the waste management systems in the numerous health care facilities throughout the country. The report highlighted the medical institutions existing locally, and their waste disposal techniques. The Ministry of Health Government of the Republic of Trinidad and Tobago in collaboration with Pan American health Organization, World Health Organization Trinidad and Tobago together produced the Code of Practice for Bio-medical Waste Management in Trinidad and Tobago, 2005. This is a standard policy document with training, supervision and operating procedures to guide the collection, treatment and disposal of Bio-Medical Waste and its management.

14.4 Recycling Initiatives

14.4.1 Paper

The Paper Recovery Operation which is located in El Socorro was formally commissioned in May 1991. In this operation, paper is collected from clients, sorted into various grades, 'baled' and sold to a local contractor who then ships it abroad for sale as feedstock in paper mills. Since its commissioning, recovery of paper has increased 41% over the first three years, with an average of 130 tons per month exported. In 2001, 2002, 2003 and 2004; 64.5%, 11.5%, 14.1% and 9.9% of the total tonnage of paper produced was recycled respectively. From Figure 14.2, the discrepancy is as a result of:

SWMCOL's ability to collect the following types of paper for recycling:

- White Ledger
- Computer Paper
- Coloured Ledger
- Mixed
- Non-windowed white envelopes
- Map, Drawn and Bond Paper

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2 **T&T SWMCOL. 'Results of Survey of Infectious Medical Waste in Trinidad and Tobago'. Oct-Dec 1999**

SWMCOL currently does not collect the following types of paper for recycling as there are no present markets:

- Thermal Fax Paper
- Carbon Paper
- Newspaper
- Tissues
- Milk, Juice, Lunch boxes (boxes with a thin film of wax)
- Candy Wrappers
- Grey Board paper

White Ledger and computer paper represent the higher grades of recyclable paper, followed by coloured ledger and mixed paper. This would also explain the large figure for the year 2001 as paper is recycled according to the market demand. This can be seen and identified in Figure 14.2. The most revenue was obtained during that year.
SWMCOL also offers collection and shredding services to clients, from which most of the paper is collected

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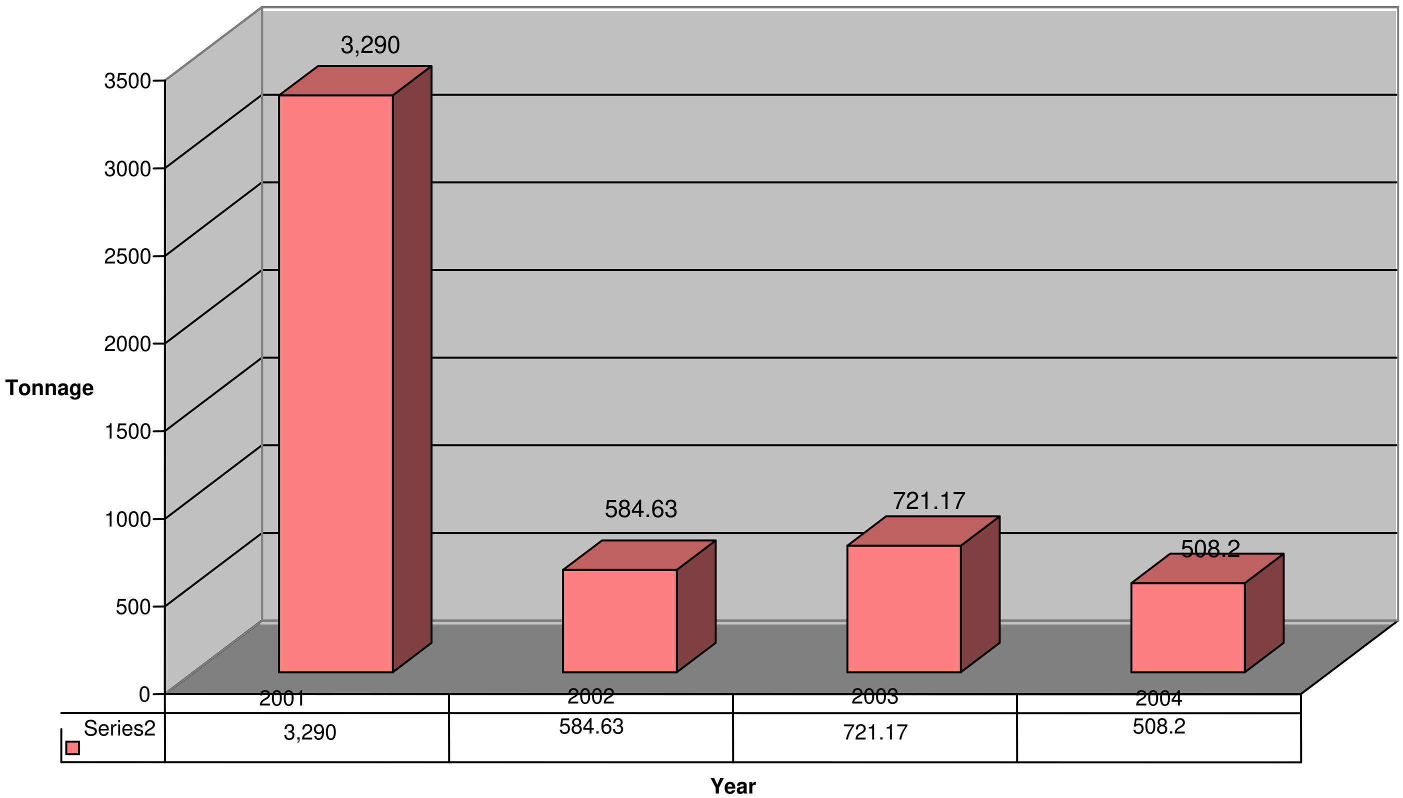
FIGURE 14.2: PAPER PRODUCTION, 2001-2004



Source: SWMCOL

14.2.2 Plastics

SWMCOL is not at present providing collection services for plastics. This is mainly done by the Commercial Plastics Recycling (CPR) Company in Penal, Trinidad. Five hundred million (500,000,000) empty Polyethylene Terephthalate (PET) plastic bottles at an average of 31.78g each is landfilled in Trinidad annually. In 2005, within the first nine (9) months six hundred thousand pounds (600,000 lbs) of PET, High Density Polyethylene (HDPE) and Polycarbonate (PC) scrap plastic bottles were recycled (i.e. baled and reground).

TABLE 14.3: WASTE GENERATION RATES FOR MEDICAL FACILITIES
Type/No. of facilities by quantity of waste generated (kgs/mth)

WASTE TYPE	H/8	PNH/4	LAB/11	FH/11	HC/57	MD/47	VET/4	DNT/16	HM/8	A&P/2	Total
1	663	37	151	30	10	…	…	…	…	…	891
2	51	…	190	117	129	186	5	50	10	5	743
3	405	…	76	50	10	…	…	…	…	…	541
4	229	105	59	17	142	…	…	…	…	…	552
5	234	23	136	…	18	8	…	4	…	…	423
6	221	72	98	114	1,040	429	125	86	33	17	2,235
7	189	…	10	55	485	375	38	…	…	…	1,152
8	250	25	188	9	1,711	825	130	70	30	…	3,238
9	10	…	…	…	84	…	…	…	…	…	94
10	486	126	126	45	2,050	952	90	65	57	4	4,001
Total	**2,737**	**388**	**1,034**	**437**	**5,679**	**2,775**	**388**	**275**	**130**	**26**	**13,869**
Annual Total/t	**32.8**	**4.7**	**12.4**	**5.2**	**68.1**	**33.3**	**4.7**	**3.3**	**1.6**	**0.3**	**166.4**
Gen. Rate per Facility	**342**	**97**	**94**	**40**	**100**	**59**	**97**	**17**	**16**	**13**	**875**

Source: SWMCOL

Key: Medical Waste Generators

H- Hospitals
LAB- Laboratories
PNH- Private Nursing Homes
FH- Funeral Homes
HC- Health Centres
MD- Medical Practitioners
VET- Veterinary Clinics
DNT- Dentists
HM- Geriatric Homes, etc
A&P- Acupuncturists & Pharmacies

Key: Medical waste Types

1- Cultures and stock of infectious agents
2- Vials containing body fluid
3- Culture dishes and other utensils
4- Stool Specimens
5- Sample containers
6- Sharps
7- Pathological waste
8- Dressing and bandages
9- Dialysis unit waste
10- Disposable protective clothing

14.5 Public Awareness

In 2003 the mandate of SWMCOL was expanded from that of management of the landfills to include the Preservation and Upgrade of the environment. These programmes attempt to limit the types of associated waste entering the landfills and also act as methods of a collective effort in gathering and disposal of waste by the use of a quality waste management system. To this end SWMCOL has increased the number of programmes which it manages:

1. **CEPEP**- The Community- based Environmental Protection and Enhancement Programme was founded on three guiding objectives:

   - Clean, enhance and beautify the physical environment
   - Provide employment opportunity to those persons left out of the distribution system- unskilled and semi skilled persons and;
   - To create a cadre of new entrepreneurs in Trinidad and Tobago.

2. **CEII**- The Community Environmental Improvement Initiative. This programme is aimed at educating the national community on the need to conserve the environment and inculcating the right attitudes and behavioural patterns towards the environment. This initiative is designed to improve the quality of life of the nation's citizens through community involvement, the education of the populace, and heightened awareness on the need to conserve and protect the physical environment of Trinidad and Tobago.

3. **DART**- Dead Animal Removal Team was set up in 2002 primarily to oversee the effective removal and disposal of small animal carcasses from the country's roads. In the years 2002, 2003, 2004 and January to September 2005 total figures of twenty-six (26), one thousand and five (1,005), two thousand and sixteen (2,016) and one thousand, three hundred and forty-eight (1,348) animals, inclusive of cats, dogs and others were collected respectively.

4. **DERT**- Disaster Emergency Response Team. This programme was developed in response to Hurricane Ivan's impact on Grenada. The Government of the Republic of Trinidad and Tobago (GORTT) mobilised several units of CEPEP to assist in the disaster relief both physically and psychologically.

5. **"I LOVE MY BEACH PROGRAMME"**- In response to the crime of dumping and littering on the nations beaches, SWMCOL created and established this programme in November 2003. The project was introduced with the objective of removing marine debris from our coastline and thereby preserving the environment.

Solid waste on the Coastline in South Trinidad

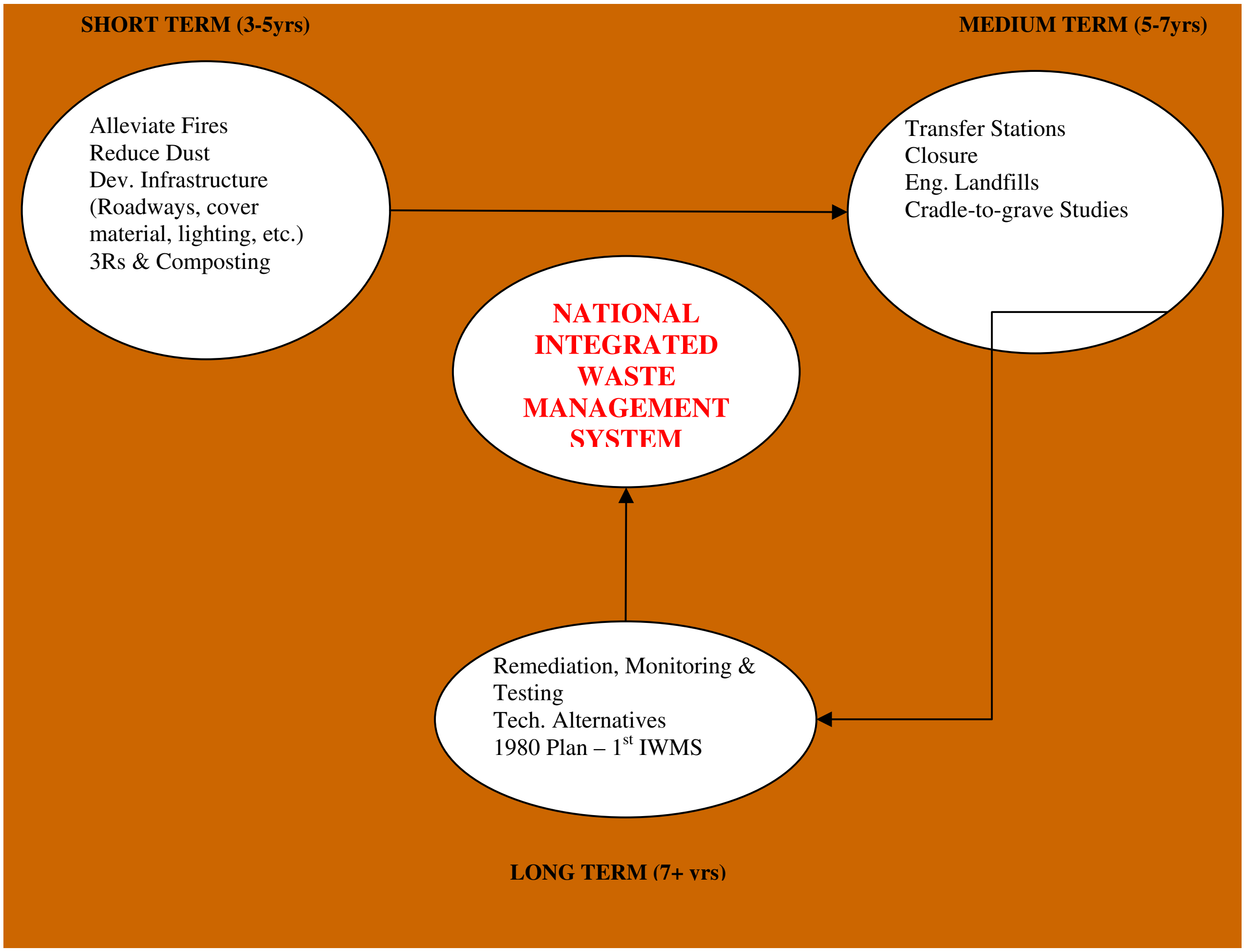
The following are the categories of waste types SWMCOL can collect: Liquid Waste (pure sewage only); Special Waste which is buried at the landfill under a special disposal (e.g. Wastewater from food production facilities). Hazardous Waste is currently not accepted the landfill. However, once treated at a facility and rendered inert the treated hazardous waste would be accepted at the landfill for final disposal. The company also collects Waste- Paper for recycling and supplies Portable Toilets.

14.6 National Integrated Waste Management System

The Trinidad and Tobago waste experience, as outlined in this chapter and the existing approach to waste management is a major cause for concern. As a small island developing state with a fragile, ecosystem and competing land uses, the problems associated with improper waste management are magnified one hundred fold. It is in this regard that SWMCOL has argued for the inception of a National Integrated Waste Management System (NIWMS) which involves a combination of initiatives that provide a systems approach to dealing with the waste generated by a society.

The NIWMS would incorporate all the component parts to establish a waste system that moves all waste from generation source to final disposal. The objective of implementing an NIWMS is to provide proper administration for both contractual and municipal collection crews with the provision of details on types of vehicles to be used, the collection routes and times, the contract period for contracted collectors, the establishment of transfer stations and the method of final disposal.

FIGURE 14.3: FLOWCHART SUMMARIZING INTEGRATED WASTE MANAGEMENT PLAN (IWMP)

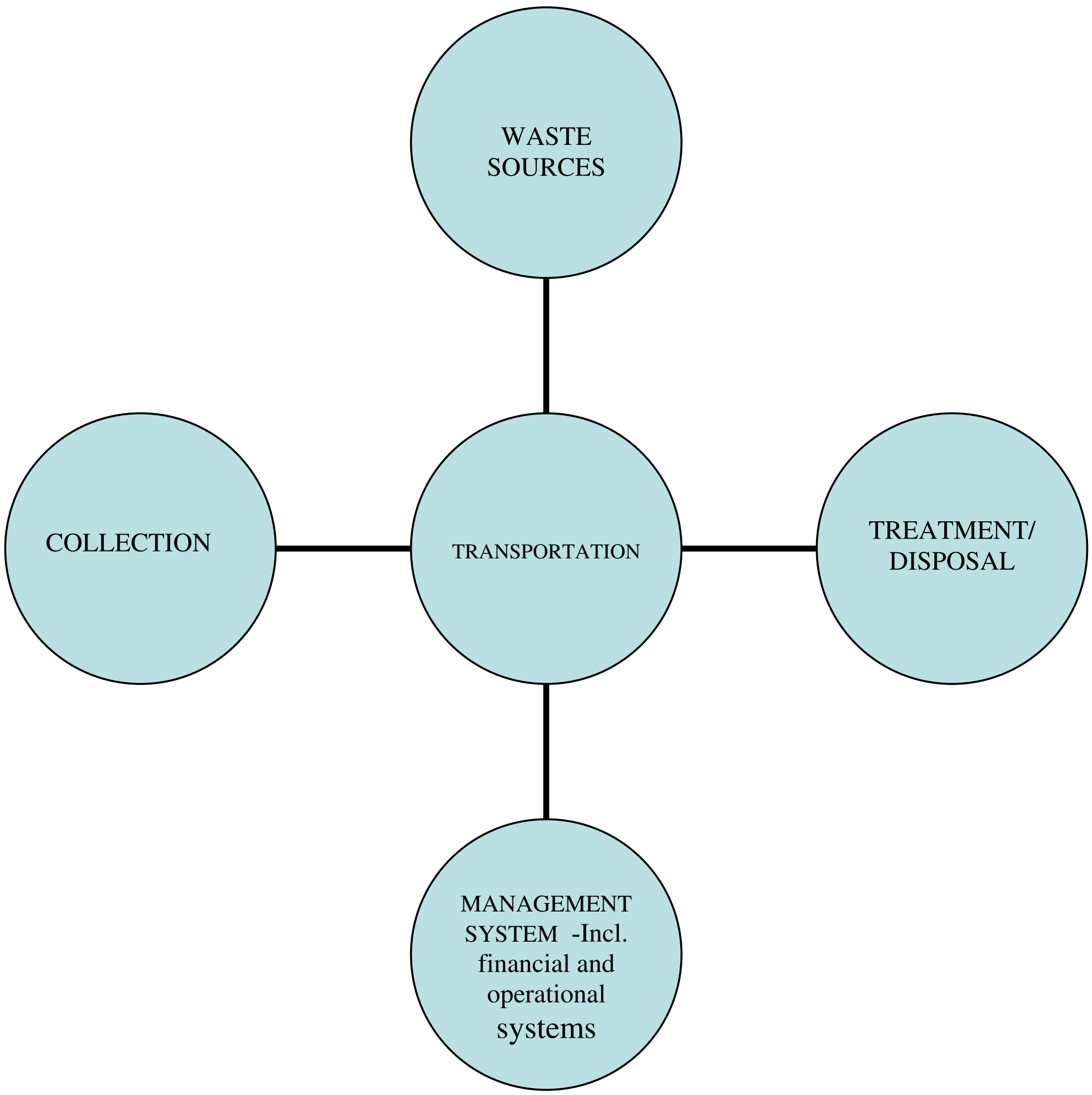


Source: SWMCOL

Figure 14.3 depicts the path that can be taken for successful implementation. Solutions are numerous and a multi-pronged approach is necessary. Solutions have been classified into short, medium and long term requirements, but ultimately, converting to an IWMS would fall in the ideal situation. This is important, especially to ensure proper waste management in light of the limited land resource common to SIDS, the ever-shrinking global village and the increases in consumerism.

All solutions are en route to the eventual long term establishment of a National Integrated Waste Management System. The 1980 study proposed an IWMS, which can be the basis for a revised NIWMS. SWMCOL hopes to implement the results of this update.

Figure 14.4 Elements of the Integrated Waste Management System



Source: SWMCOL

CHAPTER 15

ENVIRONMENTAL LEGISLATIONS, INTERNATIONAL CONVENTIONS AND PROTOCOLS

15 ENVIRONMENTAL LEGISLATION, CONVENTIONS AND INTERNATIONAL PROTOCOLS

A. Legislation

Introduction

One of the emerging dimensions to the environmental debate is the need to understand the magnitude of acts of environmental degradation and the impact of such degradation on human society, both in terms of economic welfare and human health.

Curbing environmental abuse and reversing decades of poor environmental practices are severe challenges. Many tools are required to achieve the objective of environmental restoration and environmental sustainability. These primarily include education and legislation.

The Environmental Management Authority (EMA) during 1998 and 1999 conducted an extensive survey into the legislative and institutional landscape to determine in the first instance the extent of existing laws relating to environmental protection, and secondly, how those laws impact on enforcement, effectiveness, behavior and interaction among agencies.

This challenging exercise reviewed a cross section of the legal framework spanning some fifty (50) agencies of government to determine the extent of the legislative authority they possess, the effectiveness of their laws, their interpretation and specific use with respect to environmental protection for Trinidad and Tobago.

What was discovered is that despite the general malaise attendant with developing countries towards protection of the environment and the lack in most instances of proper safe guards and regulations for that purpose, Trinidad and Tobago in this regard has on its statute books over one hundred (100) pieces of legislation (reference is made to these acts in Appendix 15.1).

An analysis of the activities and problems faced by the enforcement agencies endowed with the responsibility for protection of different aspects of the environment, displays certain interesting trends. The most pressing problem has been that of resources – financial, human, technical, mechanical and research resources. The second important hindrance to the effective enforcement of environmental laws is the presence of multiple agencies with overlapping jurisdiction and inadequate co-ordination.

This chapter takes a look at the legislative mechanisms towards the environmental protection of the country's natural resources: air, water, and land as a tool used to fight against the destruction of our beautiful environment.

15.1 Air

Air Pollution is caused by the release of substances into the atmosphere which, based on technical, scientific or medical evidence, is determined to cause or to be likely to cause harm to human health or the environment. (EMA 1999 State of the Environment Report)

Presently there is no legislation that refers pointedly to air pollutants and their control. There is, though, legislation that addresses non-specific air pollution. Table 15.1 below illustrates a few laws pertaining to air pollution and the area addressed.

TABLE 15.1 - MAIN LEGISLATION RELEVANT TO AIR POLLUTION

LAW	AREA ADDRESSED
Motor Vehicles and Road Traffic Regulations, made pursuant to the Motor Vehicles and Road Traffic Act Chap. 48:50(rev. 1980), Regulation 38, Rule 13	Visible emissions
Public Health Ordinance Chap. 12:04(1950), Sections 69 and 70	Nuisance
Environmental Management Act (2000) Sections 49-51	Authorizes the EMA to develop a legal regime for management of air pollution.
Draft Air Pollution Rules	Establishes the regime for dealing with air pollution.

Source: EMA 1999 State of the Environment Report

The Public Health Ordinance Chap. 12:04 (1950), Section 69 imposes a duty on the part of local authorities to initiate action to abate nuisances. There have been several amendments to the Motor Vehicles and Road Traffic Regulations including Regulation 38(13) which stipulates that a person in charge of a motor vehicle should not allow the emission of a visible vapour and Section 100 of the Motor Vehicles and Road Traffic Act Chapter 48:50 as amended by Section 38 of the Motor Vehicles and Road Traffic (Amendment) Act No. 25 of 1997 which adds authority for the Minister to make regulations for "(q) health, safety or environmental matters... including the prescribed vehicle emissions, use of unleaded fuels.. .".

The Draft Air Pollution Rules seek to make provisions for the management of air pollution, which includes the registration, and further characterization of significant sources of any ongoing or intermittent releases of air pollutants into the environment.

15.2 Biological Resources

Biological resources include: Genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity. (EMA 1999 State of the Environment Report)

These resources can be segregated into several sections such as fauna, flora, ecosystems (including forests and wetlands), marine ecosystems and fisheries. Table 15.2 below illustrates a few laws pertaining to protection of the biological resources in Trinidad and Tobago.

TABLE 15.2 - MAIN LEGISLATION RELEVANT TO BIOLOGICAL RESOURCES

LAW	AREA ADDRESSED
Conservation of Wildlife Act Chap. 67:01(Rev. 1980)	Makes provisions for the Conservation of wildlife by the use of measures such as regulation of hunting.
Section 3 (I) of the Plant Protection Act (1975) Act No. 13 of 1975	Makes provision for the control of the diseases and pests injurious to plants by regulation of the importation of plants.
Section 17 (I) of the Agricultural Fires Act Chap. 63:50 (Rev. 1980)	Control of fires
Forests Act Chap. 66:01 (Rev. 1980)	Protection and preservation of forested areas and floral species
Section 16 of the Petroleum Act Chap. 62:01(Rev. 1980) Section 29(I)(j) of the Petroleum Act Chap. 62:01(Rev. 1980) 42(2)(c) of the Petroleum Regulations (Rev. 1980)	Restoration of area subject to petroleum operations. Empowers the President to make regulations for the prevention of pollution of land. Confers an obligation on holders of petroleum licences to avoid pollution of tidal areas.
Marine Areas (Preservation and Enhancement) Act Chap. 37:02(Rev. 1980)	Designation of marine areas for protection and preservation.
Fisheries Act Chap. 67:51(Rev. 1980)	Regulates fishing in the waters of Trinidad and Tobago.
	This Act regulates activities in the Archipelagic

Archipelagic Waters and Exclusive Economic Zone Act No. 24 of 1986	Waters and Exclusive Economic Zone.
Municipal Corporations Act Chap. 25:05(1990) Section 232(f)	Municipal Corporations are responsible for the maintenance of parks, beaches, water fronts, swamps, forests, game sanctuaries etc.
Environmentally Sensitive Areas Rules (ESA) 2001	Designation of sensitive areas by the EMA.
Environmentally Sensitive Species Rules (ESS) 2001	Designation of sensitive species by the EMA.

Source: EMA 1999 State of the Environment Report

15.2.1 Environmentally Sensitive Areas (ESA) and Environmentally Sensitive Species (ESS)

According to Section 42 of the EM Act, the notice of declaration of an ESS or ESA should include:

a) a comprehensive description of the area or species to be so designated;
b) the reasons for such designation; and
c) The specific limitations on use of or activities within such areas or with regard to such species which are required to adequately protect the identified environmental concerns.

TABLE 15.2.1: EXISTING AND PROPOSED ENVIRONMENTALLY SENSITIVE SPECIES

YEAR	SPECIES
2004	Manatee (declared in 2005)
	White tail Sabre Wing (declared in 2005)
	Pawi (declared in 2005)

Source: Environment Management Authority

Objective under the ESS strategic plan is to increase the protection of endangered species via a declaration of 10 species by the year 2008.

TABLE 15.2.2: EXISTING AND PROPOSED ENVIRONMENTALLY SENSITIVE AREAS

YEAR	AREAS
2004	Aripo Savannah
	Buccoo Reef
	Matura (declared in 2004)
	Nariva Swamp

Source: Environment Management Authority

15.2.2 Fauna

Fauna is a collective reference for the animals of any given geographical region or geographical epoch. (EMA 1999 State of the Environment Report)

In a bid to preserve our rich heritage several laws have been enacted. The principal pillar of environmental legislation that provides the legislative authority for several activities aimed at protecting wild fauna is the Conservation of Wildlife Act Chap. 67:01(rev. 1980). Additionally, another piece of legislation as contained in Section 26 of the Environmental Management Act (2000) stipulates that the Minister may in accordance with Section 27 formulate guidelines on the designation and protection of "environmentally sensitive species". The EMA is thus duty bound in its bid to establish a system that will ensure the protection of the fauna for generations to come.

To maintain the survival of indigenous species, Section 14(I) of the Animals (Diseases and Importation) Act Chap 67:02 (rev. I 980) was enacted so as to ensure that the importation of any alien species (bird, reptile or insect) would not occur without the prior approval of the Chief Technical Officer of the Ministry of Agriculture, Land and Marine Resources (MALMR). In so doing the delicate balance, which may have otherwise been disturbed, will be protected. Section 2(1) of the Control of Importation of Live Fish Act Chap. 67:52 (Rev. 1980) seeks to impose the same safeguards and permission requirements to protect our local fish stocks.

15.2.3 Flora

Flora refers to the plants native to a certain geographical region or geographical period.
(EMA 1999 State of the Environment Report)

Like the legislation that protects fauna, the Plant Protection Act (1975) attempts to ensure that no person imports any type of animal, plant or insect that would adversely impact the presence of indigenous plant species.

The Forest Act Chap. 66:01 (Rev. 1980) and Environmental Management Act No. 3 of 2000 state that rules may be made so as to ensure that only safe environmental methods are practiced that will preserve sensitive species.

15.2.4 Forests

Although there has been rapid urbanization and industrialization, half of Trinidad and Tobago is still under forest, three-quarters of which are controlled by the State.
Illegal logging, squatting and fire have been the main causes of deforestation. The dry season, which has been particularly severe in recent years, has seen a sharp rise in the number of reported fires. The Agricultural Fires Act Chap. 63:02 (Rev. 1980) seeks to define the fire season as the period from the 1st December to 30th June the next succeeding year during which no fire can be set without the authorisation of the Trinidad and Tobago Fire Services.

For State lands the laws are more stringent and afford the forested areas even more comprehensive protection. There are various sections of the Forests Act (rev 1980), which prohibit the cutting, or firing of forested areas without authority. The Act also prevents anyone from removing, transporting or subjecting any forest produce to any manufacturing process. There is also appropriate legislation affecting squatting as contained in the State Lands Act Chap 57:01 (Rev. 1980) which clearly states that squatting is an illegal encroachment onto State lands and could cause spoil and injury to the woods and forests of such lands.

The Petroleum Act Chap 62:01 (Rev 1980) by virtue of Section 16 provides that all land subject to petroleum activities must be restored as near as possible to the original condition after the determination of an Exploration and Production (Public Petroleum Rights) Licence. The Act goes on to provide for the making of regulations that will prevent land pollution and offer compensation. These regulations confer an obligation on licence holders to avoid the pollution of seas, beaches or tidal rivers.

15.2.5 Wetlands

"Wetlands," includes soils that are formed and conditioned by standing water or water logging and adapted to anoxic biochemical processes including mangroves, peats, bog, fens, marshes and swamps. (EMA 1999 State of the Environment Report)

Unfortunately, none of the current legislation specifically addresses the issue of wetlands. The major piece of legislation that may perhaps be used to protect wetlands, is the Marine Areas (Preservation and Enhancement) Act Chap 37:02 which authorizes the Minister to designate any portion of the marine area of Trinidad and Tobago as a restricted area if he feels special steps are necessary for:

a) Preserving and enhancing the natural beauty of such areas
b) The protection of flora and fauna of such areas
c) The promotion of the enjoyment by the public of such areas
d) The promotion of scientific study and research in respect of such areas

There are also several other general pieces of legislation that may provide some aid in the protection of our wetlands. Section 26 of the Environmental Management Act, No. 3 of 2000 attempts to do just that by empowering the Authority to make rules to designate and protect environmentally sensitive areas. This is an important tool in the protection of wetlands. The Forest Act Chap. 66:01 as well, makes it an offence for anyone to enter protected/prohibited areas. Under this Act, a prohibited area is defined as a specified area being part of a Forest Reserve or State lands declared by the Minister by Order to be a prohibited area.

15.2.6 Marine Ecosystems and Fisheries

There are three hundred and fifty four (354) known species of fish off the shores of Trinidad and Tobago. Several levels of legislation currently exist. General ocean management is addressed through:

a) The Archipelagic Waters and Exclusive Zone Act No. 24 of 1986 holds that any ship passing within the Exclusive Economic Zone (EEZ) of Trinidad and Tobago must not engage in any act of willful and serious pollution, or in any fishing activities without the consent of the Minister.

b) Section 7 (1) of the Continental Shelf Act Chapter 1:52 makes it an offence for a person to discharge oil into designated areas of the sea.

c) The Territorial Sea (Amendment) Act No.22 of 1986 empowers an authorized officer to stop any vessel where he reasonably believes certain laws of the country are being infringed upon.

The management of marine resources is dealt with through:

a) The Fisheries Act which has jurisdiction over all rivers and to the Territorial Sea of Trinidad and Tobago: seeks to regulate the country's marine resources by prescribing the size and dimensions of nets or similar implements; determining the size of various catch caught; prohibiting the sale of undersized catch as outlined in the regulations; declaring any area to be prohibited; prohibiting the killing, harpooning, taking, removing, catching or any other forms of taking possession of fish or variety thereof either absolutely or at such times and within such areas as may be prescribed.

b) The Petroleum Regulations made under the Petroleum Act Chap. 62:01 is one such piece of legislation, as oil pollution is perceived as the greatest threat to marine areas. It places an obligation on a petroleum and exploration license to ensure that in the case of operation in submarine areas, pollution of the seas, beaches or tidal rivers does not occur and to ensure that navigation, agriculture, fishing, authorized scientific researches and conservation of living organisms of the sea are not unjustifiably hindered.

15.3 Water Pollution

Water Pollution is caused by the discharge of substances into or which otherwise have an impact on the surface water, sea, groundwater, wetlands or marine areas within the environment and which, based on technical, scientific or medical evidence is determined to cause or to be likely to cause harm to human health or the environment. (EMA 1999 State of the Environment Report)

Because water is so much a part of our society at various levels, the laws pertaining to its pollution are similarly varied. The table below illustrates some of these laws.

TABLE 15.3 - MAIN LEGISLATION RELEVANT TO WATER POLLUTION

LAW	AREA ADDRESSED
Section 18 (I) of the Waterworks and Water Conservation Act Chap. 54:41(Rev. 1980)	Prohibits pollution of watercourses.
Section 73 of the Summary Offence Act Chap. 11:02 (Rev. 1980)	Pollution generally of rivers.
Section 53 of the Water and Sewerage Act Chap. 54:40 (Rev. 1980)	Prohibits pollution of waters.
Sections 60F, G, H, I of the Public Health Ordinance Chap. 12:04 (Rev. 1980)	Provision for the protection of the public from polluted water.
Environmental Management Act (2000) Sections 52-54	Authority to establish legal regime for management of water pollution. Sets our regime for dealing with water pollution.
Section 29(1)(1) of the Petroleum Act Chap. 62:01(Rev. 1980)	Water pollution regulations for the petroleum industry.
Draft Water Pollution Rules	Establishes the regime for dealing with water pollution.

Source: EMA 1999 State of the Environment Report

Watercourse protection is afforded in Section 18 (I) of the Waterworks and Water Conservation Act Chap. 54:41, which prohibits the throwing or depositing of any tree, log, branches, brushwood, stone, gravel, soil or other refuse in any watercourse or in any channel, drain or out fall for water constructed or maintained by or on behalf of the State.

As part of its mandate WASA, as contained in Section 42 of the Water and Sewerage Act Chap. 54:40, is charged with the responsibility for maintaining and developing waterworks, administering and providing a reliable supply, promoting conservation techniques and proper use of water resources. WASA's power, as seen in Section 5 I (I), can extend to supporting the necessary regulations that will seek to protect water resources from pollutants.

It is an offence, as explained in Section 73(I) of the Summary Offences Act Chap. 11:02, to bathe, wash clothes or deposit any filth or dirt into any stream or pond of water, and, owners of land who cause water pollution that affect other lands may be liable for an offence.

Additionally, one of the most important pieces of legislation pertaining to water pollution is the Public Health Ordinance Chap. 12:04 (1950), which comprehensively addresses water pollution. Section 54(1) (c) vests power in local authorities by allowing them to make regulations for the keeping of clean drains and good repair. Specific references to water pollution may be found in Section 57(1) which broadly speaks of the disposal of different types of refuse in the city sewers and drains.

The other major body vested with responsibility for water pollution is the EMA. The Authority has been given a mandate to address water pollution and based on authority derived from the legislation, is perhaps the organization with the greatest responsibility over water pollution. Not only shall the EMA, as spelled out in Section 52(I) of the Environmental Management Act No. 3 of 2000 have the authority to investigate the environment generally and such premises and vehicles as it thinks necessary to ascertain the extent of water pollution, Draft Water Pollution Rules makes provisions for a register that will contain very specific information including the identification of water pollutants, the conditions that will lead to its occurrence and the level of concentrations that exist. Through the development and regular updating of this register the EMA will be better able to manage, monitor and record any additional releases of water pollution into the environment.

15.4 Noise Pollution

Noise pollution may be defined as any audible acoustic energy or vibration that will disturb, cause the annoyance or discomfort to the physiological and/or psychological well being of living things. (EMA 1999 State of the Environment Report)

Noise, although not as visible as many of the other types of pollution, is no less invasive or destructive. Table 15.4 below lists some laws, which govern the control of noise pollution.

TABLE 15.4 - MAIN LEGISLATION RELEVANT TO NOISE POLLUTION

LAW	AREA ADDRESSED
Regulations 38, 43 and 49 of the Motor Vehicles and Road Traffic Regulations Chap. 48:50(Rev. 1980)	Provide for the regulation of noise from motor vehicles.
Section 51 of the Environmental Management Act (2000)	Provides the EMA with the authority to address noise pollution.
Section 12A of the Maxi Taxi Act Chap. 48:53	Prohibits music in maxi taxis.
Noise Pollution Control Rules (NPCR) 2001	The EMA is provided with the authority to address noise pollution.

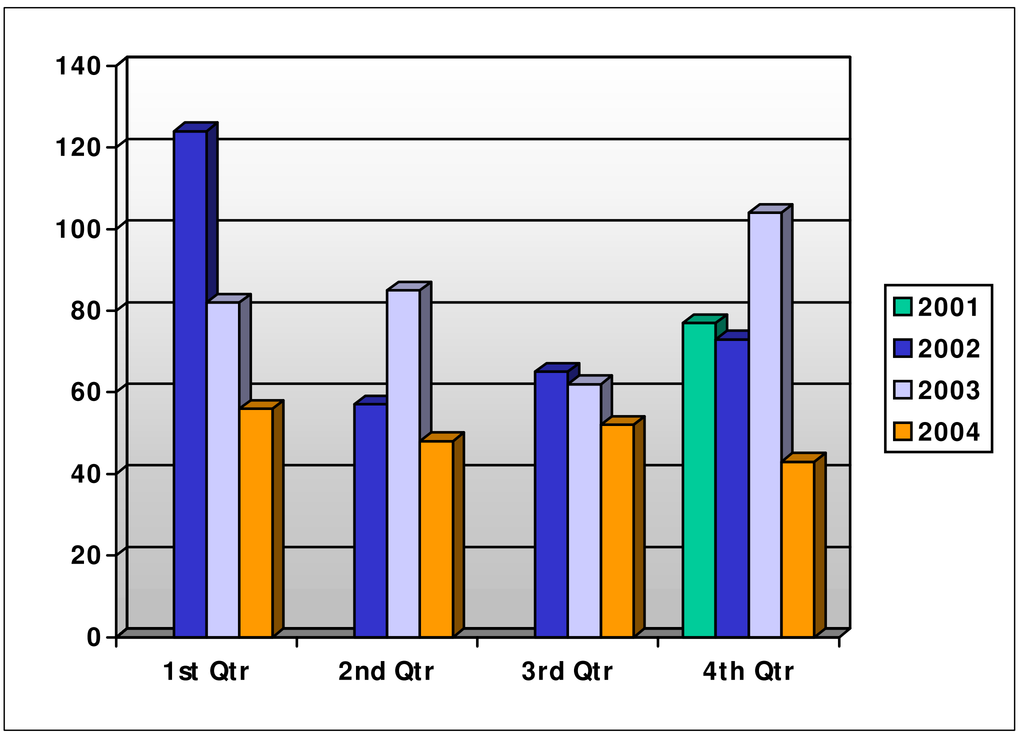
Source: EMA 1999 State of the Environment Report

Vehicles are one of the main sources of noise pollution. Various regulations of the Motor Vehicles and Road Traffic Regulations Chap. 48:50 (Rev. 1980) address not only the level of noise and the control of that noise through silencers fitted onto vehicles (Reg. 28(j)) but speak of the control in the use of horns and musical stereo systems (Reg. 38(12) and 49). Maxi Taxis were particularly targeted since it was commonplace to hear maxis referred to as types of moving discos or "boom boxes" on wheels. Consequently stringent rules were enacted to protect the traveling public. The Chapter 48:53 as amended by the Maxi Taxi (Amendment) Act No. 6 of 1994 prohibits the use of televisions, videos, radios, tape decks, compact disc players, amplifiers, equalizers, speakers or other electrical or electronic equipment for the purpose of playing music or other electrically or electronically transmitted sounds in a maxi-taxi. The Maxi Taxi (Radio) Order 1994 regulates the types of radios and speakers that an owner of a maxi taxi can install.

In the case of noise pollution, the EMA under the Environmental Management Act No. 3 of 2000 Section 49(I) has been given full authority to investigate premises or vehicles that it thinks necessary for the purpose of ascertaining the extent of noise pollution that these may cause. Like water pollution, its mandate goes further by requiring the EMA to develop a register of noise polluting sources and to implement a programme to manage such pollution.

With respect to noise pollution, the Noise Pollution Control Rules, 2001 divides Trinidad and Tobago into 'noise zones' and sets a maximum permissible sound level for each zone. In accordance with the Noise Pollution Control Rules, 2001 where a person wishes to have an event, which may generate noise that will exceed the sound level permissible for that area, that person must apply for a variation.

FIGURE 15.1: NOISE VARIATION APPLICATIONS, 2001-2004



Source: EMA 1999 State of the Environment Report

The graph indicates a marked increase of the number of noise variation applications received since the inception of the NPCR 2001. It should be noted that the NPRC was introduced in the middle half of 2001.

This is an indication of the increase in environmental awareness

15.5 Chemical Pollution

"Chemical Pollution" is essentially pollution caused by a material whether by itself or in a mixture or in a finished product, whether manufactured or acquired from the natural environment, that contains substances used as industrial and domestic chemicals and pesticides which when released into the environment have proven to cause harm to human health sometimes resulting in fatality. The varying causes of harm to humans and the environment have been either medically and or scientifically proven over several decades of research. (EMA 1999 State of the Environment Report)

Table 15.4 below lists some legislation that addresses chemical usage as it pertains to the environment.

TABLE 15.5: MAIN LEGISLATION RELEVANT TO CHEMICAL POLLUTION

LAW	AREA ADDRESSED
Pesticides and Toxic Chemicals Act (1979), as amended by the Pesticides and Toxic Chemicals (Amendment) Act (1986)	Establishes the legal regime for regulation of toxic chemicals and pesticides in Trinidad and Tobago
Fertilizers and Feeding Stuffs Act Chap. 63:55 (Rev. 1980).	Controls the sale and composition of fertilizers and feeding stuff
Explosives Act Chap. 16:02 (Rev. 1980) Section 4(1).	Prescribes the rules for the appointment of explosive magazines and the power to expand such rules
Section 4 (2) of the Trade Ordinance No. 19 of 1958	Creates the legal authority to ban importation of chemicals
Sections 59 and 60 of the Environmental Management Act (2000).	These sections authorize the EMA to establish a legal regime over hazardous substances.

Source: EMA 1999 State of the Environment Report

In Trinidad and Tobago the principal legislation for addressing the control, use, abuse and misuse of harmful chemicals is the Pesticides and Toxic Chemicals (Amendment) Act of 1986, which supplements the 1979 Pesticides and Toxic Chemicals Act. The primary purpose of strengthening the previous Act was to address the issue of the dangers posed to the society by improper regulatory controls over the use of harmful chemical pollutants such as pesticides.

Notwithstanding the Pesticides and Toxic Chemicals Act of 1986, there exists other pieces of legislation that empower other agencies of Government to have further control and regulatory authority over the use and disposal of harmful and toxic chemicals. One such authority is the

EMA. Section 26 of the Environmental Management Act gives the Minister the power to make rules for procedures required for the registration of sources from which pollutants may be released into the environment; characterization of such sources; and the quantity, condition and or concentration of pollutants or substances containing pollutants that may be released into the environment, either generally or by specific sources or categories of sources.

Section 59 of the Environmental Management Act (2000) also empowers the agency to develop a programme for the designation of specific hazardous substances and performance standards and procedures for the safe handling of such hazardous substances. The Act is not specifically related to chemicals only, but to the wider issue of harmful pollutants.

15.6 Waste and Pollution

"Waste" is defined as garbage, refuse, sludge and any other discarded material including solid, liquid, gaseous or energy sources generated by industrial, commercial, agricultural, community or mining activities. (EMA 1999 State of the Environment Report)

The continued expansion of our economy and the attendant expansion of our population have increased our output of hazardous and non-hazardous waste. The control of hazardous and non-hazardous waste is addressed by some of the laws as outlined in Table 15.6.

Dumping of rubbish by the public despite the legal notice

TABLE 15.6 - MAIN LEGISLATION RELEVANT TO WASTE POLLUTION

LAW	AREA ADRESSED
Regulation 4(I) of the Pesticides (Registration and Import Licensing) Pesticides and Toxic Chemicals Regulations (1986) made pursuant to Section 12 of the Pesticides and Toxic Chemicals Act (1979)	Regulates the registration and import of pesticides.
Environmental Management Act (2000), Sections 55-57	These sections vest responsibility in the EMA for developing a legal regime for waste management in Trinidad and Tobago.
Litter Act, Ch. 30:52 (rev. 1980), as amended by the Litter (Amendment) Public Authorities Act (1981)	Provides the legal framework for controlling littering of public places.
Sections 136 and 232(j) of the Municipal Corporations Act (1990)	Assigns responsibility for municipal wastes to corporations.
Section 62 of the Water and Sewerage Act Chap. 54:40 (Rev. 1980)	These vests in WASA responsibility for public sewerage systems.
Beverage Container's Bill	Regulates sale of beverages in sealable containers

Source: EMA 1999 State of the Environment Report

15.6.1 Hazardous Waste

Hazardous Waste means, "waste or combination of wastes, which because of its concentration, quantity or physical, chemical or infectious distinctiveness may inter alia-

(a) cause, or significantly contribute to any increase in mortality or increase in serious irreversible or incapacitating illness; or

(b) pose a substantial present or potential threat to human health, or the environment when improperly treated, stored, transported, or disposed of, or other wise managed.

(EMA 1999 State of the Environment Report)

Section 12(I) of the Pesticides and Toxic Chemicals Act 1979 gives the Minister responsible the authority to make regulations respecting the types of packages in which controlled products may be imported transported or sold, and as to the disposal of such packages after use. The Minister may also make regulations pertaining to the disposal of unwanted stocks of controlled products and or chemical pollutants.

Under the Environmental Management Act (2000) the management of waste is provided for under the following Sections:

a) Section 55 (I) gives the EMA the authority to investigate the environment and such premises and vehicles, as it deems necessary to ascertain the nature of waste, and the manner in which it is handled. Under Section 55(2), the Authority is required to develop and implement a programme for the management of such waste, which may include registration, and further characterization of significant sources of wastes being disposed into the environment.

b) Section 56 states that the EMA is required to submit to the Minister (as part of its management function) a programme to define those wastes and to establish appropriate standards and design criteria for hazardous waste handling and disposal facilities and to establish licensing and permitting requirements with respect to such wastes.

c) Section 57 empowers the EMA to grant permits authorizing any person's waste disposal activities, or licences for the operation of any waste handling facility subject to such terms and conditions as it deems fit.

15.6.2 Non-Hazardous Waste

Non Hazardous waste consists of waste that is not by nature or design toxic or not captured by the definition "Hazardous Waste", meaning that anything that is not considered to be a hazard as contained in the interpretation of hazardous waste but is considered waste is categorized as "Non-Hazardous Waste". (EMA 1999 State of the Environment Report)

There currently exist several pieces of legislation on the statute books dealing with non-hazardous waste as follows:

a) Litter Act, Ch. 30:52. This Act makes it an offence to deposit without reasonable excuse any litter in a public place other than in a receptacle placed for the purpose of collecting refuse.

b) Local Government Authorities are also vested with the power under Sections 67 and 141 of the Public Health Ordinance Chap. 12:04 to create regulations to deal with non-hazardous wastes. Under Section 64(I) these authorities are responsible for the removal of household refuse and other rubbish from premises within its respective jurisdictions. Under Section 64(2) local authorities are made responsible for the disposal of all collected refuse.

c) By virtue of Section 55, the EMA has the Authority to ascertain the volume and nature of waste and to develop and implement a programme for the management of such waste.

d) Other agencies charged with the management and maintenance of sewage are the Water and Sewerage Authority (WASA) which has responsibility under Section 62 of the Water and Sewerage Act Chap. 54:40 , for maintaining and developing the existing sewerage system and for administering the sewerage services thereby established and providing such services in Trinidad and Tobago.

e) Further management of sewage is also provided for under the Public Health Ordinance Chap. 12:04, which gives local authorities the power to make regulations for sanitary arrangements and convenience

f) of any public or other building. The Water and Sewerage Authority (WASA) also has similar responsibility as indicated above.

g) The Beverage Containers Bill provides for the regulation of the sale of beverages in sealable containers, the payment of a deposit on prescribed classes of beverage containers, the refund of the deposit on the return of reusable and recyclable containers, and other administrative and fiscal measures to encourage the reuse and recycling of beverage containers and reduce the disposal of beverage containers into the environment, and for matters incidental thereto.

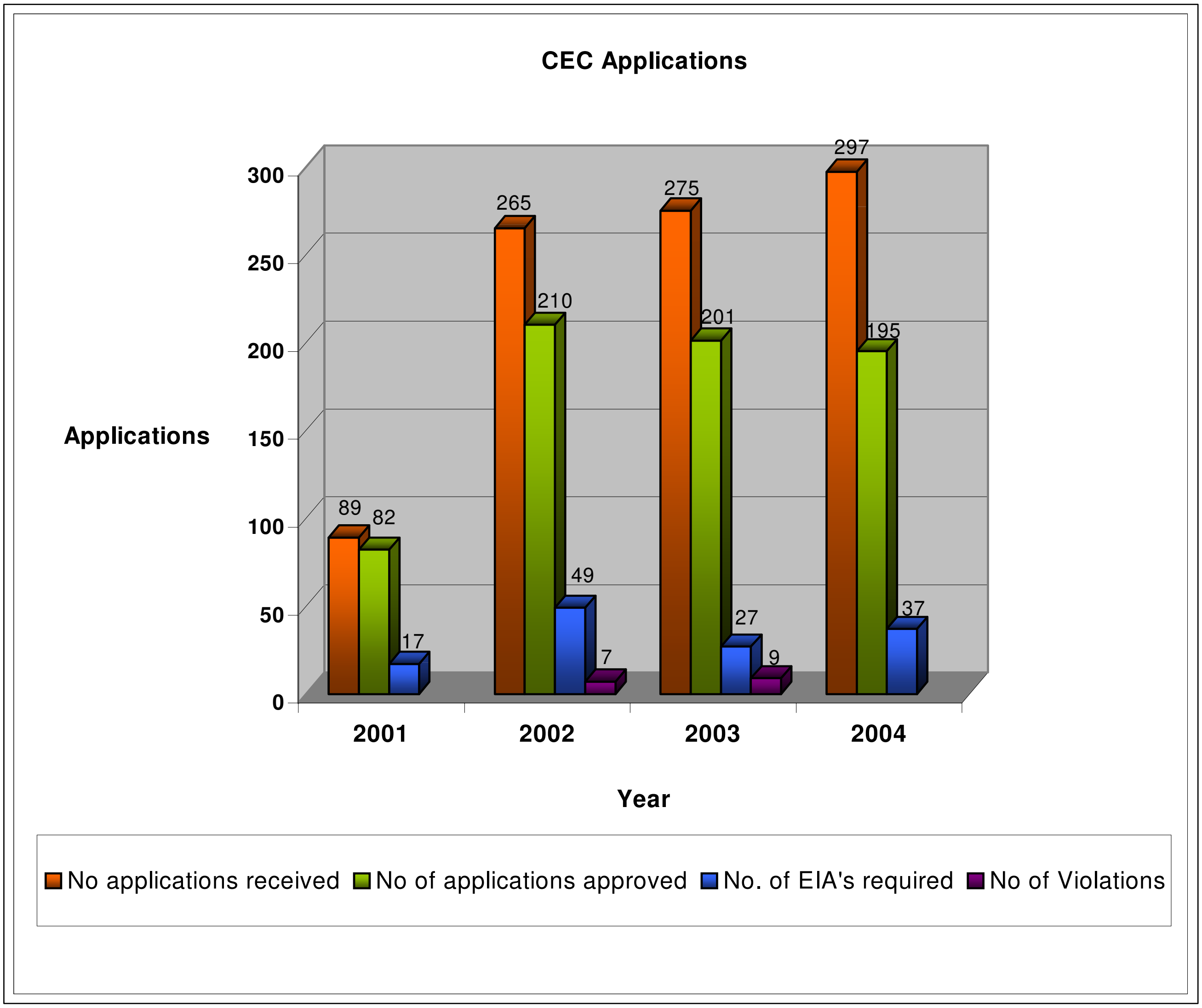
TABLE 15.6.1: POLLUTION FROM DESIGNATED ACTIVITIES

LAW	AREA ADRESSED
Certificate of Environmental Clearance Rules (CEC) 2001	The EMA is vested with the authority to regulate the conduct of designated activities so as to minimize environmental impact.

Source: EMA 1999 State of the Environment Report

Section 35(1) of the EM Act states “for the purpose of determining the environmental impact which might arise out of any new or significantly modified construction, process, works other activity, the Minister may by order subject to negative resolution of Parliament, designate a list of activities requiring a certificate of environmental clearance.” A certificate of environmental clearance is issued under section 36(1) of the EM Act 2000 which states “After considering all relevant matters, including the comments or representations made during the public comment period, the Authority may issue a Certificate subject to such terms and conditions as it thinks fit, including the requirement to undertake appropriate mitigation measures.

CHART 15.2: CERTIFICATE OF ENVIRONMENTAL CLEARANCE APPLICATIONS, 2001-2004



Source: EMA 1999 State of the Environment Report

The graph indicates a marked increase of the number of applications received since the inception of the CEC Rules 2001. This is an indication of the increase in environmental awareness.

B. ENVIRONMENTAL CONVENTIONS AND INTERNATIONAL PROTOCOLS

Introduction

Environmental issues often transcend national boundaries, making them a global concern. The release of carbon dioxide and ozone depleting substances into the atmosphere, the international trade in wild flora and fauna and the transboundary movement of hazardous waste are but a few examples of how the actions of one country can impact on other countries.

Trinidad and Tobago acceded to its first Multilateral Environmental Agreement (MEA) on 19 January 1984 the auspicious convention was the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES).

The MEAs provide the basis for international co-operation in the management of the environment on a global scale. MEAs also provide opportunities for small island developing states like Trinidad and Tobago to obtain recognition of their special needs and vulnerabilities as we attempt to move toward developed nation status in a sustainable manner. The international meetings that are associated with MEAs provide invaluable fora for the exchange of ideas, solutions and opportunities for networking.

15.7 Convention on Wetlands of International Importance Especially as Waterfowl Habitat 1971(RAMSAR Convention)

The Convention on Wetlands of International Importance Especially as Waterfowl Habitat 1971(RAMSAR Convention) also know as the Convention on Wetlands is an intergovernmental treaty adopted on 2 February 1971 in the Iranian city of Ramsar. Ramsar is the first of the modern global intergovernmental treaties on the conservation and sustainable use of natural resources. The original emphasis of the Convention was upon the conservation and wise use of wetlands primarily as habitat for waterbirds. Over the years, however, the Convention has broadened its scope to cover all aspects of wetland conservation and wise use, recognizing wetlands as ecosystems that are extremely important for biodiversity conservation and for the well-being of human communities.

Parties to the Ramsar Convention have four basic obligations to fulfill:

Obligation 1: Listed sites

The first obligation under the Convention is to designate at least one wetland for inclusion in the **List of Wetlands of International Importance** (the "Ramsar List") and to promote its conservation, including, where appropriate, its wise use. Selection for the Ramsar List should be based on the wetland's significance in terms of ecology, botany, zoology, limnology, or hydrology. The Contracting Parties have adopted specific criteria and guidelines for identifying sites that qualify for inclusion in the List of Wetlands of International Importance.

Obligation 2: Wise use

Under the Convention there is a general obligation for the Contracting Parties to include wetland conservation considerations in their national land-use planning. They have undertaken to formulate and implement this planning so as to promote, as far as possible, "**the wise use of wetlands in their territory**" (Article 3.1 of the treaty). The Conference of the Contracting Parties has approved guidelines and additional guidance on how to achieve "wise use", which has been interpreted as being synonymous with "sustainable use".

Obligation 3: Reserves and training

Contracting Parties have also undertaken to establish nature reserves in wetlands, whether or not they are included in the Ramsar List, and they are also expected to promote training in the fields of wetland research, management and wardening.

Obligation 4: International cooperation

Contracting Parties have also agreed to consult with other Contracting Parties about implementation of the Convention, especially in regard to transfrontier wetlands, shared water systems, and shared species.

Trinidad and Tobago currently has three designated Ramsar sites:

- Nariva Swamp – December 21, 1992
- Caroni Swamp – July 8, 2005
- Buccoo Reef/Bon Accord Lagoon Complex–July 8, 2005

For more information on the Ramsar Convention please refer to:
http://www.ramsar.org/about/about_infopack_2e.htm

15.8 Convention on the International Trade in Endangered Species of Wild Flora and Fauna (CITES) 1973

CITES was born out of a resolution adopted in 1963 at a meeting of members of IUCN (The World Conservation Union) and eventually entered in force on 1 July 1975. The aim of CITES is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. Because the trade in wild animals and plants crosses borders between countries, the effort to regulate it requires international cooperation to safeguard certain species from over-exploitation.

CITES was conceived in the spirit of such cooperation. Today, it accords varying degrees of protection to more than 30,000 species of animals and plants, whether they are traded as live specimens, fur coats or dried herbs.

Although CITES is legally binding on the Parties – in other words they have to implement the Convention – it does not take the place of national laws. Like many other Conventions, it provides a framework to be respected by each Party, which has to adopt its own domestic legislation to ensure that the Convention is implemented at the national level.

For more information on CITES please refer to: http://www.cites.org/

15.9 International Convention for the Prevention of Pollution from Ships (MarPol Convention) 1973

The MARPOL Convention is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. It is a combination of two treaties adopted in 1973 and 1978 respectively and updated by amendments throughout the years.

The Convention was adopted on 2 November 1973 and covers pollution by oil, chemicals, harmful substances in packaged form, sewage and garbage. The Protocol of 1978 (1978 MARPOL Protocol) relating to the 1973 Convention was adopted at a Conference on Tanker Safety and Pollution Prevention in February 1978 held in response to a spate of tanker accidents in 1976-1977.

As the 1973 MARPOL Convention had not yet entered into force, the 1978 MARPOL Protocol absorbed the parent Convention. The combined instrument is referred to as the International Convention for the Prevention of Marine Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78), and it entered into force on 2 October 1983 (Annexes I and II).

The Convention includes regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations - and currently includes six technical Annexes:

Annex I Regulations for the Prevention of Pollution by Oil

Annex II Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk

Annex III Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form
Annex IV Prevention of Pollution by Sewage from Ships

Annex V Prevention of Pollution by Garbage from Ships

Annex VI Prevention of Air Pollution from Ships (entry into force 19 May 2005)

States Parties must accept Annexes I and II, but the other Annexes are voluntary.

For more information on the Marpol Convention please refer to:
http://www.imo.org/Conventions/contents.asp?doc_id=678&topic_id=258

15.10 United Nations Convention on the Law of the Sea 1982 Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention) 1983

The Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region was adopted in Cartagena, Colombia on 24 March 1983 and entered into force on 11 October 1986, for the legal implementation of the Action Plan for the Caribbean Environment Programme. The Cartagena Convention has been ratified by 21 United Nations Member States in the Wider Caribbean Region (WCR). Its area of application comprises the marine environment of the Gulf of Mexico, the Caribbean Sea and the areas of the Atlantic Ocean adjacent thereto, south of 30 ^{0} north latitude and within 200 nautical miles of the Atlantic Coasts of the States.

The legal structure of the Convention is such that it covers the various aspects of marine pollution for which the Contracting Parties must adopt measures. Thus, the Convention requires the adoption of measures aimed at preventing, reducing and controlling pollution of the following areas:

- pollution from ships
- pollution caused by dumping
- pollution from sea-bed activities
- airborne pollution
- pollution from land-based sources and activities.

In addition, the Parties are required to take appropriate measures to protect and preserve rare or fragile ecosystems, as well as the habitat of depleted, threatened or endangered species and to develop technical and other guidelines for the planning and environmental impact assessments of important development projects in order to prevent or reduce harmful impacts on the area of application.

The Convention has been supplemented by three Protocols:

15.10.1 A Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region which was also adopted in 1983 and entered into force on 11 October 1986. The Protocol Concerning Co-operation and Development in Combating Oil Spills in the Wider Caribbean Region (the Oil Spills Protocol) was drafted and adopted concurrently with the

Cartagena Convention in 1983. The objective of the Protocol is to strengthen national and regional preparedness and response capacity of the nations and territories of the region. The Protocol also serves to foster and facilitate co-operation and mutual assistance among the nations and territories in cases of emergency in order to prevent and control major oil spill incidents.

15.10.2 A Protocol Concerning Specially Protected Areas and Wildlife (SPAW) in the Wider Caribbean Region which was adopted on 18 January 1990 and entered into force on 18 June 2000. The Protocol has been internationally recognised as the most comprehensive treaty of its kind and preceded other international environmental agreements in utilizing an ecosystem approach to conservation. The Protocol acts as a vehicle to assist with regional implementation of the broader and more demanding global Convention on Biological Diversity (CBD).

The objective of the Protocol is to protect rare and fragile ecosystems and habitats, thereby protecting the endangered and threatened species residing therein. The Caribbean Regional Co-ordinating Unit pursues this objective by assisting with the establishment and proper management of protected areas, by promoting sustainable management (and use) of species to prevent their endangerment and by providing assistance to the governments of the region in conserving their coastal ecosystems.

15.10.3 A Protocol Concerning Pollution from Land-Based Sources and Activities (LBS).

The Contracting Parties to the Cartagena Convention decided in 1987 at a meeting in Guadeloupe to give priority to this Protocol which was adopted on 6 October 1999 in Aruba. This Protocol is the first regional environmental agreement where effluent limitations and other obligations are required within a given time frame for specific sources of pollution and may serve as a model to others. Annex I of the Protocol establishes a list of the sources, activities, and contaminants of specific concern for the Wider Caribbean Region (WCR) as a whole. Annex II establishes the process for developing regional source-specific controls for the sources and activities identified in Annex I or other sources as determined by the Contracting Parties. Annexes proceeding from Annex II provide source-specific control measures in the form of regional effluent limitations and best management practices. Such annexes also contain timetables for achieving the effluent limitations and management practices. The LBS Protocol is an important instrument to assist States in the WCR to achieve the goals and obligations of two other international agreements as well. The United Nations Convention on the Law of the Sea calls upon States to adopt laws and regulations to prevent, reduce, and control, pollution of the marine environment from land-based sources and the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA), adopted in Washington in 1995, also highlights the need for action to reduce the pollutant load to the seas from land-based sources and activities. Both of these instruments emphasize the need to act at the regional level to address this problem.

For more information on the Cartagena Convention and its associated Protocols please refer to: http://www.cep.unep.org/law/cartnut.html

15.11 Convention for the Protection of the Ozone Layer (Vienna Convention) 1985

In 1985, nations agreed in Vienna to take "appropriate measures...to protect human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to modify the Ozone Layer", thus the Convention for the Protection of the Ozone Layer was born.

The main thrust of the Convention was to encourage research and overall cooperation among countries and exchange of information. Even so it took four years to prepare and agree. Twenty nations signed it in Vienna, but most did not rush to ratify it. The Convention provided for future protocols and specified procedures for Amendment and dispute settlement.

The Vienna Convention set an important precedent. For the first time nations agreed in principle to address a global environmental problem before its effects were felt, or even scientifically proven.

As the experts began to explore for specific measures to be taken, the journal 'Nature' published a paper in May 1985 by British scientists - led by Dr. Joe Farman - about severe ozone depletion in the Antarctic. The paper's findings were confirmed by American satellite observations and offered the first proof of severe ozone depletion and making the need for definite measures more urgent. As a result, In September 1987, agreement was reached on specific measures to be taken and the Montreal Protocol on Substances that Deplete the Ozone Layer was signed.

For more information please see:
http://ozone.unep.org/Treaties_and_Ratification/2A_vienna_convention.asp

15.12 Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol) 1987

Following the discovery of the Antarctic ozone hole in late 1985, governments recognized the need for stronger measures to reduce the production and consumption of a number of CFCs (CFC 11, 12, 113, 114, and 115) and several Halons (1211, 1301, and 2402). The Montreal Protocol on Substances that Deplete the Ozone Layer was adopted on 16 September 1987 at the Headquarters of the International Civil Aviation Organization in Montreal. The Protocol came into force on 1st January 1989, when it was ratified by 29 countries and the EEC. Since then several other countries have ratified it.

The Protocol was designed so that the phase out schedules could be revised on the basis of periodic scientific and technological assessments. Following such assessments, the Protocol was adjusted to accelerate the phase out schedules. It has also been amended to introduce other kinds of control measures and to add new controlled substances to the list.

For more information please refer to:
http://ozone.unep.org/Treaties_and_Ratification/2B_montreal_protocol.asp

15.13 Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention) 1989

The Basel Convention addresses the problems and challenges posed by hazardous waste. When hazardous waste is dumped indiscriminately, spilled accidentally or managed improperly, it can cause severe health problems, even death, and poison water and land for decades. The Basel Convention addresses wastes that are toxic, poisonous, explosive, corrosive, flammable, ecotoxic and infectious.

The need for the Convention arose in the late 1980s, when a tightening of environmental regulations in industrialized countries led to a dramatic rise in the cost of hazardous waste disposal. Searching for cheaper ways to get rid of the wastes, “toxic traders” began shipping hazardous waste to developing countries and to Eastern Europe. When this activity was revealed, international outrage led to the drafting and adoption of the Basel Convention.

During its first decade (1989-1999), the Convention was principally devoted to setting up a framework for controlling the "transboundary" movements of hazardous wastes, that is, the movement of hazardous wastes across international frontiers. It was during this decade that a central goal of the Basel Convention, "environmentally sound management" (ESM), was developed. The aim of "environmentally sound management" is to protect human health and the environment by minimizing hazardous waste production whenever possible. ESM means addressing the issue through an "integrated life-cycle approach", which involves strong controls from the generation of a hazardous waste to its storage, transport, treatment, reuse, recycling, recovery and final disposal.

During the present decade (2000-2010), the Convention will build on this framework by emphasizing full implementation and enforcement of treaty commitments. The other area of focus will be the minimization of hazardous waste generation. Recognizing that the long-term solution to the stockpiling of hazardous wastes is a reduction in the generation of those wastes - both in terms of quantity and hazardousness - Ministers meeting in December of 1999 set out guidelines for the Convention's activities during the next decade, including:

- active promotion and use of cleaner technologies and production methods;
- further reduction of the movement of hazardous and other wastes;
- the prevention and monitoring of illegal traffic;
- improvement of institutional and technical capabilities -through technology when appropriate - especially for developing countries and countries with economies in transition;
- further development of regional and subregional centres for training and technology transfer.

One of these controls consisted of the development of a control system which is based on prior written notification. Because hazardous wastes pose such a potential threat to human health and the environment, one of the guiding principles of the Basel Convention is that, in order to minimize the threat, hazardous wastes should be dealt with as close to where they are produced as possible. Therefore, under the Convention, transboundary movements of hazardous wastes or other wastes can take place only upon prior written notification by the State of export to the competent authorities of the States of import and transit (if appropriate). Each shipment of hazardous waste or other waste must be accompanied by a movement document from the point at which a transboundary movement begins to the point of disposal. Hazardous waste shipments made without such documents are illegal. In addition, there are outright bans on the export of these wastes to certain countries. Transboundary movements can take place, however, if the state of export does not have the capability of managing or disposing of the hazardous waste in an environmentally sound manner.

The key objectives of the Basel Convention are:

- to minimize the generation of hazardous wastes in terms of quantity and hazardousness;
- to dispose of them as close to the source of generation as possible; and
- to reduce the movement of hazardous wastes.

For more information on the Basel Convention please refer to:
http://www.basel.int/pub/basics.html

15.14 United Nations Framework Convention on Climate Change (UNFCCC) 1992

The Convention on Climate Change sets an overall framework for intergovernmental efforts to address the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The Convention enjoys near universal membership, with 189 countries having ratified.

Under the Convention, governments:

- gather and share information on greenhouse gas emissions, national policies and best practices
- launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries
- cooperate in preparing for adaptation to the impacts of climate change.

The Convention entered into force on 21 March 1994.

For more information on the UNFCCC please see:
http://unfccc.int/essential_background/convention/items/2627.php

15.15 Convention on Biological Diversity (CBD) 1992

The Convention on Biological Diversity (CBD) is one of the two Conventions signed by the international community during the Earth Summit, at Rio de Janeiro (Brazil) in 1992. The other convention is the Convention on Climate Change. The three objectives of the CBD are:

- the conservation of biological diversity,
- the sustainable use of its components,
- the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

The CBD is the first agreement to address all aspects of biological diversity (species, ecosystems and genetic resources) and has become one of the most widely ratified international treaties on environmental issues.

Unlike other international agreements that set strict concrete targets for action, the Convention on Biological Diversity is a framework agreement that takes a flexible approach to implementation, leaving it up to individual countries to determine how its provisions are to be implemented. Provisions are mostly expressed as goals and policies, rather than as precise obligations and targets.

One of its greatest achievements so far has been to generate an enormous amount of interest in biodiversity at national level, both in developed and developing countries. Biodiversity is now seen as a critically important environment and development issue.

For more information on the CBD please go to:
http://bch-cbd.naturalsciences.be/belgium/convention/convention-faq.htm

15.16 The Cartagena Protocol on Biosafety

On 29 January 2000, the Conference of the Parties to the Convention on Biological Diversity adopted a supplementary agreement to the Convention known as the Cartagena Protocol on Biosafety. The Protocol seeks to protect biological diversity from the potential risks posed by living modified organisms resulting from modern biotechnology. It establishes an advance informed agreement (AIA) procedure for ensuring that countries are provided with the information necessary to make informed decisions before agreeing to the import of such organisms into their territory. The Protocol contains reference to a precautionary approach and reaffirms the precaution language in Principle 15 of the Rio Declaration on Environment and Development. The Protocol also establishes a Biosafety Clearing-House to facilitate the exchange of information on living modified organisms and to assist countries in the implementation of the Protocol.

“Living modified organism” means any living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology;

For more information on the Cartagena Protocol please refer to:
http://www.biodiv.org/biosafety/background2.aspx

15.17 Convention on Persistent Organic Pollutants (POPs) (Stockholm Convention)

The Stockholm Convention is a global treaty to protect human health and the environment from persistent organic pollutants (POPs). POPs are chemicals that remain intact in the environment for long periods, becoming widely distributed geographically; they accumulate in the fatty tissue of living organisms and are toxic to humans and wildlife. POPs circulate globally and can cause damage wherever they travel. In implementing the Convention, Governments will take measures to eliminate or reduce the release of POPs into the environment.

Please refer to the following website for more information: http://www.pops.int/

15.18 United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, (UNCCD) 1994

The objective of the UNCCD is to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa. The Convention does this through action at all levels, supported by international cooperation and partnerships. It uses an integrated approach to combat desertification, which is consistent with the principles of sustainable development as contained in Agenda 21. The UNCCD came into force in December 1996.

15.19 The Kyoto Protocol 1997

The 1997 Kyoto Protocol shares the UNFCCC's objective, principles and institutions, but significantly strengthens the Convention by committing Annex I Parties to individual, legally-binding targets to limit or reduce their greenhouse gas emissions. Only Parties to the Convention that have also become Parties to the Protocol (i.e. by ratifying, accepting, approving, or acceding to it) will be bound by the Protocol's commitments. 163 countries have ratified the Protocol to date. Of these, 35 countries and the EEC are required to reduce greenhouse gas emissions below levels specified for each of them in the treaty. The individual targets for Annex I Parties are listed in the Kyoto Protocol's Annex B. These add up to a total cut in greenhouse-gas emissions of at least 5% from 1990 levels in the commitment period 2008-2012. The Kyoto Protocol entered into force on 16 February 2005.

For more information on the Kyoto Protocol please see:
http://unfccc.int/essential_background/kyotoprotocol/items/2830.php

Table 15.7 presents a summarized view of important facts pertaining to Conventions and International Protocols which relates to Trinidad and Tobago.

TABLE 15.7: SUMMARY FACTS ON CONVENTIONS AND INTERNATIONAL PROTOCOLS

Convention	Signed	Accede/Accept/Ratify by Trinidad and Tobago	Date of entry into force	Number of Parties as at 31 Dec. 2005	Focal Point
RAMSAR Convention, 1971		Acceded to the Convention on Wetlands on 21 April 1993	21 December 1975	150	MPUE
CITES, 1973		Acceded to the Convention on 19 January 1984	1 July 1975	169	MPUE
Marpol, 1973					
Law of the Sea, 1982			16 November 1994	149	
Cartegena Convention, 1983		24 January 1986	11 October 1996	21	MPUE
Protocol Concerning Cooperation in Combating Oil Spills in the Wider Caribbean Region		24 January 1986	11 October 1986	21	
SPAW Protocol, 1990		10 August 1999	18 June 2000	12	MPUE
LBS Protocol, 1999		Protocol on 28 March 2003	The Protocol is not in force	2	MPUE
Vienna Convention, 1985		28 August 1989	22 September 1988	190	MPUE
Montreal Protocol, 1987		28 August 1989	1 January 1989	189	
Basel Convention	-------------------	18 February 1994 acc	5 May 1992	166	MPUE
UNFCCC, 1992		24 June 1994 Trinidad and Tobago is a Non-Annex 1 country	21 March 1994	189	MPUE
CBD, 1992		1 August 1996	21 December 1975	188	MPUE
UNCCD, 1994	-------------------	8 June 2000 acc	6 September 2000	191	MPUE
Kyoto Protocol, 1997	7 January 1999	28 January 1999	16 February 2005	158	
The Cartagena Protocol on Biosafety to the Convention on Biological Diversity	------------------	5 October 2000	11 September 2003	130	MPUE
Stockholm Convention, 2001	-------------------	13 December 2002 acc	17 May 2004	117	

Glossary of Terms

GLOSSARY OF TERMS

A

ACCEDE

States that did not send their signatures to the Convention during the time it was opened for signatures are given the option to join the Convention at any time. This is called acceding. Once a country sends its request for accession to the UN, the Convention comes into force in that country after a period of 90 days.

ADOPT

Once governments agree on the need to develop a convention on an issue, they develop the text which is then adopted.

AFFORESTATION

Artificial establishment of forest by planting or seeding in an area of non-forest land.

AGRICULTURAL LAND

Land including arable land, land under permanent crops and land under permanent meadows and pastures.

AGRICULTURAL POLLUTION

Liquid and solid wastes from all types of farming activities, including run-off from pesticide and fertilizer use, and from feedlots, erosion and dust from ploughing; animal manure and carcasses and crop residues.

AGRICULTURAL WASTE

Waste produced as a result of various agricultural operations. It includes manure and other wastes from farms, poultry houses and slaughter houses, harvest waste, fertilizer run-off from fields, pesticides that enter into water, air or soils and salt and silt drained from fields.

AIR POLLUTION

The presence of contaminant or pollutant substances in the air that do not disperse properly and that interferes with human health or welfare or produces other harmful environmental effects.

AIR POLLUTANT

Substances in the air that could, at high enough concentrations, harm human beings, animals, vegetation or material. Air pollutants may thus include forms of matter of almost any natural or artificial composition capable of being airborne. They may consist of solid particles, liquid droplets or gases or combinations of these forms.

AIR POLLUTION SOURCES

Activities that result in air pollution including agricultural activities, combustion processes, dust producing processes, manufacturing activities, nuclear energy related activities, spray painting, printing, dry cleaning and so on.

AIR POLLUTION RULES

Establishes a permitting system and air pollution emission standards for industrial processes.

ALKALINITY

Capacity of aqueous media to react with hydroxyl ions. Alkalinity is the factor representing the acid-neutralizing capacity of aqueous system.

ARTISANAL FISHERIES

Small-scale fisheries using relatively small amount of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, mainly for local consumption.

AQUIFER

Underground geologic formation or group of formations, containing groundwater that can supply wells and springs.

AQUACULTURE

The farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants. Farming implies some sort of intervention in the rearing process to enhance protection from production from predators and so forth. It also implies individual or corporate ownership of the stock being cultivated.

AUTOMOBILE AIR POLLUTION

Emissions from cars and other vehicular traffic consisting chiefly of carbon monoxide, nitrogen oxides, unburnt gasoline, carbon dioxide and lead.

B

BEVERAGE CONTAINER LEGISLATION

Proposes a deposit/refund system for beverage containers such as plastic soft-drink bottles. Allows for the establishment of recycling centres and voluntary industry stewardship programmes.

BIODEGRADABLE

Capable of decomposing rapidly under natural conditions.

BIODIVERSITY

The range of genetic differences, species differences and ecosystem differences in a given year.

BIOMASS

Total living weight (generally in dry weight) of all organisms in a particular area or habitat. It is sometimes expressed as weight per unit area of land or per unit volume of water.

BIOCHEMICAL OXYGEN DEMAND (BOD)

Dissolved oxygen required by organisms for the aerobic decomposition of organic matter present in water.

BOARD FOOT

A unit for measuring wood volume in a tree, logs, or board. A board foot is commonly 1 foot by 1 foot by 1 inch, but any shape containing 144 cubic inches of wood equals one board foot.

BRACKISH WATER

Water containing salts at a concentration significantly lower than that of sea water. The concentration of total dissolved salts in usually in the range of 1,000-10,000 milligrams per litre (mg/1).

BUILT-UP AND RELATED LAND

Land under houses, roads, mines, quarries or any other facilities, including auxiliary spaces, deliberately installed so that human activities may be pursued. Included are also certain types of open land (non-built-up land) that is closely connected with these activities such as the waste tips, derelict land in built-up area, junkyards and city parks and gardens. Land occupied by scattered farm buildings and annexes is excluded.

BUILDING CODES

Building Regulations concerning materials, structural design, construction practices, safety, building services, (lighting, ventilation, electricity, heating/air conditioning, escalators, plumbing, water supply, drainage and so forth) and specifications for appropriate administrative and technical control .

BYCATCH

Part of a catch of a fishing unit taken incidentally in addition to the target species towards which fishing effort is directed. Some or all of it may be returned to the sea as discards, usually dead or dying.

C

CALIPER

A tool to measure the diameter of a tree.

CANOPY

Branches and leaves of woody plants that are developed some distance above the ground.

CARBON DIOXIDE

A colourless, odourless and poisonous gas that results from fossil fuel combustion and is normally part of ambient air. It is also produced in the respiration of living organisms (plants and animals) and considered to be the main greenhouse gas, contributing to climate change.

CARBON MONOXIDE

Colourless, odourless and poisonous gas produced by incomplete fossil fuel combinations. Carbon monoxide combines with the haemoglobin of human beings, reducing its oxygen carrying capacity with effects harmful to human beings.

CARRYING CAPACITY

The maximum number of individuals of a wildlife species that an area can support during the most unfavorable time of the year.

CATCHMENT AREA

Area from which rainwater drains into river systems.

CEC DESIGNATED ACTIVITIES ORDER

Activities requiring a Certificate of Environmental Clearance (CEC)

CHROMIUM

Heavy metal used in the manufacture of alloys and electroplating. It is a multivalent element that in hexavalent form can be toxic in drinking water if concentration exceeds 50 milligrams per litre.

CLASS

The sub division of various tree species according to use in terms of value to priority.

CLIMATE

Condition of the atmosphere at a particular location (microclimate) or region over a long period of time. It is the long term summation of atmospheric elements – such as the solar radiation, temperature, humidity, precipitation type (frequency and amount), atmospheric pressure and wind (speed and direction) and their variations.

CLIMATE CHANGE

Term frequently used in reference to global warming due to greenhouse gas emissions from human activities.

COASTAL LAGOONS

Sea-bodies situated at the coast, but separated from the sea by and spits or similar land features. Coastal Lagoons are open to the sea in restricted spaces.

COASTAL PROTECTION

Steps required to prevent erosion of the coast. The stabilization of beaches or dunes is achieved by mechanical or vegetational means, or through erecting heavy sea overalls or revetments.

COST, INSURANCE AND FREIGHT (C.I.F)

A sales transaction in which the seller pays for the transportation and insurance of goods up to the port of destination specified by the buyer.

COAL

A readily combustible black or brownish-black rock whose composition, including inherent moisture, consists of more than 50 percent by weight and more than 70 per cent by volume of carbonaceous material. It is formed from plant remains that have compacted, hardened, chemically altered and metamorphosed by heat and pressure over geologic time.

COASTAL PROTECTION

Steps required to prevent erosion of the coast. The stabilization of beaches or dunes is achieved by mechanical or vegetational means or through erecting heavy sea walls or revetments.

COASTAL ZONE

Lands and waters adjacent to the coast that exert an influence on the uses of the sea and its coast that exert an influence on the uses of the sea and its ecology or inversely, whose uses and ecology are effected by the sea.

COLOURED LEDGER

Same as white ledger, except the paper is coloured.

COMBUSTION

Chemical oxidation accompanied by the generation of light and heat.

COMPOST

Mixture of organic garbage and degradable thrash with soil, in which bacteria in the soil break down the garbage and thrash into organic fertilizer.

COMPUTER PAPER

This refers to continuous paper usually solid white, or blue or green lined, used specifically for computer use.

CONSERVANCY

A sub division of the forestry division Trinidad is divided into six conservancy or sections.

CONSERVATION

Management of human use of organisms or ecosystems to ensure that such use is sustainable. (IUCN / WWF, 1991)

CONTAMINANT

Any physical, chemical, biological or radiologic substance or matter that has an adverse effect on air, water, land/soil or biota. The term is frequently used synonymously with *pollutant.*

CORD

A unit of wood cut for fuel that is equal to a stack 4 x 4 by 8 feet or 128 cubic feet. A cord is the legal measure of fuel wood volume in Maryland.

CROP ROTATION

Practice of growing different crops in succession on the same land.

CRUDE OIL

A mixture of hydrocarbons that exists in liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities.

CRUSTACEANS

A group of mainly marine invertebrates, including lobsters, crabs and shrimps with hard shells.

COMMITTEE OF THE WHOLE (COW)

At the opening plenary session of each COP, a committee is established and chaired by a Vice-President of the COP, and open to the participation of all Parties. This Committee of the Whole (COW) makes recommendations on draft decisions for adoption by the COP. Its Chairperson has the authority to delegate work to drafting groups.

CONVENTION

International Conventions are legal agreements among sovereign countries, addressing a particular issue.

CONFERENCE OF THE PARTIES (COP)

Comprising governments that have ratified the Convention, the Conference of the Parties is the supreme decision-making body of the Convention. The Parties are the only ones with voting rights during COP sessions.

COUNTERURBANIZATION

Movement of city dwellers to suburban areas resulting in the creation of new urban areas. This is a phenomenon usually observed in industrialized countries.

CUTTING CYCLE

The period of time between major harvests in a stand.

CURRENT TIP

This is the unloading or dumping area for waste delivered to the landfill.

CYCLONE

Any closed circulation in which the winds rotate counter-clockwise in the northern hemisphere or clockwise in the southern hemisphere. The term tropical cyclone refers to such a circulation, non-frontal in origin, which develops over tropical waters, between latitude 09^0 and 30^0.

D

DAM

An impounded body of water, used for the supply of drinking water, electricity generation, irrigation or animal husbandry. Watercourses serving as part of a reservoir system are included.

DEFORESTATION

Clearing of tree formations and their replacement by non-forest land uses.

DEGRADATION

Deterioration in environmental quality from ambient concentrations of pollutants and other activities and processes such as improper land and the use and natural disasters.

DEMERSAL

Living in close relation with the bottom and depending on it. Example: Groupers and lobsters are demersal resources.

DEPLETION (in natural resource accounting)

For renewable resources – the part of the harvest, logging, catch and so forth above the sustainable level of the resource stock; for non-renewable resources- the quantity of resources extracted.

DERELICT VEHICLE

A deserted or abandoned vehicle which is run-down and dilapidated and discarded by the owner.

DIRECT TRANSIT

Passengers remain on board before embarkation.

DISAGGREGATION

To become separated from a mass, breaking up into component parts.

DISCARDS

Fish or other living organisms released or returned to the sea, dead or alive, whether or not such organisms are brought fully on board a fishing vessel.

DISCHARGE

Release of substances (residuals of production and consumption) into water or soil.

DISSOLVED OXYGEN

Amount of gaseous oxygen actually present in water expresses in terms either of its presence in the volume of water (milligrams of oxygen per litre) or of its share in saturated water (percentage).

DISSOLVED SOLIDS

Disintegrated organic and inorganic material contained in water. Excessive amounts make water unsuitable for drinking or for the use in industrial process.

DISPOSAL OF WASTE

Waste elimination techniques comprising landfills, containment, underground disposal, dumping at sea and all other disposal methods.

DROUGHT

Prolonged absence or marked deficiency of precipitation which may contribute to desertification.

DUMPING

Waste disposal in an uncontrolled manner.

E

EARTHQUAKE

Sudden shaking or trembling of the earth caused by faulting or volcanic activity.

EARTHFILL STORAGE

Area used to store earthfill material which is used as cover material for waste.

ECOLOGY

Totality or pattern of relationships between organisms and their environment.

ECOLOGICAL BALANCE

Equilibrium between and harmonious coexistence of organisms and their environment.

ECOSYSTEM

A system in which the interaction between different organisms and their environment generates a cyclic interchange of materials and energy.

ECONOMIC INSTRUMENTS

Fiscal and other economic incentives and disincentives to incorporate environmental costs and benefits into the budgets if households and enterprises. The objective is to encourage environmentally sound and efficient production and consumption through full-cost pricing. Economic instruments include effluent taxes on changes on pollutants ad waste, deposit-refund systems and tradable pollution permits.

EFFLUENT

Liquid waste product (whether treated or untreated) discharged from an industrial process or human activity that is discharged into the environment.

EFFLUENT CHARGE

Fee or tax to be paid on discharges into the environment based on the quantity and or quality of discharged pollutants.

EFFLUENT STANDARDS

Maximum amount of pollutants permitted in effluents.

ELECTRICITY

A form of energy characterized by the presence and the motion of elementary charged particles generated by friction, induction or chemical change.

ELECTRICITY GENERATION

The process of producing electric energy or amount of electric energy produced by transforming other form of energy, commonly expressed in kilowatt-hours (kWh) or megawatts.

EMISSIONS

Discharge of pollutants into the atmosphere from stationary sources such as smokestacks, other vents, surface areas of commercial or industrial facilities and mobile sources, for example, motor vehicles, locomotives and aircraft.

EMISSION DAMAGE

Effects of air pollution on buildings, monuments, organisms and ecosystems.

ENDANGERED

A species is considered "Endangered" by IUCN when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future, as defined by any of the relevant IUCN criteria.

ENDANGERED SPECIES

Taxa in danger of extinction and whose survival is unlikely if causal factors continue operating. Included are taxa whose numbers have been drastically reduced to a critical level or whose habitants have been so drastically reduced to critical level or whose habitants have been so drastically impaired that they are deemed to be in immediate danger of extinction, in so far as they have definitely have not been seen in the wild in the past 50 years.

ENERGY

The capacity for doing work as measured by the capability of doing work (potential energy) or the conversion of this capability to motion (kinetic energy). Energy has several forms, some of which are easily convertible and can be changed to another form useful work. Most of the world's convertible energy comes from fossil fuels burned to produce

ENERGY BUDGET

Record of the flow of energy through a system.

ENERGY DEMAND

The requirement for energy as an input to provide products and/or services.

ENERGY CONSUMPTION

The use of energy as a source of heat or power or as a raw material input to a manufacturing process.

ENTER INTO FORCE

After a certain number of countries have ratified a convention, it comes into force, which means it becomes legally binding for those countries that have ratified it. For the UNCCD, this was 26th December, 1996; ninety days after the 50th country had ratified it.

ENVIRONMENT

The totality of all the external conditions affecting the life, development and survival of an organism.

ENVIRONMENT DEGRADATION

Deterioration in environmental quality from ambient concentrations of pollutants, and other activities and processes such as improper land use and natural disaster.

ENVIRONMENTAL EXPENDITURES

Capital and current expenditures related to characteristic activities and facilities specified in classifications.

ENVIRONMENTAL IMPACT

Direct effect of socio-economic activities and natural events on the components of the environment.

ENVIRONMENTAL PROTECTION

Any activity to maintain or restore the quality of environmental media through preventing the emission of pollutants or reducing the presence of polluting substances in environmental media. It may consist of (a) changes in characteristics of goods and services, (b) changes in consumption patterns (c) changes in production techniques, (d) treatment or disposal of residuals in separate environmental protection facilities, (e) recycling and (f) prevention of degradation of the landscape and ecosystems.

ENVIRONMENTALLY SENSITIVE AREAS (ESA) RULES

Provision will be made for the designation of National Parks and other protected areas in coordination with other relevant government entities.

ENVIRONMENTALLY SENSITIVE SPECIES RULES (ESS)

Protects endangered species and fulfills domestic legal obligations under several international treaties.

ENVIRONMENTAL FUNCTIONS

Environmental services, including spatial functions, waste disposal, natural resource supply and life support.

EMISSION STANDARD

Maximum amount of pollution discharge legally allowed from a single source, mobile or stationary

ENVIRONMENT IMPACT

Direct effect of socio-economic activities and natural events in the components of the environment.

ENVIRONMENT STATISTICS

Statistics that describe the state and trends of the environment, covering the media of the natural environment (air/climate, water, land/soil), the biota within the media, and human settlements. Environment statistics are integrative in nature, measuring human activities and natural events that affect the environment, the impacts of these activities and events, social responses to environmental impacts and quality and availability of natural assets – broad definition include environmental indicators, indices and accounting.

EROSION

The wearing away and transport of the soil by wind or running water, glaciers or waves. Erosion occurs naturally but it is often intensified by human land-clearing activities related to farming, residential or industrial development.

ESA REGULATIONS

Allows for ESA management plans, user fees and penalties for violat ions.

EXCLUSIVE ECONOMIC ZONE (EEZ)

Concept adopted at the Third United Nations Conference on the Law of the sea (1982), whereby a coastal state assumes jurisdiction over the exploration and exploitation of marine resources in its adjacent section of the continental shelf taken to be a band extending 200 miles from the shore.

EXPIRED SPECIAL DISPOSAL AREA

The area that is no longer used for the disposal of special waste.

EXHAUST GASES

Gases produced by burning of petrol (gasoline) in combustion engines. Exhaust gases are harmful to human beings, plants and animals.

EXTINCT SPECIES

Species not definitely located in the wild during the past 50 years.

F

FAECES

Waste matter discharged from the bowels.

FAECAL WASTE

Unstabalised sludges collected from septic tanks, cesspits and pit privies.

FAECAL COLIFORM BACTERIA

Micro-organism found in the intestinal tract of human beings and animals. Its presence in the water indicates faecal pollution and pollution and potentially dangerous bacterial contamination.

FAUNA

All animal life.

FALLOW AGRICULTURAL LAND

Arable land not under rotation that is set aside for a period of time ranging from one to five years before it is cultivated again, or land, usually under permanent crops, meadows or pastures that is not being used for such purposes for a period of at least one year. Arable land that is normally used for the cultivation of temporary crops, but temporarily based for grazing, is included.

FELLING

The cutting of standing trees.

FISH AGGREGATING DEVICE (FAD)

Artificial or natural floating objects placed on the ocean surface, often anchored to the bottom, to attract several schooling fish species underneath, thus increasing their catchability.

FISHERY

A unit that is engaged in raising and/or harvesting fish. Typically, the unit is defined in terms of some or all of the following: people involved species or type of fish, area of water or seabed, method of fishing, class of boats and purpose of the activities.

FISHERY MANAGEMENT

The integrated process of information gathering, analysis, planning, decision-making, allocation of resources and formulation and enforcement of fishery regulations by which the fishery management authority controls the present and future behaviour of interested parties in the fisheries, in order to ensure the continued productivity of the living resources.

FISHING EFFORT

The amount of fishing gear of a specific type used on the fishing grounds over a given unit of time e.g. hours trawled per day, number of hooks set per day or number of hauls of a beach seine per day.

FISHING MORTALITY

A mathematical expression which reflects all deaths in the stock that are due to fishing. Example: a rate that indicates the percentage of the population caught in a year.

FLAT

Flats are self-contained private dwelling units in a single or multi-storied building.

FLASH FLOOD

Flood of short duration with a relativity high peak discharge.

FLORA

All plant life.

FOREST

A biological community dominated by trees and other woody plants.

FORESTER

A degreed professional trained in forestry and forest management.

FORESTRY

The science of tending woodlands.

FOREST COVER

All the trees and other woody plants (underbrush) covering the ground in forest. It includes (a) trees and all shrubs (b) herbs and shrubs growing there under or in openings in the forest or brush fields (c) litter or fallen leaves, branches, fallen trees and other negative material on the forest floor and (d) the rich humus of partially decayed vegetable matter at the surface and top layer of the soil.

FOREST FUNCTIONS

(a) Environmental functions of forest or other wooded areas that include protection of soil against erosion, water flow control, air purification, wind shelter, noise abatement, preservation of habitats, protection of species of fauna and flora, preservation of wildlife forage grounds and other biological uses, (b) economic functions of the production of timber and other forestry products and recreational activities and (c) social functions for example, of an aesthetic or religious nature.

FOSSIL FUEL

An energy source formed in the Earth's crust from decayed organic material. The common fossil fuels are petroleum, coal and natural gas.

FREE ON BOARD (F.O.B)

A sales transaction in which the seller makes the product available for pick up at a specified price and the buyer pays for the subsequent transportation and insurance.

FRESHWATER

Naturally occurring water having a low concentration of salts. It is generally accepted as suitable for abstractions and treatment to produce potable water.

FUELWOOD

Wood and wood products used as fuel, including wood waste, black liquor, red liquor, spent sulfite liquor, pitch, wood sludge, peat, railroad ties and utility poles.

FULLY EXPLOITED

Term used to qualify a stock which is probably neither being overexploited nor underexploited and is producing, on average, close to its Maximum Sustainable Yield.

FUMES

Tiny particles trapped in vapour within a gas system.

G

GIRDLING

A method of killing trees by cutting through the stem, thus interrupting the flow of water and nutrients.

GLOBAL WARMING

Phenomena believed to occur as a result of the build up of carbon dioxide and other greenhouse gases. It has been identified by many scientists as a major global environmental threat.

GREENHOUSE EFFECT

Warming of the earth’s atmosphere caused by a build up of carbon dioxide and other greenhouse or trace gases that act like a pane of glass in a greenhouse, allowing sunlight to pass through and heat the earth but preventing a counterbalancing loss of heat radiation.

GREENHOUSE GASES

Carbon dioxide, nitrous oxide, methane, ozone and chloro-fluorocarbons occurring naturally and resulting form human (production and consumption) activities, and contributing to the greenhouse effect (global warming).

GROSS REGISTERED TONNAGE

A measure of a vessel´s size and capacity.

GROUNDWATER RESERVOIR

Reservoir under the earth’s surface that obtains its water through infiltration and percolation.

H

HABITAT

A place where an organism or population (human, animal, plant, micro organism) lives.

HARDWOODS

A general term encompassing broadleaf, deciduous trees.

HARVEST

The cutting, felling, and gathering of forest timber.

HARD WATER

Alkaline water containing dissolved salts that interfere with some industrial processes and prevents soap from lathering.

HAZARDOUS AIR POLLUTANTS

Air pollutants that may reasonably be expected to cause or contribute to irreversible illness or death. They include asbestos, beryllium, mercury, benzene, coke oven emissions, radionuclides and vinyl chloride.

HAZARDOUS SUBSTANCE

Any substance that poses a threat to human health and the environment. Hazardous substances are toxic, corrosive, ignitable, explosive or chemically reactive.

HAZARDOUS WASTE

Waste that, owing to their toxic, infectious, radioactive or flammable properties pose a substantial actual or potential hazard to the health of humans and other living organisms and the environment.

HAZARDOUS WASTE (SPECIAL)

Wastes requiring specialized handling and disposal to render them safe.

HEAVY METALS

Potentially toxic metals used in industrial processes, for example, arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc. They may damage plant and animal life at low concentrations and tend to accumulate in the food chain.

HERBICIDE

Substances used to control weeds on the growth of undesirable grass or plants.

HUMAN SETTLEMENT

Integrative concept that comprises (a) physical components or shelter and infrastructure and (b) services to which the physical elements provide support, that is to say, community services such as education, health, culture, welfare, recreation and nutrition.

HYDROCARBONS

Compounds of hydrogen and carbon in various combinations that are present in petroleum products and the natural gas. Some hydrocarbons are major air pollutants, some may be carcinogenic and others contribute to photochemical smog.

HYDROLOGY

(1) Science that deals with the waters above and below the land surfaces of the earth, their occurrence, circulation and distribution, both in time and in space, their biological, chemical and physical properties and their interaction with the environment including their relation to living beings and (2) Science that deals with the process governing depletion and replenishment of water resources of the land areas of the earth including the various phases of the hydrolic cycle.

I

INDUSTRIAL WASTES

Liquid, solid and gaseous wastes originating from the manufacture of specific products.

INFILTRATION

Flow of water through the soil surface into a porous medium.

INFORMAL SETTLEMENTS

(1) Areas where groups of housing units have been constructed on land that the occupants have no legal claim to or occupy legally. (2) Unplanned settlements and areas where housing is not in compliance with current planning and building regulations (unauthorized housing)

INTEGRATED FARMING

Semi-intensive aquaculture systems in synergy with agriculture (including animal husbandry).

INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS (ICCAT)

This organization oversees management of fisheries for tuna and tuna-like species in the Atlantic and Mediterranean (Source: FAO website and Fisheries Division).

INTENSIVE-AQUACULTURE

System of culture characterized by (i) a production of up to 200 tonnes/ha/yr; (ii) a high degree of control; (iii) high initial costs, high-level technology, and high production efficiency; (iv) tendency towards increased independence of local climate and water quality; (v) use of man-made culture systems.

INTENSITY

A measure of the shaking and damage caused by the earthquake and this value changes from location to location.

INTRANSIT

Passengers have up to 48 hours to depart from Piarco International Airport on their connecting flights.

INTRANSIT TOTAL

Sum of both direct transit and intransit.

IRRIGATION

Artificial application of water to land to assist in the growing of crops and pastures. It is carried out by spraying water under pressure (spray irrigation) or by pumping water onto the land (flood irrigation).

L

LABOUR FORCE

The total population of persons 15 years old and over from private households engaged in or willing and able to be engaged in the production of economic goods and services.

LAND COVER
All trees, shrubs, herbs deciduous plants and so forth that cover an area.

LANDSLIDE
Downward mass movement of earth or rock on unstable slopes**.**

LAND CLASSIFICATION
Land categories, reflecting quality classes, capability classes or grade, depending upon the characteristics of the land and/ or its potential for agricultural use.

LAND DEGRADATION
Reduction or loss of the biological or economic productivity and complexity of rain-fed cropland, irrigated cropland or range, pasture, forest or woodlands resulting from natural processes, land use or other human activities and habitation patterns such as land contamination, soil erosion, and the destruction of the vegetation cover.

LANDFILL
Final placement of the waste in or on the land in a controlled or uncontrolled way according to different sanitary, environmental protection and other safety requirements.

LAND TENURE
Right to the exclusive occupancy and use of a specified area of land.

LAND USE
Use of land for more than one purpose, for example, grazing of livestock, recreation and timber production. The term may also apply to the use of associated bodies of water for the recreational purposes fishing and water supply.

LEACHATE PONDS
Leachate is liquid that has percolated through solid waste mixed with rainwater and has extracted dissolved and suspended materials. Leachate formed is pumped into a holding pond where it is broken down through oxidation.

LEAD

Heavy metal whose compounds are highly poisonous to health. Its use in gasoline, paints and plumbing compounds has been generally reduced.

LIFE EXPECTANCY (at birth)

The number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same through its life.

LIQUIFIED NATURAL GAS (LNG)

Natural gas (primarily) methane) that has been liquefied by reducing its temperature to minus 260 degrees Fahrenheit at atmospheric pressure. (The volume of the LNG is 1/600 that of the gas in its vapour state.)

LOADED

Having a load.

LOGGER

An individual who harvests timber as a profession.

LOGGING

Process of harvesting trees, sawing them into appropriate lengths and transporting them to a saw mill.

M

MAGNITUDE

This is the most common measure of an earthquake's size. It is a measure of the size of the earthquake source and is the same number no matter where you are or what the shaking feels like.

MAJOR HURRICANE

A term utilized by the National Hurricane Centre for hurricanes that reach maximum sustained 1-minute surface winds of at least 50 m/s (96 kt, 111 mph). This is the equivalent of category 3, 4 and 5 on the Saffir-Simpson scale.

MANURE

Organic material used to fertilize land, usually consisting of barnyard and stable refuse (livestock excretion), with or without accompanying litter such as straw hay or bedding.

MARGINAL LAND

Land of poor quality with regard to agriculture use and unsuitable for housing or otherwise.

MARINE POLLUTION

Direct or indirect introduction by humans of substances or energy into the marine environment (including estuaries) resulting in harm to living resources, hazards to human health, hindrances to marine activities, including fishing, impairment of the quality of sea water and reduction of amenities.

MARKING TIMBER

Indicating by paint or other means which trees are to be cut or otherwise treated. It is advisable to mark trees to be harvested twice-once at eye level and once on the stump.

MERCURY

Heavy metal that can accumulate in the environment is highly toxic if breathed or swallowed.

MIXED

A mixture of various grades of recyclable waste paper not limited by fibre content and includes most types of clean and dry paper including glossy paper, magazines, windowed envelopes and sticky note pads.

MIXED CROPPING

System of sowing two or three crops together on the same land, one being the main crop and the others the subsidiaries.

MIXED FARM

Farm on which both crop production and livestock-keeping are practiced simultaneously.

MONOCULTURE

Repeated cultivation of a single crop on a given area of land.

MUNICIPAL WASTE

Waste produced by residential, commercial and public service sectors that are collected by local authorities for treatment and/or disposed in a central location.

N

NATURAL DISASTER

Sudden calamitous event as in the case of the earthquakes, tsunamis, floods, volcanic eruptions, cyclones and landslides or ongoing misfortune as in conditions or processes such as drought and desertification.

NATIONAL PARK

Large natural areas not materially altered by human activity where extractive resource uses are not allowed and whose purpose is to protect nature and scenic areas of national and international significance for scientific, educational and recreational use.

NATURAL RESOURCES

Natural assets (raw materials) occurring in nature that can be used for economic production or consumption.

NATURAL SELECTION

Natural process by which organisms that adapt to their environment survive while those that do not adapt become eliminated progressively.

NET PRICE

Valuation used in environmental accounting to estimate the economic value of a natural resource and its depletion. It is defined as the actual market price of a natural resource output minus all marginal exploitation costs including a normal return to capital.

NEW AND RENEWABLE ENERGY SOURCES

Energy sources including solar energy, geothermal energy, wind power, hydropower, ocean energy (thermal gradient, wave power and tidal power) biomass draught animal power, fuelwood, peat, oil shale and tar sands.

NICHE

Appropriate combination of conditions for the survival of a given species.

NITRATE

Nitrogen-containing compound that can exist in the atmosphere or as a dissolved gas in water. It may produce harmful effects on humans and animals.

NONGAME WILDLIFE

Wildlife species that are protected by state wildlife laws and can not be hunted. Examples include songbirds, eagles, etc.

NOISE

Audible sound from traffic, construction and so on that may generate unpleasant and harmful effects (hearing loss). It is measured in decibels.

NOISE POLLUTION

Sound at excessive levels that may be detrimental to human health.

NOISE POLLUTION RULES

Establishes ambient noise pollution standards and a National Noise Abatement Advisory Panel.

NOISE ZONING

Classification of areas according to the intensity of the noise levels that are acceptable for particular activities.

NON-RENEWABLE NATURAL RESOURCES

Exhaustible natural resources such as the mineral resources that cannot be regenerated after exploitation.

NON- SCHEDULED FLIGHTS

Operate on a seasonal basis and vary during the year e.g. Chartered or Cargo flights.

O

OBSERVERS
Although conventions are legal agreements among sovereign countries, the UNCCD makes special provisions for national and international agencies and NGOs to attend the meetings of the COP as Observers.

OCEAN DUMPING
Deliberate disposal of hazardous wastes at sea from vessels, aircraft, platforms or other human-made structures. It includes ocean incineration and disposal of waste into the seabed and sub seabed.

OCCUPATIONAL HEALTH HAZARDS
Hazards of exposure to pollution, noise and vibrations in the working environment. Exposure limits are produced by the International Labour Organization (ILO).

OIL DARK
Odorous, coloured, dense liquid that is a water pollutant and also an air pollutant when burnt.

OIL SPILL
Oil discharged accidentally or intentionally that floats on the surface of water bodies as a discrete mass and is carried by the wind, currents and tides. Oil spills can be the partially controlled by chemical dispersion, combustion mechanical contaminant and absorption. They have destructive effects on coastal ecosystems.

OPEN ACCESS
A condition of a fishery in which anyone who wishes to fish may do so.

OPEN DUMP
Uncovered site used for disposal of waste without environmental controls.

OPEN LAND
Non- built-up land with no or with significant, vegetation cover.

ORGANIC FARMING

Farming system that avoids the use of artificial fertilizers, pesticides or herbicides and uses organic manures and organic methods of crop rotation.

ORGANIC FERTILISERS

Fertilisers derived from animal products and plant residues containing sufficient nitrogen.

OUTTURN

This is the product of the plantation after harvesting or sawmilling.

OVERGRAZING

Grazing by livestock or wildlife to the pint where the grass cover is depleted, leaving bare, unprotected patches of soil. As a result, water and wind cause erosion, especially on clay soils and the growth of poisonous plants and thorny shrubs may increase.

OVERPOPULATION

Exceeding of certain threshold limits of population density when environmental resources fail to meet the requirements of individual organisms regarding shelter, nutrition and so forth. It gives rise to high rates of mortality and morbidity.

OVERSTOCKED

The situation in which trees are so closely spaced that they compete for resources and do not reach full growth potential.

OVERSTORY

The level of forest canopy that includes the crowns of dominant, co dominant and intermediate trees.

OVER-CAPITALIZED

Economic over fishing. A condition which occurs when a fishery is generating no economic rent, primarily because an excessive level of fishing effort is applied in the fishery.

OVERFISHED OR OVEREXPLOITED

A stock is considered “overfished” when exploited beyond an explicit limit beyond which its abundance is considered "too low" to ensure safe reproduction.

OVERFISHING

In general, action of exerting a fishing pressure (fishing intensity) beyond agreed optimum level. A reduction of fishing pressure would, in the medium term, lead to an increase in the total catch.

OVERPOPULATION

Exceeding of certain threshold limits of population density when environmental resources fail to meet the requirements of individual organisms regarding shelter, nutrition and so forth. It gives rise to high rates of mortality and morbidity.

OZONE DEPLETION

Destruction of ozone in the stratosphere, where it shields the earth from harmful ultraviolet radiation. Its destruction is caused by chemical reactions in which oxides of hydrogen, nitrogen, chlorine and bromine act as catalysts.

P

PARTIES

The Parties to a Convention are sovereign States. In addition, some Conventions allows recognition of regional integration bodies, such as the European Union, to become Parties to the Convention, although their rights are limited, in that they cannot vote independently of their member countries.

PATHOGEN

Micro-organism that can cause disease in other organisms. It may be present in the sewage, run-off from animal farms, swimming pools, contaminated shellfish and so forth.

PELAGIC FISH

Fish that spend most of their life swimming in the water column with little contact with or dependency on the bottom.

PER CAPITA GDP AND PER CAPITA GNI

These are obtained by dividing the value of the respective variable by the mid year population estimates for the reference year.

PERSONS WITH JOBS

All persons who worked for pay for any length of time during the survey week. The definition includes persons who were temporarily absent from work due to vacation, illness etc. Also included are unpaid family members in family businesses.

PEST

Species viruses, bacteria and other micro-organisms considered harmful to the health of human beings, crops and other living organisms.

PESTICIDES

Any substance or mixture of substances that is used to prevent, destroy or control pests- including vectors of human on animal disease and unwanted species of plants or animals. Pesticides may cause harm during or otherwise interfere with the production, processing, storage, transportation, marketing of food, agricultural commodities, wood and wood products or animal feedstuffs or that may be administered to animals so as to control insects, arachnids or other pests in or on their bodies.

PHOSPHORUS

Element that, while being essential to the life as a key nutrient factor, nevertheless, contributes to the eutrophication of lakes and other bodies of water.

PLANTATION

A stand or coupe, the same species planted for commercial purposes.

POLLUTION

(1) Presence of substances and heat in environmental media (air, water, land) whose nature, location or quantity produces undesirable environmental effects, (2) activity that generates pollutants.

POLLUTION OF POVERTY

Environmental problems that result from the lack of development rather than from the development process itself. These problems include poor water quality, inadequate housing and sanitation, malnutrition and disease.

POPULATION DENSITY

Total number of inhabitants per square unit of surface area.

PRECAUTIONARY APPROACH

Set of measures taken to implement the Precautionary principle. A set of agreed cost-effective measures and actions, including future courses of action, which ensures prudent foresight, reduces or avoids risk to the resource, the environment, and the people, to the extent possible, taking explicitly into account existing uncertainties and the potential consequences of being wrong.

PRIMARY ENERGY CONSUMPTION

Direct use at the source or supply to users without transformation of crude energy that is energy that has been subjected to any conversion or transformation process.

PROTECTED AREA

Legally established land or water area under either public or private ownership that is regulated and managed to achieve specific conservation objectives.

PROTOCOL

An amendment or addition to a convention is called a protocol. Protocols usually embody commitments to execute national and sub-regional action programmes within a fixed time frame.

PROTECTION OF SPECIES AND HABITATS

Environmental Protection activity comprising the conservation of threatened species in flora and fauna and the protection of ecosystems/habitats that are essential to the well being of significant species of flora and fauna.

PRUNING

The act of sawing or cutting branches from a living tree. In forest management, pruning is done to promote the growth of clear, valuable wood on the tree bole.

Q

QUALITY OF LIFE

Notion of human welfare (well-being) measured by social indicators rather than by ‘quantitative’ measures of income and production.

R

RAINFOREST

Luxuriant forest, generally composed of tall, broad-leaved evergreen trees, found in regions where annual rainfall exceeds 1, 800 millimeters.

RATIFY

Before a Convention can become legally binding at the national level, countries that have signed it must present it to their parliaments or legislative bodies for ratification. Ratification means that the convention is officially accepted, and is consistent with the country’s national laws. The instruments of ratification are then presented to the United Nations.

RATIFICATION

The ratification of international treaties follows the same rules as the passing of laws in most democracies. An important exception is the United States, where treaty ratification requires a two-thirds majority in the U.S. Senate (and the United States House of Representatives does not vote on it at all). This makes it considerably more difficult in the US than in other democracies to rally enough political support for international treaties. Note: Signing is optional, indicating intention to ratify. Ratification is the key step for a country to formally accept an international treaty.

RECYCLE

Processing and use of wastes in production and consumption processes, for example, melting of scrap iron so that it can be converted into new iron products.

REFORESTATION

Artificial or natural re-establishment of forest that was in an area that was previously under forest cover.

REGENERATION CUT

A timber harvest designed to promote natural establishment of trees.

RESERVOIR

Place where water is collected and stored in large quantities for use when required.

RETREADED

Tyres where the treading has been replaced. To put a new tread on (a worn pneumatic tire casing) either by recapping or by cutting fresh treads in the smooth surface.

ROLL ON/ ROLL OFF

Vehicles imported into Trinidad and Tobago in a fully assembled state.

ROTATION

The number of years required to grow a stand to a desired size or maturity.

ROYALTY

The monies paid or charged by the government are referred to as such.

S

SAFFIR-SIMPSON HURRICANE INTENSITY SCALE

An index for the Atlantic and Northeast Pacific basins to give an estimate of the potential flooding and damage to property given a hurricane's estimated intensity:

SALINITY

Salt content of environmental media.

SANITATION

Improvement of environmental conditions in households that affect human health by means of drainage and disposal of sewage and refuse.

SANITARY SEWAGE

Domestic Wastes from bath rooms, kitchen and so on.

SAPLING

A tree at least 4 1/2 feet tall and up to 4 inches in diameter.

SAWLOG

A log large enough to be sawed economically on a sawmill. Sawlogs are usually at least 8 inches in diameter at the small end.

SAWMILLER

A person who owns a sawmill that is capable of converting round logs into boards.

SAWTIMBER

Trees from which sawlogs can be made.

SCHEDULED FLIGHTS

Operate on a constant basis, they run throughout the year and are always in the system.

SEWERAGE

Organic waste and waste- water produced by residential and commercial establishments.

SIGNATORIES

Once a convention has been adopted, the normal practice is to open it for signatures from States for a specified period of time. For instance in the case of the UNCCD, this was for one year between October 1994 and 1995. Countries then append their signatures to the Convention, which is done at the United Nations Headquarters in New York; making them signatories to the Convention.

SILVICULTURE

Management of forest land for timber.

SKIDDER

A rubber-tired machine with a cable winch or grapple used to drag logs out of the forest.

SKIDDING

The act of moving trees from the site of felling to a leading area or landing. Tractors, horses, or specialized logging equipment can be used for skidding. Skidding methods vary in their impact on soils and the remaining stands.

SLASH AND BURN AGRICULTURE

Method of cultivation whereby areas of the forest are burnt and cleared for planting. When soil fertility declines, cultivation shifts to a new plot.

SLUMS

Areas of older housing that are deteriorating in the sense of being underdeveloped, overcrowded and dilapidated.

SOIL

Loose and unconsolidated outer layer of the earth's crust, made up of small particles or different sizes.

SOIL EROSION

Wearing away and transport of the soil by wind or running water, glaciers or waves. Erosion occurs naturally but is often intensified by human land clearing activities related to farming, residential or industrial development.

SOLID WASTE MANAGEMENT

Supervised handling of waste material from generation at the source through the recovery process to disposal.

SOLID WASTE

Those with insufficient liquid content to be free flowing. It refers to the useless, unwanted, or discarded materials resulting from society's normal activities.

SPECIAL WASTE

Categories of waste not normally accepted at the landfills for disposal without the prior approval of SWMCOL.

SPECIES

All the individuals and populations of a particular kind of organism, maintained by biological mechanisms that result in their breeding only with their own kind.

SQUATTER SETTLEMENTS

Areas of Housing Units that have been constructed or erected on land to which the occupants do not have a legal claim.

STAND

A group of forest trees of sufficiently uniform species composition, age, and condition to be considered a homogeneous unit for management purposes.

STAND DENSITY

The quantity of trees per unit area, usually evaluated in terms of basal area, crown cover and stocking.

STOCK

A group of individuals in a species occupying a well defined spatial range independent of other stocks of the same species. Such a group can be regarded as an entity for management or assessment purposes.

STOCK ASSESSMENT

The process of collecting and analysing biological and statistical information to determine the changes in the abundance of fishery stocks in response to fishing, and, to the extent possible, to predict future trends of stock abundance.

STOCKING

The number and density of trees in a forest stand. Stands are often classified as understocked, well-stocked or overstocked.

STRATIFICATION

Division of a forest, or any ecosystem, into separate layers of vegetation that provide distinct niches for wildlife. See canopy and understory.

SUBDUCTED

A geological process in which one edge of one crustal plate is forced below the edge of another.

SUBDUCTION ZONE

The zone of convergence of two tectonic plates.

SURFACE WATER

All water naturally opens to the atmosphere, including rivers, lakes, reservoirs, streams, impoundments, seas, estuaries and so on. The term also covers springs, wells or other collectors of water that are directly influenced by surface waters.

SUSTAINABLE CATCH (YEILD)

The number (weight) of fish in a stock that can be taken by fishing without reducing the stock biomass from year to year, assuming that environmental conditions remain the same.

SUSTAINABLE FISHING

Fishing is sustainable when it can be conducted over the long-term at an acceptable level of biological and economic productivity without leading to ecological changes that foreclose options for future generations.

SWAMP

Type of wetland with water standing permanently or for a considerable period of time and with a dense cover of native vegetation. Swamps may be freshwater or saltwater and tidal or non-tidal.

SWARM

A number of earthquakes of similar magnitude occurring closely within a given period or place.

T

TANTEAK

Government company established to harvest and process lumber from the plantations.

THREATENED SPECIES

A species or subspecies whose population is so small or is declining so rapidly that it may become endangered in all or a significant portion of its range.

TOTAL ALLOWABLE CATCH (TAC)

The TAC is the total catch allowed to be taken from a resource in a specified period (usually a year), as defined in the management plan. The TAC may be allocated to the stakeholders in the form of quotas as specific quantities or proportions.

TROPICAL CYCLONE

A non-frontal synoptic scale low-pressure system over tropical or sub-tropical waters with organized convection (i.e. thunderstorm activity) and a definite cyclonic surface wind circulation.

TROPICAL DEPRESSION

A tropical cyclone in which the maximum sustained wind speed (using the U.S. 1 minute average standard) is 33 kt (38 mph, 18 m/s) or less. Depressions have a closed circulation.

TROPICAL DISTURBANCE

A discrete tropical weather system of apparently organized convection - generally 200 km to 600 km (100 to 300 nmi) in diameter - originating in the tropics or subtropics, having a non-frontal migratory character, and maintaining its identity for 24 hours or more.

TROPICAL STORM

A tropical cyclone in which the maximum sustained surface wind speed (using the U.S. 1 minute average standard) ranges from 34 kt (39 mph, 19 m/s) to 63 kt (73 mph, 34 m/s).

TURTLE EXCLUDER DEVICE (TED)

A grid-like device inserted into the trawl net, before the cod-end, designed with an escape panel to allow turtles to exit the net on hitting the grid, while the catch passes through the grid and is captured in the cod-end (Source: Fisheries Division).

U

URBANIZATION

(1) Increase in the proportion of a population living in urban areas, (2) Process by which a large number of people become permanently concentrated in relatively small areas forming cities.

URBAN RUN-OFF

Storm water from city streets and adjacent domestic or commercial properties that contains litter and organic and bacterial wastes.

UNDERSTOCKED

A stand of trees so widely spaced, that even with full growth potential realized, crown closure will not occur.

UNDERSTORY

The level of forest vegetation beneath the canopy.

UNIT SALE

A timber sale in which the buyer makes regular (weekly, monthly) payments based on mill receipts. Unit sales are useful when the amount of timber sold is so large that a preharvest, lump-sum payment would be prohibitive.

UNLOADED

Not having a load.

V

VIRGIN FOREST
An area of old-growth trees that never has been harvested by humans.

VULNERABLE
A species is considered "Vulnerable" when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future, as defined by any of the relevant IUCN criteria.

W

WASTE
Materials that are not prime products (that is products produced for the market) for which the generator has no further use in terms of his/her own purposes of production, transformation or consumption and of which he/she wants to dispose wastes may be generated during the extraction of raw materials into intermediate and final products, the consumption of final products and other human activities. Residuals recycled or reused at the place of generation are excluded.

WASTE WATER
Used waster, typically discharged into the sewage system. It contains matter and bacteria in solution or suspension.

WASTEWATER TREATMENT
Process to render waste water fit to meet environmental standards or other quality norms. Three broad types of treatment may be distinguished: mechanical, biological and advanced.

WASTE HANDLING, PERMITS AND LISCENCES RULES
Establishes a Permit and Licensing system for solid and hazardous waste handling, recycling and disposal.

WATER POLLUTION

Presence in water of harmful and objectionable material obtained from sewers, industrial wastes and rainwater run-off in sufficient concentrations to make it unfit for use.

WATER POLLUTION RULES

All industry putting water pollutants into the environment from a point source will be required to register with the EMA. Those exceeding specified water pollutant effluent standards will require a permit.

WATER QUALITY

Physical, chemical, biological and organoleptic (taste-related) properties of water.

WATERSHED

Land area that drains into a stream. Area from which all precipitation flows into a single stream or set of streams.

WATER SUPPLY SYSTEM

System for the conversion, transmission, treatment, storage and the distribution of water from source to consumers, for example, homes, commercial establishments, industry, irrigation facilities and public agencies for water-related activities (fire fighting, street flushing and so forth).

WETLAND

Area of low-lying where the water table is at or near the surface most of the time. Wetlands include swamps, bogs, fens marshes and estuaries.

APPENDIX

EFFLUENT SAMPLE OF OIL AND GAS FOR THE PERIOD JANUARY TO DECEMBER 1995 - 1999

Company	YEARS	Months											
		January	February	March	April	May	June	July	August	September	October	November	December
A.T.O.C Pt.Galeota Oily Water Pond	1995	92	-	-	17	217	-	421	No Sample	-	-	53	-
	1996	-	-	40	-	28	240	-	-	46	554	blank	blank
	1997	blank	23	blank	-	-	-	-	blank	37	blank	-	48
	1998	blank	97	blank	134	48	5	115	25	13	98	blank	21
	1999	7	63	10	-	7	blank	blank	24	8	15	<4	blank

4 LAND USE

APPENDIX 4.1 LISTING OF ARCHAEOLOGICAL SITES IN TOBAGO BY PARISHES

Parish	Name of Site	Character of Site
St. Patrick	1.Sandy Point	Midden / Burial
	2.Crown Point	Pottery Deposit (cave)
	3.Milford 1	Midden
	4.Milford 2	Midden
	5.Swallows	Individual Find
	6.Pigeon Point	Pottery Deposit
	7.Bon Accord 1	Individual Find
	8.Bon Accord 2	Individual Find
	9.Canaan	Individual Find
	10.Tyson Hall	Individual Find
	11.Kilgwyn	Pottery Deposit
	12.Sheerbirds Point	Pottery Deposit/ Burial
	13.Golden Grove	Midden
	14.Buccoo	Pottery Deposit
	15.Friendship	Midden
	16.Lowlands	Individual Find
	17.Mount Irvine 1	Midden
	18.Mount Irvine 2	Midden / Burial
	19.Mount Irvine 3	Pottery Deposit / Burial
	20.Mount Irvine 4	Midden
	21.Mount Irvine 5	Pottery Deposit
	22.Rocky Point	Midden
	23.Great Courland Bay	Pottery Deposit
	24.Turtle Beach 1	Pottery Deposit
	25.Tutle Beach 2	Pottery Deposit
	26.Black Rock	Individual Find
St. Andrew	1.Diamond	Individual Find
	2.Signal Hill	Individual Find
	3.Patience Hill	Individual Find
	4.Spring Gardens	Individual Find
	5.Burleigh Castle	Individual Find
	6.Fort	Pottery Deposit
	7.Rockly Vale	Individual Find
	8.Scarborough	Pottery Deposit
	9.Rockly Bay	Pottery Deposit
St. George	1.Minster Bay	Pottery Deposit
	2.Adelphi	Individual Find

	3.Mason Hall	Individual Find
	4.Belmont	Individual Find
	5.Hillsborough Bay	Pottery Deposit
St. Mary	1.Granby Point	Pottery Deposit
	2.Goodwood	Individual Find
	3.Goldsborough	Pottery Deposit
	4.Pembroke	Individual Find
	5.The Lure	Individual Find
St. Paul	1.Richmond Bay	Pottery Deposit
	2.Belle Garden	Pottery Deposit
	3.Queen's Bay	Pottery Deposit
	4.Indian Point	Pottery Deposit
	5.King's Bay	Pottery Deposit
	6.Merchiston	Pottery Deposit
	7.Lucy Vale Bay	Pottery Deposit
St. John	1.Trois Rivieres	Individual Find
	2.Speyside 1	Pottery Deposit
	3.Speyside 2	Pottery Deposit
	4.Charlotteville 2	Pottery Deposit
	5.Little Tobago	Pottery Deposit
	6.Charlotteville 1	Individual Find
	7.Cambleton	Pottery Deposit
	8.Anse Formi	Pottery Deposit
	9.Bloody Bay	Individual Find
	10.Parlatuvier Bay	Pottery Deposit
St. David	1.King Peter's Bay	Pottery Deposit
	2.Moriah	Individual Find
	3.Little Bay	Pottery Deposit
	4.Culloden Bay	Midden
	5.Arnos Vale Bay	Pottery Deposit / Burial
	6.Lover's Retreat	Midden / Burial
	7.Plymouth	Pottery Deposit
St. George	1.Caledonia	Individual Find

Source: Report on the 1987 Archaeological-Historical Survey of Tobago; Arie Boomert

LISTING OF ARCHAEOLOGICAL SITES IN TRINIDAD BY COUNTIES

County	Name of Site	Character of Site
St. George	1.Perruquier Bay, Chacachacare	Individual Find
	2.Chaguaramas	
	3.Bayshore	Individual Find
	4.Mucurapo	Individual Find
	5.Laventille	Midden
	6.St. Joseph	Individual Find
	7.Morne Coco	Individual Find
	8.Blanchisseuse	Pottery Deposit
	9.Caurita	Petroglyph[23]
	10.Tacarib	Pottery Deposit
	11.Maracas	Individual Find
	12.San Juan	Midden
	13.Arima	Pottery Deposit
	14.Tacarigua	Pottery Deposit
	15.St Joseph 1	Midden
	16.St Joseph 2	Midden/ Burial
	17.Arena Road	Pottery Deposit
	18.Gonzales	Individual Find
	19.Morne Poui Bay	Individual Find
	20.Diego Martin	Individual Find
	21.St. James	Individual Find
	22.Port of Spain	Individual Find
	23.River Estate	Individual Find
	24.Cambural	Pottery Deposit
	25.Morne Jean	Individual Find
	26.Cocorite	Individual Find
	27.Talparo	Individual Find
	28.St Joseph	Individual Find
	29.Wallerfield	Individual Find
	30.Damier River	Individual Find
	31.Sanders Bay, Chacachacare	Midden
	32.Mucurapo	Individual Find
	33.Mucurapo	Individual Find
St. David	1.Sans Souci	Pottery Deposit
	2.Toco-Mission	Individual Find
	3.Cumana Bay	Individual Find
	4.Salybia	Individual Find
	5.Tompire River	Individual Find
	6.Toco-Mission	Individual Find
St. Andrew	1.Manzanilla	Midden/Burial
	2.North Manzanilla	Midden
	3.Manzanilla	Individual Find

	4.North Manzanilla	Midden
	5.Matura Bay	Midden
	6.Plum Mitan	Midden
	7.Brigand Hill	Midden
Nariva	1.Cocal 1	Midden
	2.Bush Bush Trace	Midden
	3.Cocal 2	Individual Find
	4.Ortoire	Midden
	5.Kernahan Trace	Midden
	6.Siewdath Trace	Midden
	7.Chip Chip Hill	Midden
	8.Last Location	Midden
Caroni	1.Blue River	Midden
	2.Savenetta 1	Flint Deposit[24]
	3.Basterhall Reservoir	Individual Find
	4.Savenetta 2	Midden
	5.Belle Vue	Individual Find
	6.San Pedro	Midden/Burial
	7.Perseverance	Midden
	8.Forres Park	Individual Find
	9.Dow	Individual Find
	10.Arena Reservoir	Individual Find
	11.Tortuga	Midden
	12.Mamoral	Individual Find
Mayaro	1.Point Radix 1	Midden/Burial
	2.Point Radix 2	Midden
	3.Lagon Doux	Midden
	4.St. Bernard	Midden
	5.Resthouse	Midden
	6.Beause jour	Midden
	7.St. Ann's 1	Midden
	8.Beggorat	Midden
	9.Britannia	Midden
	10.Cedar Grove 1	Midden
	11.Cedar Grove 2	Midden
	12.Benitier	Midden
	13.La Brea River	Individual Find
	14.Tavia River	Individual Find
	15.Iguana River	Individual Find
	16.Guayaguayare	Midden/Burial
	17.St Catherine's	Midden/Burial
	18.Gros Morne	Individual Find
	19.St. Ann's 2	Midden
	20.Bon Espoire	Midden

Victoria	1.Tableland	Pottery Deposit
	2.Marac 1	Midden/Burial
	3.Marac 2	Burial
	4.Ganbat Trace	Individual Find
	5.Rock River Trace	Individual Find
	6.Princes Town1	Midden
	7.La Lune 1	Midden
	8.La Lune 2	Individual Find
	9.Moruga	Midden
	10.Mount Stewart 1	Individual Find
	11.Mount Stewart 2	Individual Find
	12.Princes Town 2	Individual Find
	13.Bontour	Midden
	14.San Fernando-Harris Promenade/High Street	Midden
	15.San Fernando-Carib Street.	Midden/Burial
	16.Tarouba Hill	Midden
	17.Mayo	Midden
	18.Marabella	Midden
	19.Trinidad Hill	Midden
	20.Picton-Golconda	Midden
	21.Pointe-a-Pierre	Individual Find
	22.Pointe-a-Pierre	Individual Find
Victoria	23.Cipero River	Individual Find
	24.Gasparillo	Individual Find
	25.Mount Moriah	Midden
	26.Lengua	Individual Find
	27.Monkey Town	Individual Find
	28.Whitelands	Pottery Deposit
	29.Poonah Road	Midden
	30.Atagual	Midden Burial
	31.Jadoo Hill	Pottery Deposit
	32.Usine St Madeline	Individual Find
	33.Union	Midden
	34.Ben Lomand	Midden
	35.Brothers	Individual Find
	36.Craignish	Individual Find
	37.Lewis Road	Individual Find
	38.Mendoza-La Gloria	Individual Find
	39.Woodlands 2	Midden
	38.Woodlands 5	Individual Find
	39.Cedar Hill	Midden
	40.Cipero Road	Individual Find
	41.Tarouba 1	Individual Find
	42.Tarouba 2	Individual Find
	43.Tarouba 3	Individual Find
	44.Palmiste	Midden
	45.Petit Morne	Midden
	46.Duncan	Individual Find

Victoria	47.Esperance 2	Individual Find
	48.Woodlands 1	Individual Find
	49.Woodlands 3	Individual Find
	50.Woodlands 4	Individual Find
	51.Carib Valley	Midden
	52.Cipero Road 2	Individual Find
	53.Cottage Road	Individual Find
	54.Esperance 1	Individual Find
	55.Esperance 3	Individual Find
	56.La Fortunee	Individual Find
	57.Wellington	Individual Find
	58.Jaglal Trace	Pottery Deposit
	59.Reform	Individual Find
	60.Moruga Road	Pottery Deposit
St. Patrick	1.Cedros	Midden
	2.Siparia-Pastora Street	Individual Find
	3.Pointe d'Or	Flint Deposit
	4.Pointe d'Or	Individual Find
	5.Las Bajos	Individual Find
	6.Pitch Lake 1	Individual Find
	7.Icacos	Midden/Burial
	8. Palo Seco East	Midden
	9.Chagonaray	Midden
	10.Quinam	Midden
	11.St. John	Midden
	12.Columbus Estate	Individual Find
	13.Fyzabad	Flint Deposit
	14.Lawrence Hill	Individual Find
	15.Pitch lake 2	Midden
	16.Pointe Fortin 1	Flint Deposit
	17.Granville	Midden
	18.Pointe Fortin 2	Individual Find
	19.Otaheite	Midden
	20.Erin	Midden/Burial
	21.Sylvester Trace	Midden
	22.Los Iros	Midden
	23.Quinam East	Midden
	24.Delhi Road	Midden
	25.Grant's Trace	Midden
	26.Batiment Crase	Midden
	27. Pitch Lake 3	Flint Deposit
	28. Banwari Trace	Midden/Burial
	29.Parrylands	Individual Find
	30.Palo Seco	Midden/Burial
	31.Coora Road	Individual Find
	32.Buenos Ayres	Midden
	33.Guayabal River	Individual Find

	34.Carapal	Midden
	35.Grand Ravine	Midden
	36.Ridge Trace	Midden
	37.Platanite Trace	Individual Find
	38.Debideyal Trace	Midden

Source: Trinidad: Pre-Columbian and Historic-Amerindians Sites- Archaeological Committee Listing

5 AGRICULTURE

APPENDIX 5.1 NUMBER OF HOLDINGS, AREA AND QUANTITY OF FERTILIZER USED BY LOCATION OF HOLDING AND TYPE OF FERTILIZER

Location of Holding	Type of Fertilizer								
	Lime/Lime stone	Sulphate of Ammonia	Urea	Super Phosphate	Mixed Fertilizers	Foliar Fertilizers	Calnitro	Manure/Co mpost	Other
Trinidad and Tobago									
Number of Holdings	**1,479**	**1,032**	**8,004**	**759**	**6,832**	**1,027**	**1,087**	**4,502**	**979**
Area (Ha)	**2,055.9**	**1,714**	**15,150.5**	**1,488.1**	**9,988.7**	**1,414.2**	**1,431.1**	**5,426.2**	**1,547.8**
Quantity (kg)	**957,695.7**	**382,030**	**4,743,896.4**	**318,150.9**	**3,261,774**	**197,229.1**	**418,795.5**	**11,819,908.2**	**485,551.8**
Trinidad									
Number of Holdings	1,455	1,007	7,928	732	6,647	1,000	1,077	4,306	957
Area (Ha)	2,044.3	1,700.1	15,079.3	1,474.1	9,876.7	1,401.3	1,427.7	5,346.6	1,542.6
Quantity (kg)	954,283	379,396	4,740,083	316,602	3,245,494	196,615	418,436	11,715,946	484,361
City of Port of Spain									
Number of Holdings	-	-	-	-	-	-	-	1	-
Area (Ha)	-	-	-	-	-	-	-	0.1	-
Quantity (kg)	-	-	-	-	-	-	-	11	-
City of San Fernando									
Number of Holdings	-	-	5	-	6	-	1	-	-
Area (Ha)	-	-	3.8	-	4.2	-	0.1	-	-
Quantity (kg)	-	-	864	-	714	-	9	-	-
Borough of Arima									
Number of Holdings	4	2	8	-	11	2	2	22	6
Area (Ha)	2	1.8	8.2	-	8.4	0.4	0.1	12.9	1.9
Quantity (kg)	134	91	622	-	15,702	46	95	32,227	483

Borough of Chaguanas									
Number of Holdings	65	35	220	38	186	25	34	148	24
Area (Ha)	81.1	71.5	304.1	81.2	250.4	51.1	67.7	171.6	40.5
Quantity (kg)	72,917	21,714	93,556	10,895	125,027	4,523	12,735	629,406	7,704
Borough of Point Fortin									
Number of Holdings	-	-	7	2	13	5	-	15	-
Area (Ha)	-	-	8.9	0.8	7.3	1.1	-	2	-
Quantity (kg)	-	-	1173	32	1795	23	-	8195	-
Diego Martin									
Number of Holdings	77	100	129	28	355	115	102	190	13
Area (Ha)	34.4	69.7	53.1	16	152.6	43.1	40.7	87.1	3.9
Quantity (kg)	9,392	21,727	18,132	3468	66,466	11,644	9,654	78,295	1,500
San Juan/ Laventille									
Number of Holdings	138	42	148	48	254	71	72	248	56
Area (Ha)	100.1	30	120.8	38.3	251.6	59.8	56.9	164.9	52.4
Quantity (kg)	103,228	13,598	40,867	14,373	173,890	16,232	21,913	363,486	22,212
Tunapuna/Piarco									
Number of Holdings	489	183	739	115	1,035	189	269	1,118	230
Area (Ha)	731.8	271.7	975.1	215.4	1,407.7	293.5	363.1	1,347.9	324.1
Quantity (kg)	420,302	71,707	439,568	110,591	588,614	54,449	134,054	4,640,916	136,763
Couva/Tabquite/Talparo									
Number of Holdings	226	124	1,363	132	1,244	98	143	733	144
Area (Ha)	401	199.1	2,938.4	330.7	2,373	161.9	221.7	1,091.7	186.2
Quantity (kg)	141,947	51,321	990,824	53,499	940,644	39,995	33,968	2,705,709	64,921
Mayaro/RioClaro									
Number of Holdings	73	76	1047	71	690	133	130	199	55
Area (Ha)	111	149.9	1757.3	112.3	1053.1	169.3	225.6	280.1	110.9
Quantity (kg)	24,875	31,831	406,582	12,987	347,684	12,641	121,584	247,764	18,529
Sangre Grande									
Number of Holdings	183	103	803	65	1,036	192	223	792	157
Area (Ha)	364.2	350.4	1,343.9	136.6	1,993.9	434.2	309.5	1,333	276

Quantity (kg)	104,395	21,765	180,074	13,589	443,692	19,837	69,884	2,274,382	121,028
Princess Town									
Number of Holdings	68	135	1812	108	613	48	31	214	117
Area (Ha)	81.3	280.4	4,806.3	317.8	1,088	65.9	48	361.2	274.4
Quantity (kg)	29,508	92,938	1,706,885	59409	243,416	3825	4,682	287,075	76,451
Penal/Debe									
Number of Holdings	82	154	1,274	84	721	96	49	398	78
Area (Ha)	86.8	174.9	2,285.9	170.1	809.2	81.7	58	298.4	77.9
Quantity (kg)	28,712	35,897	779,293	30,369	184,710	31,541	6,435	319,965	14,506
Siparia									
Number of Holdings	50	53	373	41	383	26	21	228	77
Area (Ha)	50.6	100.8	473.5	54.8	477.2	39.4	36.3	198.8	94.3
Quantity (kg)	18,873	16,807	81,661	7,391	113,138	1,860	3,423	128,513	20,264
Tobago									
Number of Holdings	24	25	76	27	185	27	10	196	22
Area (Ha)	11.6	13.9	71.2	14	112	12.9	3.3	79.6	5.3
Quantity (kg)	3,412	2,634	3,814	1,549	16,280	614	360	103,962	1,190

Source: Agricultural Census 2004

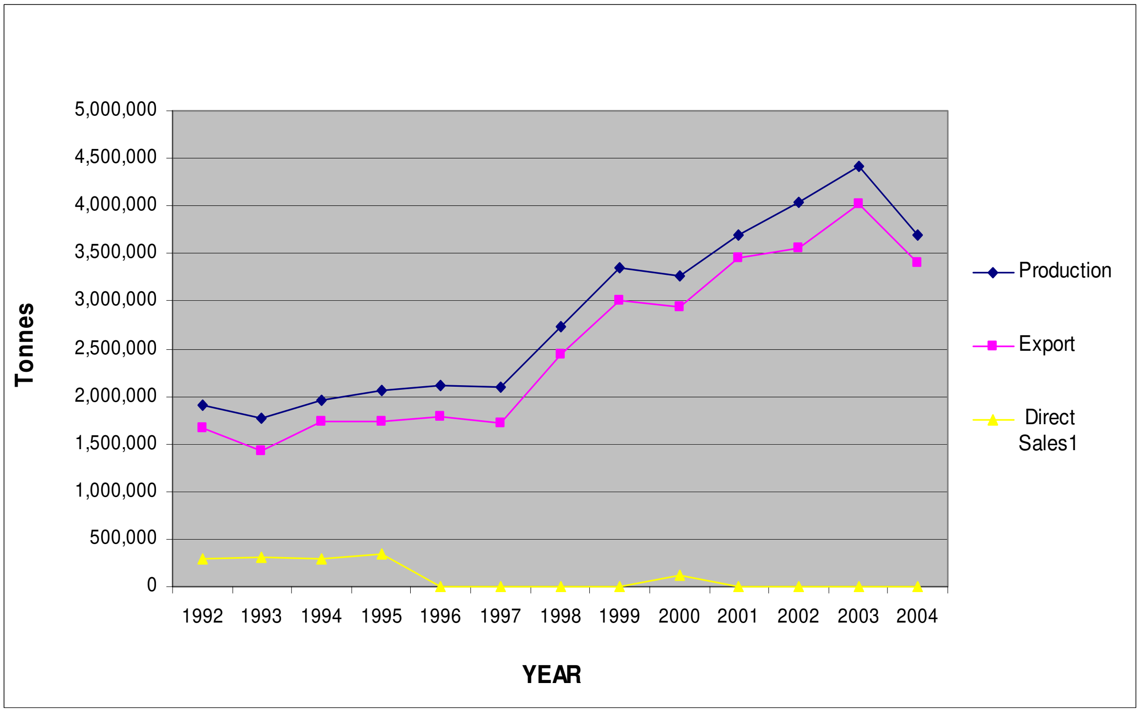
APPENDIX 5.2: ANHYDROUS AMMONIA- PRODUCTION AND DISPOSALS 1992-2004

Year	Production	Export	Direct Sales[1]	Anhydrous Ammonia use per hectare
	Tonnes			
1993	1,768,006	1,423,774	317,318	14.17
1994	1,955,455	1,736,876	295,953	15.61
1995	2,058,892	1,737,916	335,326	19.97
1996	2,110,636	1,792,498	208	0.01
1997	2,096,174	1,726,642	335	0.02
1998	2,734,213	2,432,704	2,949	0.32
1999	3,357,777	3,009,901	420	0.04
2000	3,262,432	2,931,339	112,392	15.31
2001	3,694,970	3,459,044	565	0.07
2002	4,045,651	3,565,245	530	0.07
2003	4,412,884	4,017,394	337	0.04
2004	3,699,135	3,403,868	333	0.06

Source: Central Bank of Trinidad & Tobago

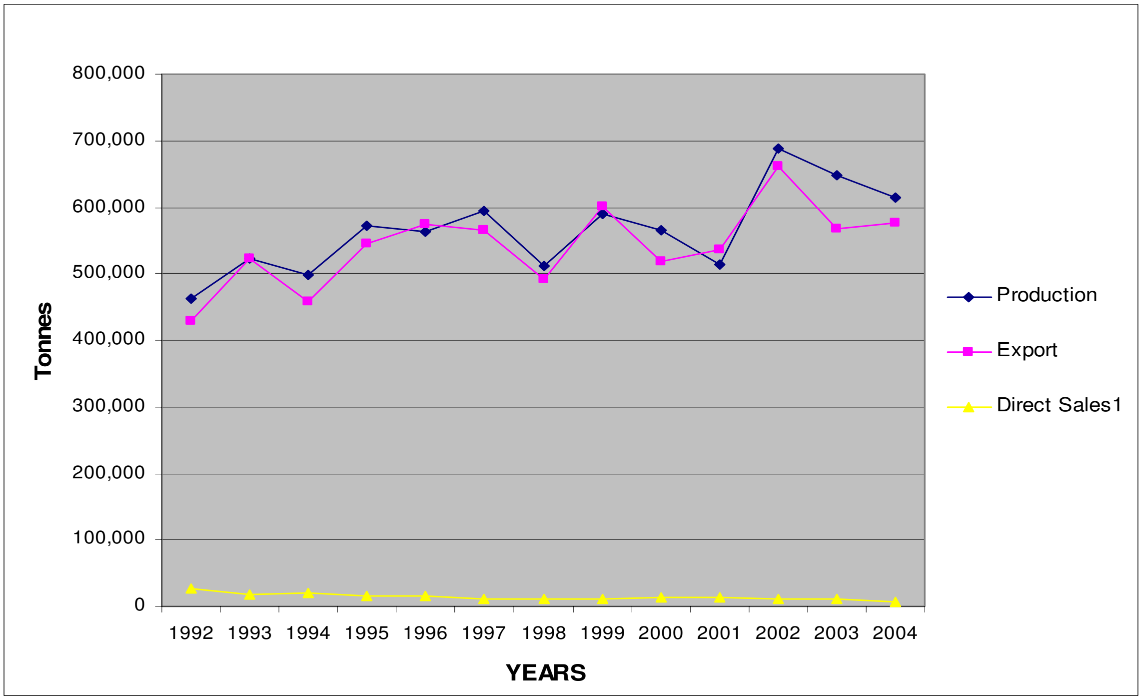
[1] *Direct sales are ex-factory sales on the local market*

ANHYDROUS AMMONIA- PRODUCTION AND DISPOSAL 1992- 2004



Source: Central Bank of Trinidad and Tobago

APPENDIX 5.3: UREA PRODUCTION AND DISPOSALS 1992-2004



Source: Central Bank of Trinidad and Tobago

The production and exports of urea has been fairly steady (i.e. around 500,000 tonnes) during the period 1995 to 2004. However, sales on the local market are comparatively low but similar over the same period.

APPENDIX 5.4 AREA TREATED BY LOCATION OF HOLDING AND TYPE OF CHEMICAL

Location of Holding	Total All Types	Type of Chemical (Hectares)			
		Insecticides/ Pesticides	Bactericides	Fungicides	Weedicides/ Herbicides
Trinidad and Tobago					
Area Treated	**39,117**	**2,019**	**12,311.90**	**1,962.40**	**5,069.90**
Trinidad					
Area Treated	**38,668.70**	**1,847.80**	**12,210.10**	**1,949.20**	**5,017.40**
City of Port of Spain					
Area Treated	-	-	-	-	-
City of San Fernando					
Area Treated	9.3	-	5.1	0.1	0.2
Borough of Arima					
Area Treated	31.1	15	7.6	0.1	2.2
Borough of Chaguanas					
Area Treated	977.8	74.5	321.9	77.7	149.3
Borough of Point Fortin					
Area Treated	12.5	-	6.8	-	1.7
Diego Martin					
Area Treated	537	38.5	192.1	7.3	133.1
San Juan /Laventille					
Area Treated	1,121.80	228.3	310.3	84.2	189.1
Tunapuna/Piarco					
Area Treated	6,185.20	571.7	1961.3	562.7	1,167.80
Couva/Tabaquite/Talparo					
Area Treated	8,150.60	190.7	2,687.20	521.1	1,267.70
Mayaro/Rio Claro					
Area Treated	3,461.80	136.4	11250	124.3	315
Sangre Grande					
Area Treated	6,320.30	233.2	2,300	150.5	918.8
Princess Town					
Area Treated	6,494.80	136.8	1,659.10	150.5	361.9
Penal/Debe					
Area Treated	3,816.60	102	1,013	178.5	335.3
Siparia					
Area Treated	1,549.90	120.6	620.6	92.1	175.2
Tobago					
Area Treated	**448.2**	**171.3**	**101.8**	**13.2**	**52.5**

Source: CSO Agricultural Report 2004

APPENDIX 6.1 LIST OF LEGALLY CONSTITUTED AND DEMARCATED FOREST RESERVE

Name of Forest Reserve	Area as at 1.12.76		Date of Proclamation
	Acres	Hectares	
Arena	3,797	1,537	16/2/22
Arima	1,830	741	16/2/22
Blanchisseuse	2,150	870	5/8/1959
Brigand Hill	316	128	8/12/2025
Cap de Ville	5,207	2,107	25/8/53
Caroni	7,900	3,197	10/11/1936
Cedros	3,348	1,355	14/11/58
Central Range	40,136	16,243	16/2/22
Central Extension	1,586	642	24/9/38
Ecclesville Windbelt	1,277	517	4/10/1934
Erin	5,237	2,119	16/2/22
Freeport	273	111	14/11/58
Galeota Point	200	81	9/9/1939
Godineau Swamp	228	92	9/9/1939
Longdenville	787	319	25/8/53
Longstretch	2,549	1,032	28/12/53
Las Cuevas	569	230	5/9/1961
Manzanilla Windbelt	4,404	1,782	16/2/22
Manzanilla Extension	947	383	11/2/1955
Matura	4,494	1,819	1/2/2023
Eastern Extension	21,455	8,683	14/11/58
Western Extension	5,785	2,341	11/3/1959
Mc Nair Ravine Sable	662	268	26/7/34
Melajo	4,923	1,992	17/8/44
Morne L'Enfer	8,114	3,284	16/2/22
Nariva Windbelt	6,249	2,529	12/3/1954
Northern Range A	804	325	16/2/22
Northern Range A Ext 1	136	55	17/11/45
Northern Range A Ext 2	223	90	24/3/49
Northern Range B	2,314	936	16/2/22
Northern Range C	255	103	16/2/22
Paria	1,782	721	5/8/1960
Rochard Douglas	4,735	1,916	21/8/42
San Pedro	507	205	2/12/1943
Siparia	834	338	22/2/28
Southern Watershed	11,197	4,531	16/2/22
Eastern Extension	2,765	1,119	30/10/39
Southern Extension	2,500	1,012	7/9/1939
Western Extension	2,490	1,008	25/3/43
Southern Extension No.2	3,461	1,401	14/11/58
Northern Extension No.11	892	361	14/11/58
Northern Extension No.2	503	204	14/11/58
Northern Extension No.3	284	115	14/11/58
Northern Extension No.4	201	81	14/11/58
Tacarigua	1,749	708	11/3/1959
Tobago	9,776	3,956	16/2/22
Todd's Road North	463	187	19/3/30
Todd's Road South	208	84	9/5/2029
Tumpuna	5,336	2,159	16/2/22
Valencia	6,841	2,787	14/11/58
Victoria Mayaro	128,285	51,915	12/3/1954
Yarra	1,578	639	5/8/1960
TOTAL	**324,542**	**131,356**	

Source: Forestry Division

7 FISHERIES AND AQUACULTURE

APPENDIX 7.1: DESCRIPTION OF FISHING METHODS/GEARS USED IN TRINIDAD & TOBAGO (CHAN A SHING 2002)

Gillnets

These include **multifilament** or fillet nets (braided nylon, green twine); **monofilament**, transparent or shark nets (single nylon); and an uncommon, recent innovation, joined multimonofilament nets. The average stretched mesh size is 9.5 cm for mono and 10.2 cm for multi nets. They may be set either on the water surface (pelagic) or on the sea floor (demersal). Usually multifilament nets are set on the surface while monofilament nets are set demersally. Depending on how this gear is deployed a range of species are caught. These nets are used to catch carite (Spanish mackerel) and associated species, kingfish (King mackerel), sharks, cavalli, and ancho. They are also used to catch flyingfish in Tobago. More recently mullet and other groundfish are being targeted.

Trawl Nets

This gear is a funnel-shaped net, attached to otter doors, and towed behind a vessel to fish on the sea floor. The local fishery comprises vessels categorized by size and level of mechanisation, using varying size nets, from 8.5 m artisanal boats to industrial double-rigged vessels over 21 m long. The trawl net targets shrimp but also catches a significant quantity of groundfish and crabs. The main species of commercial importance taken in the bycatch include croaker, weakfish, blinch, grunt, snapper and catfish. Semi-industrial and industrial trawlers which retrieve the net mechanically must be outfitted with Turtle Excluder Devices.

Pelagic or Surface Lines

Surface lines comprise a-la-vive, trolling/towing, switchering and pelagic longline and yield primarily kingfish, carite, wahoo, dolphinfish, cavalli, tunas and sharks.

(i) **A-la-vive** - This method refers to fishing with live bait using hooks and nylon twine line, with or without weights. Kingfish is targeted but carite and other species are also caught.

(ii) **Trolling or Towing** - By this method, four (4) to six (6) lines are towed from bamboo outriggers off pirogues. Lines vary between 20 m and 90 m in length and usually there is one (1) hook per line. Artificial lures or “spoons” without weights are used.

(iii) **Switchering** - This is essentially a handline with baited hooks (dead bait), with or without weights, generally deployed while the boat is stationary.

(iv) **Pelagic longline** - This gear targets large migratory pelagics such as tunas and billfish. Sharks are a common bycatch of this fishery. Between 700 – 1,300 hooks are attached to a mainline set at about 30 m - 50 m below the surface of the water. Baited hooks are attached to the mono-filament leader lines which are snapped onto the main line at about 100 m - 150 m intervals. The line is about 24 - 89 km long. Buoys are attached to the main line after every 3 - 10 hooks. High flyers and buoys are attached to the end of each section of approximately 50 hooks. “Cyalume” light sticks may be attached to every 3 - 7 hooks when targeting swordfish.

<u>Demersal Lines</u>

Demersal lines comprise banking and palangue and target snappers, grunts, groupers and sharks.

(i) **Banking** - This gear consists of one (1) to several hooks attached to a weighted main line, set demersally in an area shallower than its surroundings, hence the name “banking”.

(ii) **Palangue** - This gear is a demersal longline which consists of a mainline, set demersally, which carries a number of branch lines with baited hooks. The gear is used primarily to target sharks, snappers and groupers. Grunts and other demersals are also caught.

Fishpots

This gear is operated on both an artisanal and industrial scale locally. The artisanal vessels use mainly 1.2 m by 1.2 m arrowhead pots constructed of chicken wire on mangrove or wild coffee frames. The industrial vessels use collapsible pots made of synthetic mesh or welded wire mesh (BRC), on steel frames averaging 2.1 m by 1.5 m. Fishpots are used to target primarily snappers and groupers. Grunts and lobsters are also valuable components of the catch. Squirrelfish (marianne or mary anne) is caught in significant quantities.

Seines

Seine nets include beach or land seines, bait seines and Italian seines. The bait seine captures small schooling fish such as sardine and herring. The catch of other seines comprise carite, shark, cavalli, grunts and a range of other species.

(i) **Beach/Land Seine** - This gear is a seine, made of multifilament net, deployed by a crew of up to six, and retrieved by as many as 40 persons. It is used to encircle an area of water bounded by the shore where schooling species are seen "beating" on the water surface. These nets range in length up to 457 m.

(ii) **Bait seines –** This gear is smaller than the beach seine, is generally operated by three to four people, and is used to capture bait species near the shore.

(iii) **Italian Seine** - This gear is basically a purse seine, made of multifilament net, deployed by a crew of 6-12. Operated from a pirogue, schooling species are encircled while seen "beating" on the water surface. These nets range in length up to 366 m.

APPENDIX 7.2: STATUS AND MANAGEMENT OF MARINE FISHERIES RESOURCES

SPECIES	DATA USED IN STUDY	STATUS OF STOCK	MANAGEMENT RECOMMENDATIONS	CURRENT MANAGEMENT MEASURES IN PLACE FOR EACH FISHERY / STOCK
ARTISANAL FLEET (Gillnet, Surface handlines, Seines)				
Carite or Spanish Mackerel (*Scomberomorus brasiliensis*)	1972-2002 (Trinidad); 1977-2002 (Southern Caribbean & nearby Atlantic)	Fully exploited to overexploited	Managers should specify management objectives for the fishery, as well as one or more alternative management procedures to be studied.	Minimum diagonal stretched mesh of 4.25" (10.8 cm) for gillnets (except where mullet and flyingfish are targeted). [Note: Minimum diagonal stretched mesh of 3.5" (8.9 cm) for monofilament gillnets catching mullet. (No species, other than mullet, may be landed in excess of 15% of the total catch.)] Gear regulations (length, width, mesh size of fillet nets and seines). No carite or kingfish less than 12" (30.5 cm) shall be taken, sold, or be exposed for sale.
	1991-1992 (Trinidad: artisanal gillnet & line)	Fully exploited	-No increase in fishing effort; -Gillnet mesh size should not be less than 4.75" (12.1 cm) stretched mesh; -Line fishing to be encouraged over the use of gillnets.	
Kingfish or King Mackerel (*Scomberomorus cavalla*)	1996-1998; 2004 (Trinidad: artisanal a-la-vive, banking, switchering, troll)	Overexploited	-Reductions in fishing effort by as much as two-thirds may be required to reduce the risk of stock collapse; -Implement a combination of the following measures: introduce a six month closed season; increase size at first capture (e.g. by enforcing fish and/or mesh size limits) from the current 50 cm up to 60 cm; introduce a limited entry regime to replace the current free access.	
	1995-2003 (Trinidad: artisanal troll & a-la-vive); 1950-2003 (Gulf of Mexico to Guianas)	Fully exploited to overexploited	-No increase in fishing effort and catch of all gears beyond the current levels; -A regional fisheries management commission should be established in the Caribbean to manage sub-regionally shared stocks.	

SPECIES	DATA USED IN STUDY	STATUS OF STOCK	MANAGEMENT RECOMMENDATIONS	CURRENT MANAGEMENT MEASURES IN PLACE FOR EACH FISHERY / STOCK
ARTISANAL FLEET (Gillnet, Surface handlines, Seines)				
	1987 (Trinidad: artisanal gillnet & line)	Fully exploited	-No increase in fishing effort; -Gillnet mesh size should not be less than 4.75" (12.1 cm) stretched mesh; -Line fishing to be encouraged over the use of gillnets.	
Four-winged flyingfish (*Hirundichthys affinis*)	1989/90 – 1990/91 (Tobago)	Heavily exploited	-Reduce foreign fishing effort; -There should be a conservative approach towards increasing local effort; -Management plan should consider the multi-species nature of this fishery.	Minimum diagonal stretched mesh of 1.75" (4.5 cm) for monofilament gillnets.
Herrings, anchovies, sardines				No sardine shall be sold except to bona fide fishermen for the purpose of bait.

SPECIES	DATA USED IN STUDY	STATUS OF STOCK	MANAGEMENT RECOMMENDATIONS	CURRENT MANAGEMENT MEASURES IN PLACE FOR EACH FISHERY / STOCK
TRAWL FLEET (Artisanal, Semi-industrial and Industrial trawlers)				
All shrimp species: Brown (*Farfantepenaeus subtilis*); White (*Litopenaeus schmiti*); Pink (*F. notialis*); Honey or Seabob (*Xiphopenaeus kroyeri*); Red-spotted (*F. brasiliensis*).	1975, 1988-2004 (Trinidad & Venezuela: trawl)	Overexploited. Stock biomass is declining.	Introduce new fishing controls in both Trinidad & Tobago and Venezuela to decrease the total number of days at sea. This can be done by implementing a closed season for trawling and limiting the numbers of trawlers with a view to reducing the fleet size.	Controls on entry to the fishery, of industrial and semi-industrial trawlers. Zoning of areas of operation of trawl fleets in Gulf of Paria: artisanal trawlers permitted outside one nautical mile (1.85 km) from the coast; non-artisanal trawlers with engine size <=180Hp permitted outside the 6 fathom (11 m) isobath; non-artisanal trawlers with engine size >180Hp permitted outside the 10 fathom (18.3 m) isobath. Trawling is permitted: outside of 2 nautical miles (3.7 km) on the South coast of Trinidad; outside of 2 nautical miles (3.7 km) on the North coast of Trinidad, West of Saut D'eau, Nov 15-Jan 15 between 6am and 6pm. Trawling is prohibited: off the East coast of Trinidad; between 12 nautical miles (22.2 km) and the coast of Tobago. Minimum stretched mesh of cod-end (bag) of trawl net is 7.5 cm (3")
Pink shrimp (*F. notialis*); Honey or seabob (*X. kroyeri*)	1992-2002 (Trinidad: trawl)	Fully exploited to overexploited	-Do not increase fishing effort; -Attempt to reduce fishing effort; -Target larger shrimp as catch is predominantly young shrimp.	
Brown shrimp (*F. subtilis*)	1988-2001 (Trinidad: trawl); 1973-2001(Venezuela: trawl)	Severely overfished, with overfishing taking place since the 1970s.	-Introduce measures to reduce fishing mortality; -Adopt a common strategy for effort control by both countries targeting the resource.	
	1988-1996 (Trinidad: trawl); 1973-1996 (Venezuela: trawl)	Overfished	Fishing effort should remain at or below the 1996 level (9,000 days at sea) for a few years to allow the stock to rebuild.	
Shrimp fishery	1995-1996 (Trinidad: trawl); 1995-1998 (Venezuela: trawl)	Fully exploited to overfished, over-capitalised	20% reduction in existing levels of effort would improve profits to the fishery by 12% and reduce the probability of the biomass falling below sustainable levels.	
Cro-cro or Croaker (*Micropogonias furnieri*)	1987, 1989-1997 (Trinidad: artisanal trawl, gillnet & line; Venezuela: trawl)	Fully exploited to overfished	No increase in fishing effort.	

SPECIES	DATA USED IN STUDY	STATUS OF STOCK	MANAGEMENT RECOMMENDATIONS	CURRENT MANAGEMENT MEASURES IN PLACE FOR EACH FISHERY / STOCK
TRAWL FLEET (Artisanal, Semi-industrial and Industrial trawlers)				
Salmon or Weakfish (*Cynoscion jamaicensis*)	1989-1997 (Trinidad: artisanal trawl, gillnet & line)	Fully exploited to overfished	No increase in fishing effort.	
Lane Snapper (*Lutjanus synagris*)	1963, 1975, 1995 - 2004 (Trinidad: artisanal gillnet, line, fishpot & all trawl fleets)	Overall stock biomass does not appear to be affected by the high local fishing mortality. It is theorized that this may be due to relatively constant recruitment to the fishery in Trinidad from an external source of the stock in the region.	-No specific management advice at this time; -Fishing effort should be monitored and, pending further research, a precautionary approach to management is recommended.	No snapper under 8" (20.3 cm) in length should be taken or sold.
Groundfish fishery	1989-1997 (Trinidad artisanal trawl & gillnet)	Fully exploited to overfished	Limit effort for all fleets.	

ARTISANAL FLEET / SEMI-INDUSTRIAL MULTI-GEAR FLEET / RECREATIONAL FLEET (Fishpot, Demersal line)				
Snapper Plumhead (*Rhomboplites aurorubens*)	1992 (Trinidad: artisanal fishpot on North & East coast)	Fully exploited	Restrict fishing.	No snapper under 8” (20.3 cm) in length should be taken or sold.
Lane snapper (*Lutjanus synagris)*	1980-1981 (Trinidad: artisanal fishpot on North & East coast)	Underutilised but the species may be currently fully exploited to overexploited	Increase the age of first capture of species.	
Redfish (*L. purpureus*)	1992 (Trinidad: artisanal fishpot on North & East coast)	Fully exploited	-Limit effort; -Increase mesh size of fishpots.	
Yellowedge Grouper (*Epinephelus flavolimbatus*) Sweetlip (*Mycteroperca interstitialis*)	1992 (Trinidad: artisanal fishpot on North & East coast)	Fully exploited or overexploited	-Restrict effort; -Increase mesh size of fish traps; -Establish impact of illegal fishing by fleets of other countries on these resources.	

SPECIES	DATA USED IN STUDY	STATUS OF STOCK	MANAGEMENT RECOMMENDATIONS	CURRENT MANAGEMENT MEASURES IN PLACE FOR EACH FISHERY / STOCK
SEMI-INDUSTRIAL PELAGIC LONGLINE FLEET / SEMI-INDUSTRIAL MULTI-GEAR FLEET / RECREATIONAL FLEET				
Wahoo (*Acanthocybium solandri*)	1995-2003 (Eastern Caribbean)	Stable stock suggested	Precautionary approach – no large increases in effort above the current level until stock dynamics are better understood.	
Yellowfin tuna (*Thunnus albacares*)	ICCAT database – annual submissions from countries and entities exploiting the resources and findings of scientific research papers	Fully exploited to overexploited	-Fishing effort not to exceed 1992 level; -Closed area/season for fishing on Fish Aggregating Devices (FADs).	These species are currently managed by the International Commission for the Conservation of Atlantic Tunas (ICCAT). Trinidad and Tobago is a contracting Party to ICCAT. ICCAT measures to take effect upon promulgation of new fisheries management legislation.
Bigeye tuna (*Thunnus obesus*)		Fully exploited to overexploited	-Contracting and Cooperating Parties and Entities (CPCs) of ICCAT to implement a management and conservation program from 2005 to 2008; -Total Allowable Catch (TAC) of 90,000 t for each year from 2005 to 2008; -Observers required on 5% of longline vessels > 24m; -Moratorium on FAD fishing (time and area specified) for all surface fleets, on-board observers required during the moratorium; -Trade monitored by Statistical Document Program.	
Skipjack tuna (Katsuwanus pelamis)				
Albacore (North Atlantic stock) (*Thunnus alalunga)*				
Albacore (South Atlantic stock) (*Thunnus alalunga)*		Indeterminate, however there may be overexploitation within the FAD fisheries	No management recommendations.	
Marlin - Atlantic blue marlin (*Makaira* nigricans) & Atlantic white marlin (*Tetrapturus albidus*)		Fully exploited to overexploited	-CPCs fishing Northern albacore to limit number of fishing vessels from 1999 onwards to the average number in 1993-1995; -Annual TAC of 34,500 t for 2004-2006; -EU, US, Venezuela, Japan and Chinese Taipei allocated quotas, other CPCs to limit catches to 200 t;	
		Close to fully exploited	-Annual TAC of 30,915 t for 2005-2007.	
Swordfish (North Atlantic stock) (*Xiphias gladius)*		Atlantic blue marlin overfished for about 3 decades	-Two phase Rebuilding Plan in effect from 2001: phase 1 2001-2006; -Annual harvest of blue marlin by longline and purse seine	

SPECIES	DATA USED IN STUDY	STATUS OF STOCK	MANAGEMENT RECOMMENDATIONS	CURRENT MANAGEMENT MEASURES IN PLACE FOR EACH FISHERY / STOCK
SEMI-INDUSTRIAL PELAGIC LONGLINE FLEET / SEMI-INDUSTRIAL MULTI-GEAR FLEET / RECREATIONAL FLEET				
Swordfish (South Atlantic stock) (*Xiphias gladius)*				
Atlantic sailfish (West Atlantic stock) (*Istiophorus albicans*)				
Atlantic sailfish (East Atlantic stock) (*Istiophorus albicans*)				
Sharks: Blue shark *(Prionace glauca)*		Fully exploited	-10 year rebuilding program (2000-2009); -Annual TAC of 14,000 t for 2003-2006; -Country specific catch limits (T&T has catch limit of 125 t); -Minimum size: 25 kg live weight / 125 cm lower jaw fork length with 15% by number tolerance or 15 kg / 119 cm lower jaw fork length with no tolerance; -Trade monitored by Statistical Document Program.	
		Indeterminate, however there is apparent stability in at least one target fishery.	-Annual TAC established for 2003-2006; -Country specific catch limits; - Minimum size: 25 kg live weight / 125 cm lower jaw fork length with 15% by number tolerance or 15 kg / 119 cm lower jaw fork length with no tolerance; -Trade monitored by Statistical Document Program.	

SPECIES	DATA USED IN STUDY	STATUS OF STOCK	MANAGEMENT RECOMMENDATIONS	CURRENT MANAGEMENT MEASURES IN PLACE FOR EACH FISHERY / STOCK
SEMI-INDUSTRIAL PELAGIC LONGLINE FLEET / SEMI-INDUSTRIAL MULTI-GEAR FLEET / RECREATIONAL FLEET				
		Over the past 2 decades abundance indices have remained relatively stable. As a result current catch level is considered to be sustainable.		
		Cause for concern on the status of this stock because the abundance indices and estimated catches from coastal fisheries have decreased over recent years.		
		Very preliminary results indicated that both the North and South Atlantic stocks appear in good condition (close to unfished biomass levels).	-CPC vessels to not have on board fins that total > 5% of the weight of sharks onboard up to first point of landing; -In fisheries not directed at sharks CPCs to encourage release of live sharks, especially juveniles, that are not used for food and/or subsistence.	
Sharks: Shortfin mako *(Isurus oxyrinchus)*		Very preliminary results indicated that the North Atlantic stock may have experienced depletion and that the South Atlantic stock may have decreased since 1971 but to a lesser extent than the North Atlantic stock.		

APPENDIX 7.3: SOME DETAILS ON AQUACULTURE TECHNOLOGIES: REARING AND PRODUCTION SYSTEMS

The aquaculture technologies which are used in the sector are elaborated below in terms of the different rearing systems and the culture methods used for production of aquatic organisms.

Rearing Systems

- Raceways (concrete troughs)
- Tanks (glass, plastic)
- Earthern ponds
- Cages
- Natural lakes, rivers, ponds

Production Systems

Intensive:

- High capital expenditure
- High stocking densities and hatchery systems
- Use of supplemental feed with high nutritional value
- High productivity per unit area
- Strict management practices
- Independent of climate
- High risks

Extensive:

- Utilize wild fish stocks
- Feeding is rarely practiced; organisms feed on phytoplankton
- Low stocking densities – low productivity per unit area
- Utilize large expanses of water e.g. lakes, ponds
- Low capital expenditure
- Dependent on climate

Semi-Intensive:

- High capital expenditure but lower than Intensive Systems

- Seedstock produced in hatchery but stocking is lower than Intensive Systems.
- Feeding is both from naturally occurring organisms (plankton) in well-fertilized ponds, as well as supplemental commercial rations
- Dependent on the climate

APPENDIX 7.4: SOME HISTORY ON SPECIES INTRODUCED / CULTURED IN TRINIDAD FROM THE 1950S TO THE 1990S

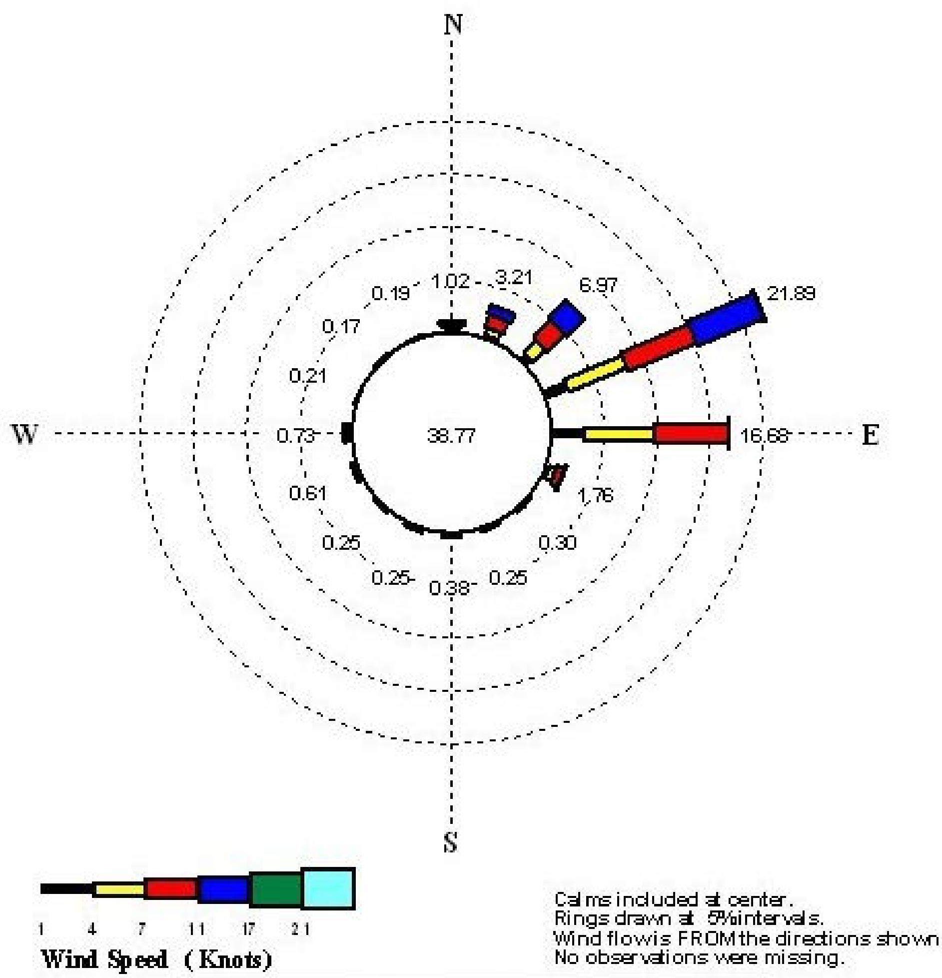
YEAR / TIME PERIOD	SPECIES INTRODUCED / CULTURED
Early 1950s	*Oreochromis mossambicus* (black tilapia) introduced into the cooling-water dams of oil companies to control the breeding of mosquitoes.
1958	*O. mossambicus* introduced to the Bamboo Grove Fish Farm of the Fisheries Division. A combination rice culture with mixed culture of cascadura/guabine/coscorub/teta already existed at the station.
Early 1970s	Focus was on the culture of *O. mossambicus*. Farmers were encouraged to culture this tilapia on a subsistence basis using water ponds on their holdings. Integrated culture was practised with duck and/or rice farming. There was little understanding of pond management, water quality management, and feeding and predator control. Bamboo Grove Fish Farm operated on an extensive basis. Tilapia fingerlings/adults were sold at Bamboo Grove Fish Farm. Fish was also introduced into natural watercourses. Cascadura (*Hoplosternum littorale*) culture was enhanced by Bamboo Grove Fish Farm. *O. aureus*, blue tilapia, was introduced by Bamboo Grove Fish Farm.
Late 1970s	Floodwaters carried *O. mossambicus* into the Caroni Swamp and environs where a population was established.
Early 1980s	Mirror and grass carps, *Cyprinus carpio* and *Ctenopharyngodon idella*, were introduced by the Bamboo Grove Fish Farm as potential raw material for fish processing. An active extension programme was pursued, and *O. nilotica*, the silver tilapia, was introduced from Jamaica as the preferred species for cultivation.
	The Institute of Marine Affairs (IMA) introduced red hybrids (*Tilapia spp.*) for cultivation and research.
	Sugarcane Feed Centre of the Ministry of Agriculture got involved in tilapia culture to obtain a protein substitute for pigs.

1985	IMA and Professor Julian S. Kenny of the University of the West Indies (UWI) introduced the Asian freshwater prawn, *Macrobrachium rosenbergii* to Trinidad.
1988	La Vega Limited imported *Cherax quadricarinatus*, the Australian red claw crayfish.
Late 1980s	The river conch, *Pomacea urceus* was successfully cultured by the IMA.
Early 1990s	Commercial attempts were made by a private entrepreneur to culture various species of Penaeid shrimps (*Penaeus monodon* and *P. vannamei)* in the Gulf of Paria, but this proved unsuccessful because of the intrusion of undesirable wild species and fouling of the inlets.
1991-1992	The Chinese government was involved in a technical co-operation programme with the Fisheries Division to culture Malaysian prawns, *M. rosenbergii*, commercially. A handbook was produced for interested farmers.
1990-1995	Caroni (1975) Ltd. initially cultured *M. rosenbergii*, after which focus shifted to the production of *Tilapia spp.*
1992-1993	*Hoplosternum littorale* was produced by Caroni (1975) Ltd.
1995	Mariculture trials were conducted using seamoss, *Gracilaria spp* and the Carangid, *Trachinotus spp*.
1997	Wallerfield Fish Hatchery began commercial-scale fingerling production of *O. nilotica,* the silver tilapia.

Source: (Fisheries Division records, personal communication with Charles Nurse, staff member of the Fisheries Division, and Ramando Rampersad, co-owner of Wallerfield Fish Hatchery 2006).

11.1 CLIMATE

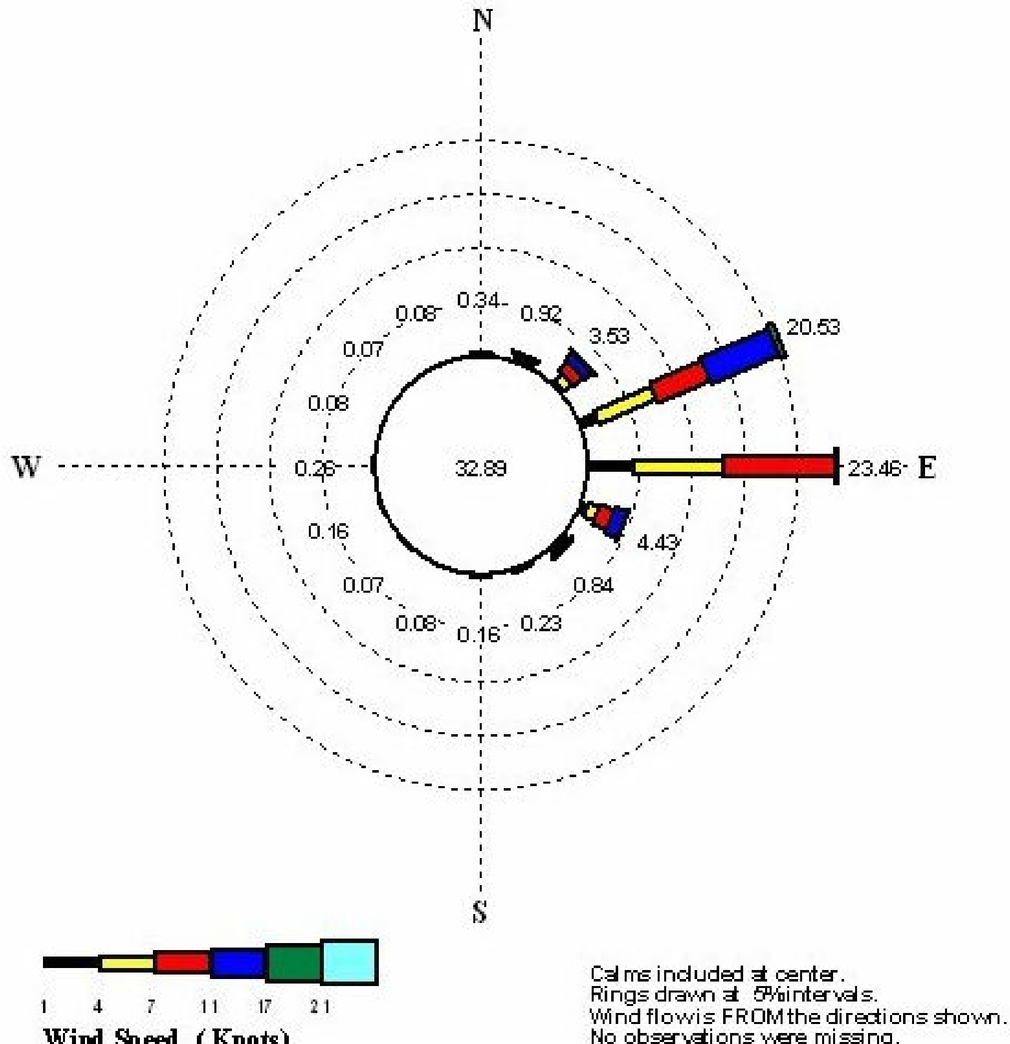
Wind Rose for Piarco, Trinidad for 1999



Average Wind Speed with Standard Deviation for Piarco for 1999

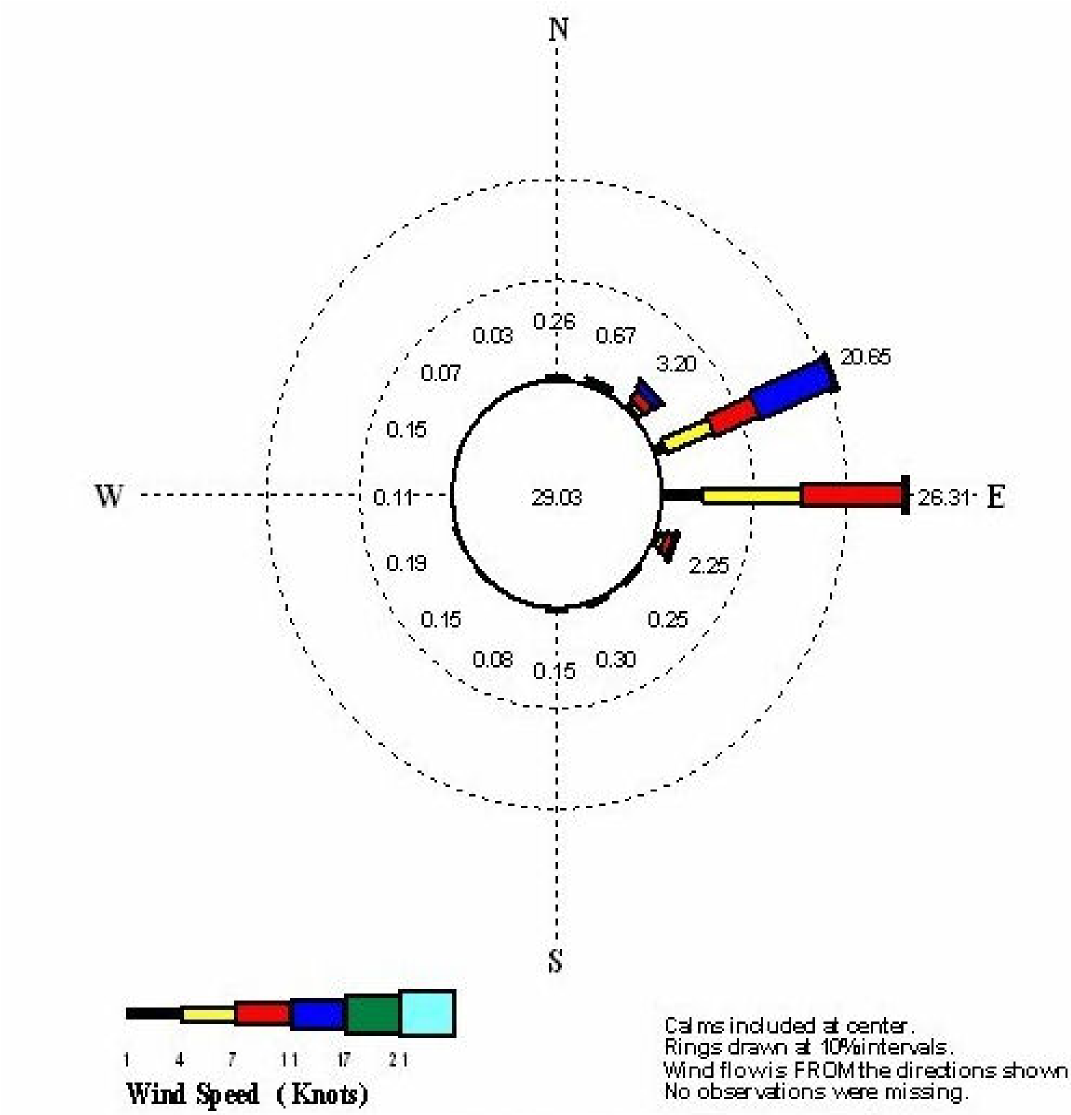
	Average Speed	St. Deviation
With Calm	4.96	4.91
Without Calm	8.1	Nil

Wind Rose for Piarco, Trinidad for 2000



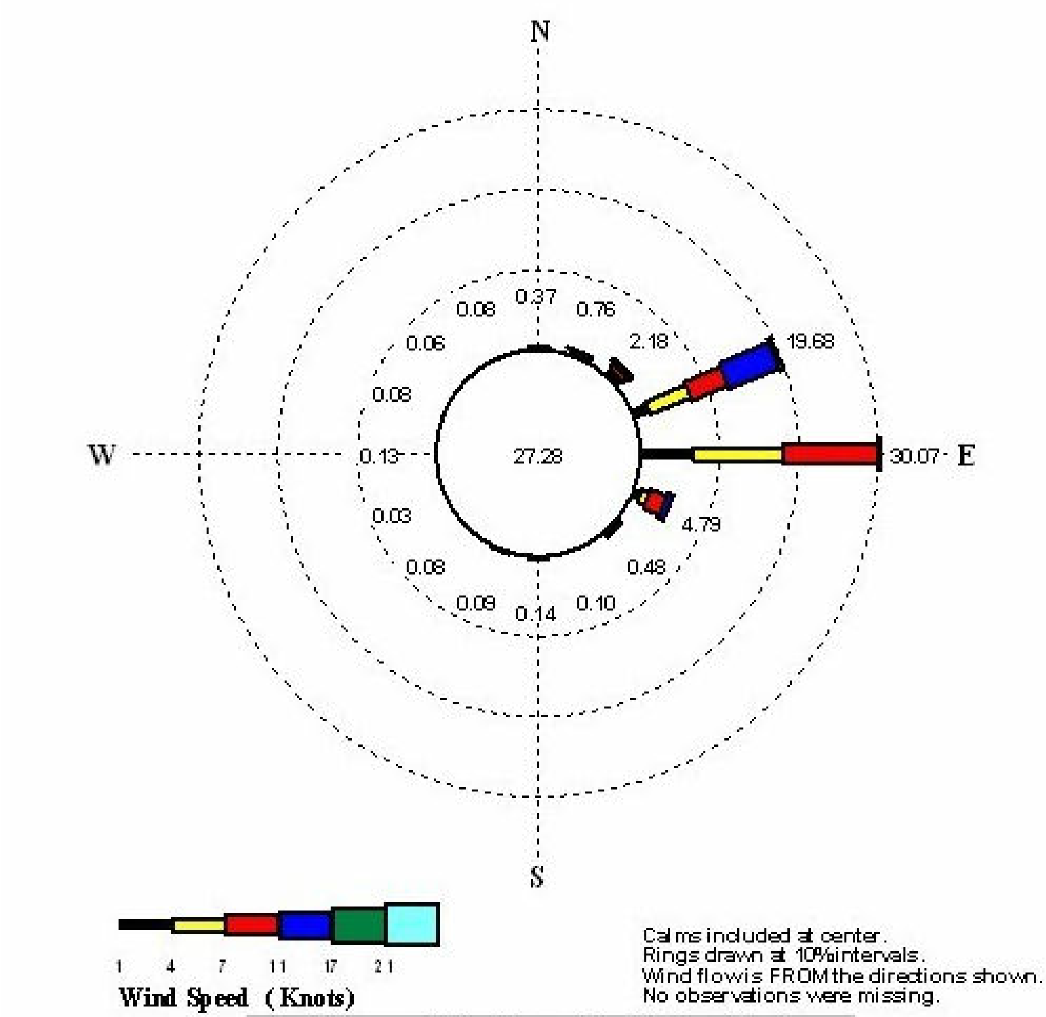
Average Wind Speed with Standard Deviation for Piarco for 2000		
	Average Speed	St. Deviation
With Calm	5.78	5.17
Without Calm	8.8	Nil

Wind Rose for Piarco, Trinidad for 2001



Average Wind Speed with Standard Deviation for Piarco for 2001		
	Average Speed	St. Deviation
With Calm	6.33	5.21
Without Calm	8.82	Nil

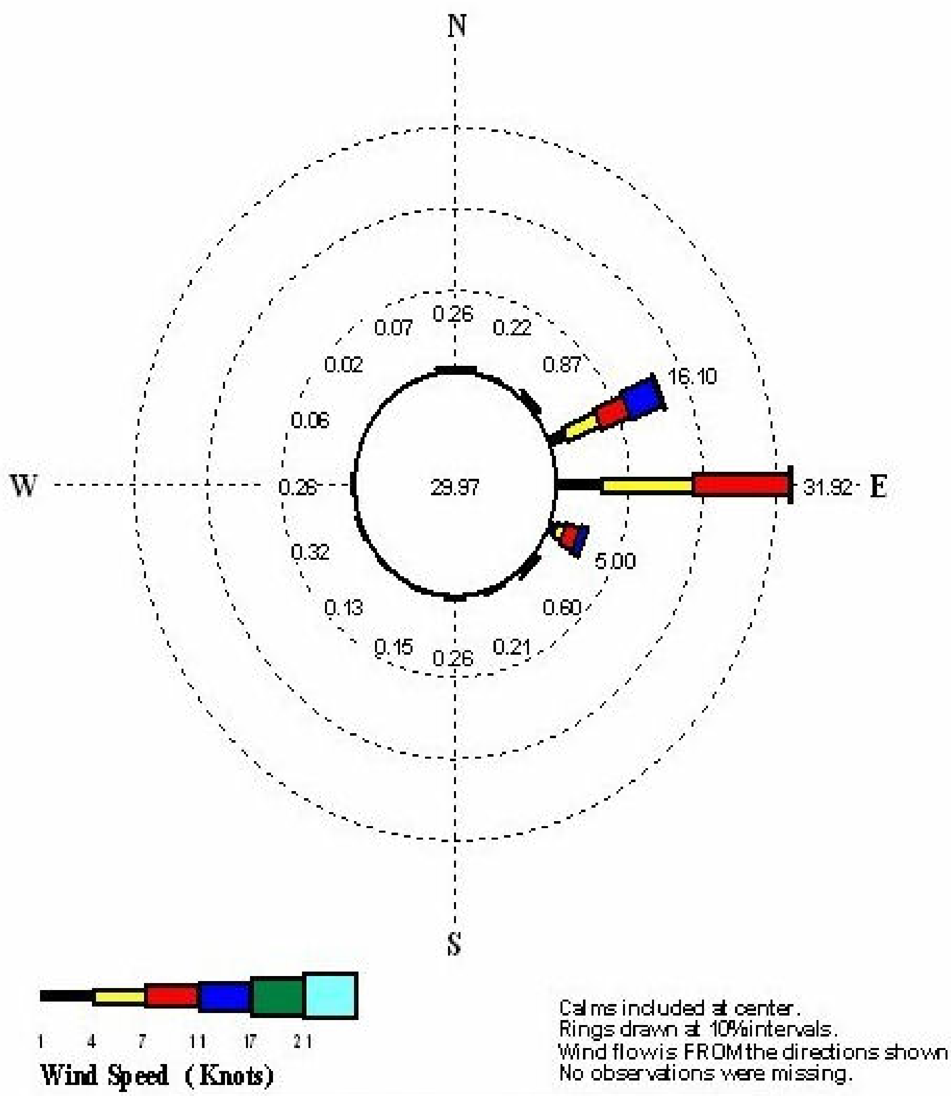
Wind Rose for Piarco, Trinidad for 2002



Average Wind Speed with Standard Deviation for Piarco for 2002

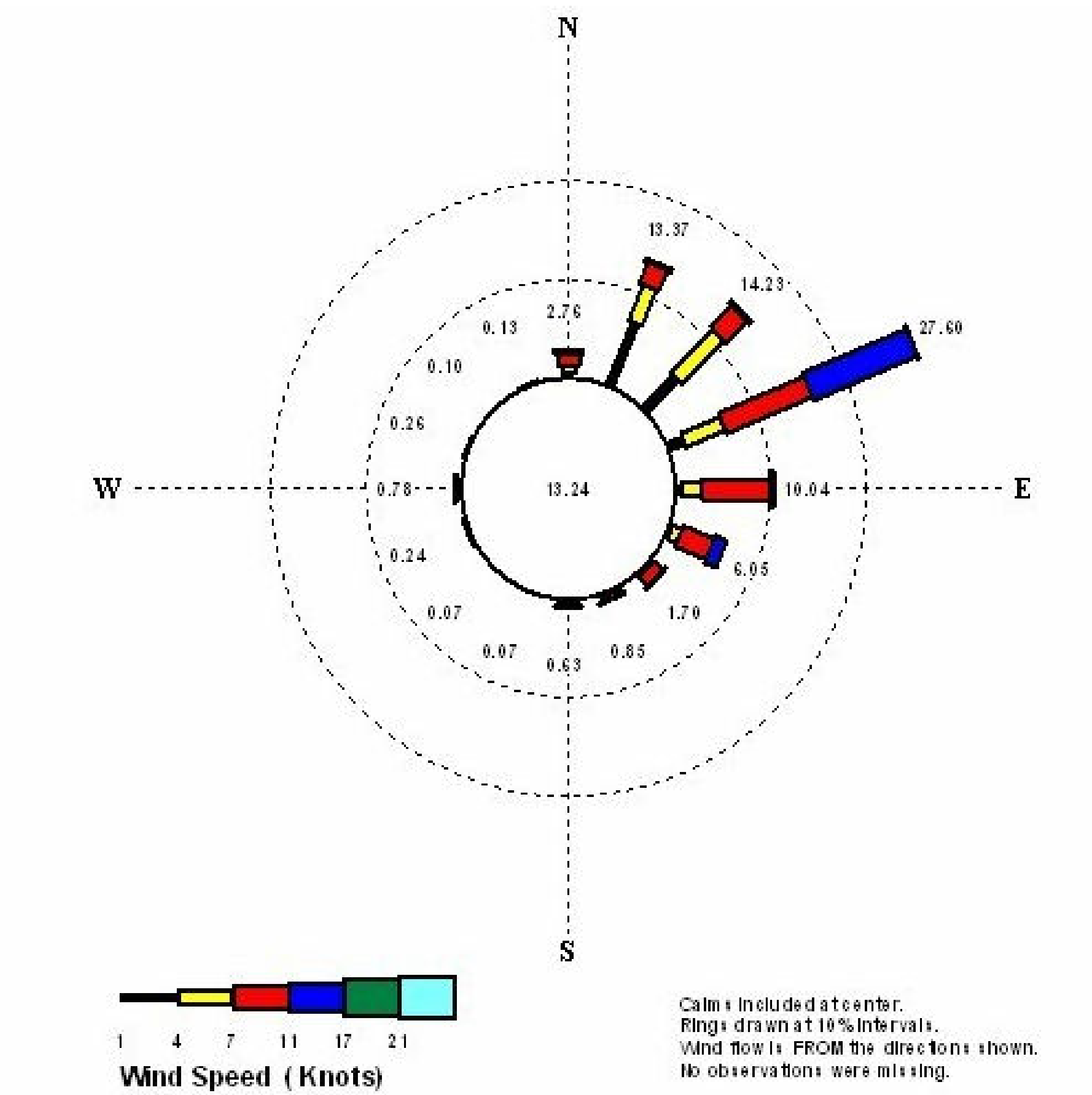
	Average Speed	St. Deviation
With Calm	6.01	4.96
Without Calm	8.28	Nil

Wind Rose for Piarco, Trinidad for 2003



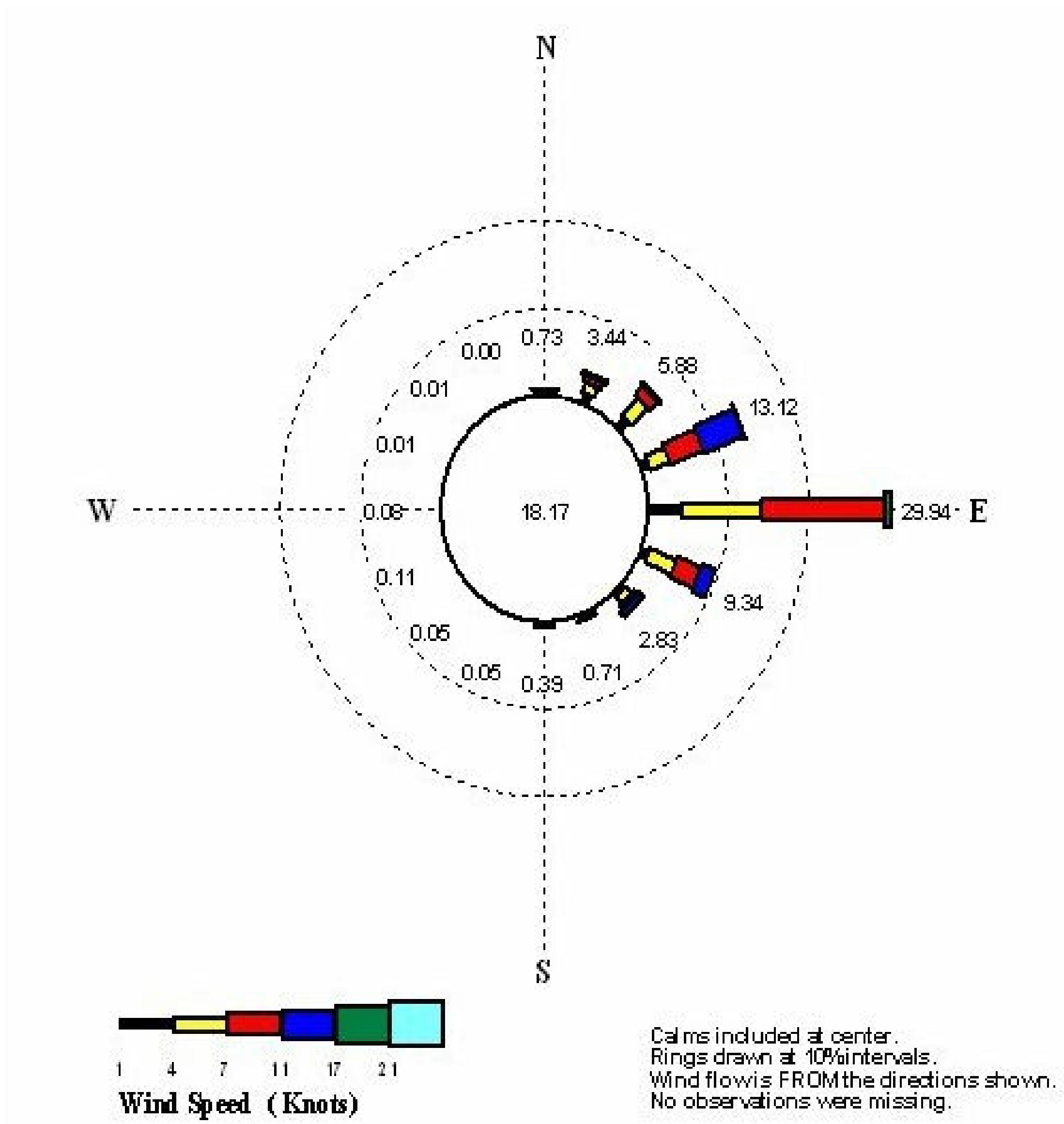
Average Wind Speed with Standard Deviation for Piarco for 2003		
	Average Speed	St. Deviation
With Calm	5.66	4.9
Without Calm	8.31	Nil

Wind Rose for Crown Point, Tobago for 1999



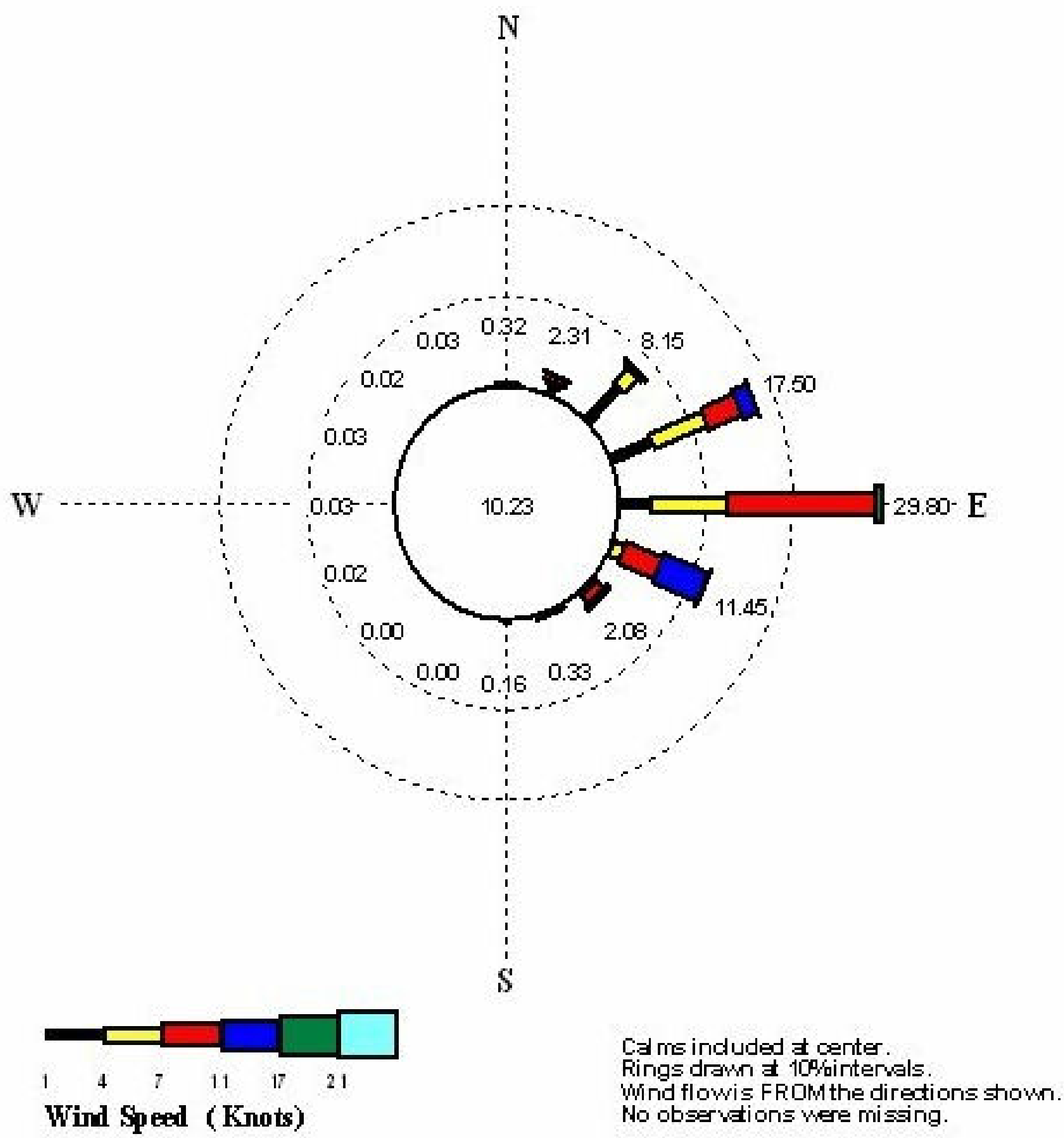
Average Wind Speed with Standard Deviation for Crown Point for 1999		
	Average Speed	St. Deviation
With Calm	6.81	4.42
Without Calm	7.86	Nil

Wind Rose for Crown Point, Tobago for 2000



Average Wind Speed with Standard Deviation for Crown Point for 2000		
	Average Speed	St. Deviation
With Calm	6.92	4.83
Without Calm	8.37	NIL

Wind Rose for Crown Point, Tobago for 2002



Average Wind Speed with Standard Deviation for Crown Point for 2002

	Average Speed	St. Deviation
With Calm	7.3	4.59
Without Calm	8.17	NIL

12.1 SAFFIR-SIMPSON HURRICANE INTENSITY SCALE

DEFINITION:

An index for the Atlantic and Northeast Pacific basins to give an estimate of the potential flooding and damage to property given a hurricane's estimated intensity:

Table 11.1 Saffir-Simpson Scale

Saffir-Simpson Category	Maximum sustained wind speed			Minimum surface pressure	Storm surge	
	mph	m/s	kt	mb	ft	m
1	74-95	33-42	64-82	Greater than 980	3-5	1.0-1.7
2	96-110	43-49	83-95	979-965	6-8	1.8-2.6
3	111-130	50-58	96-113	964-945	9-12	2.7-3.8
4	131-155	59-69	114-135	944-920	13-18	3.9-5.6
5	156+	70+	136+	less than 920	19+	5.7+

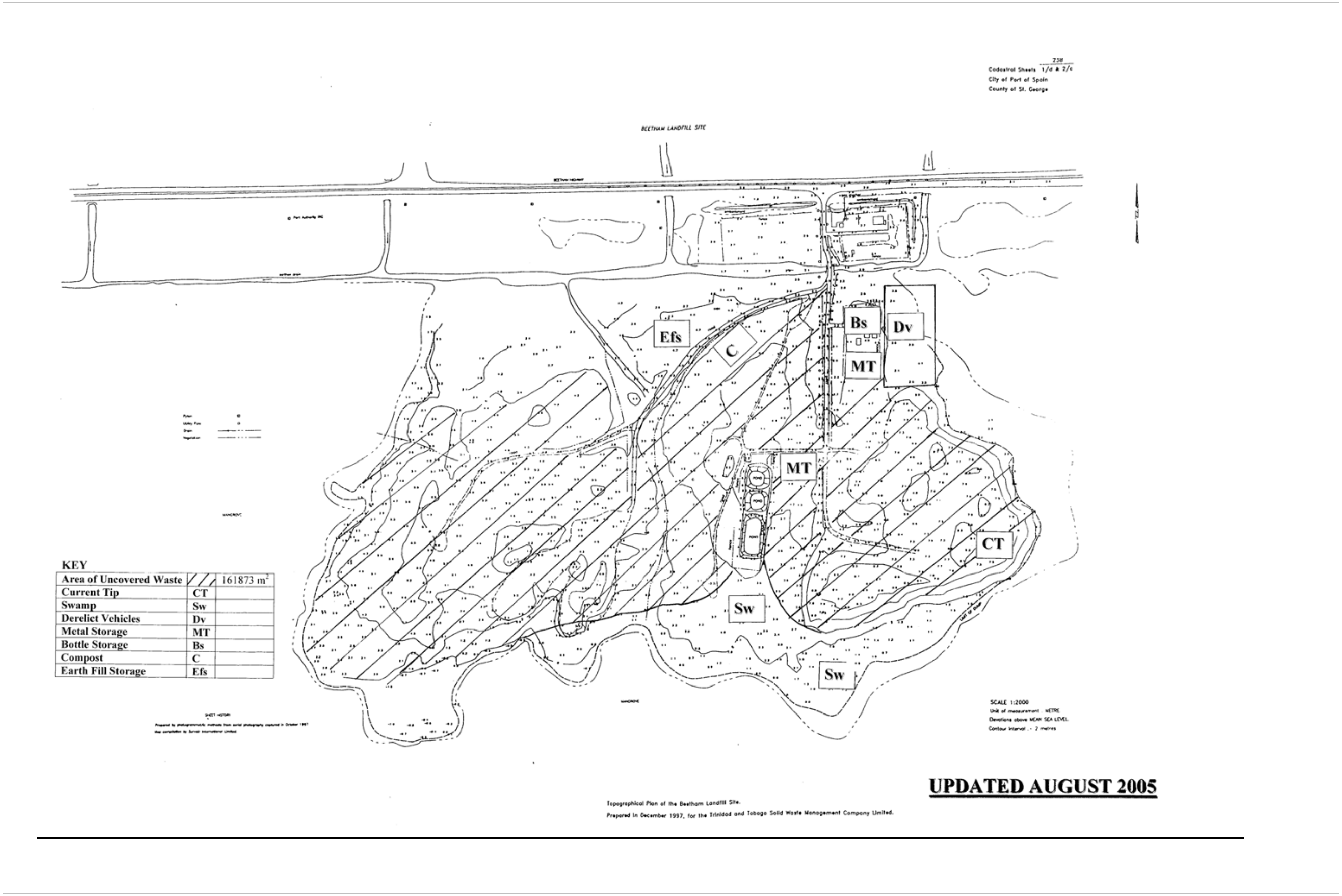
14 SOLID WASTE

APPENDIX 14.1

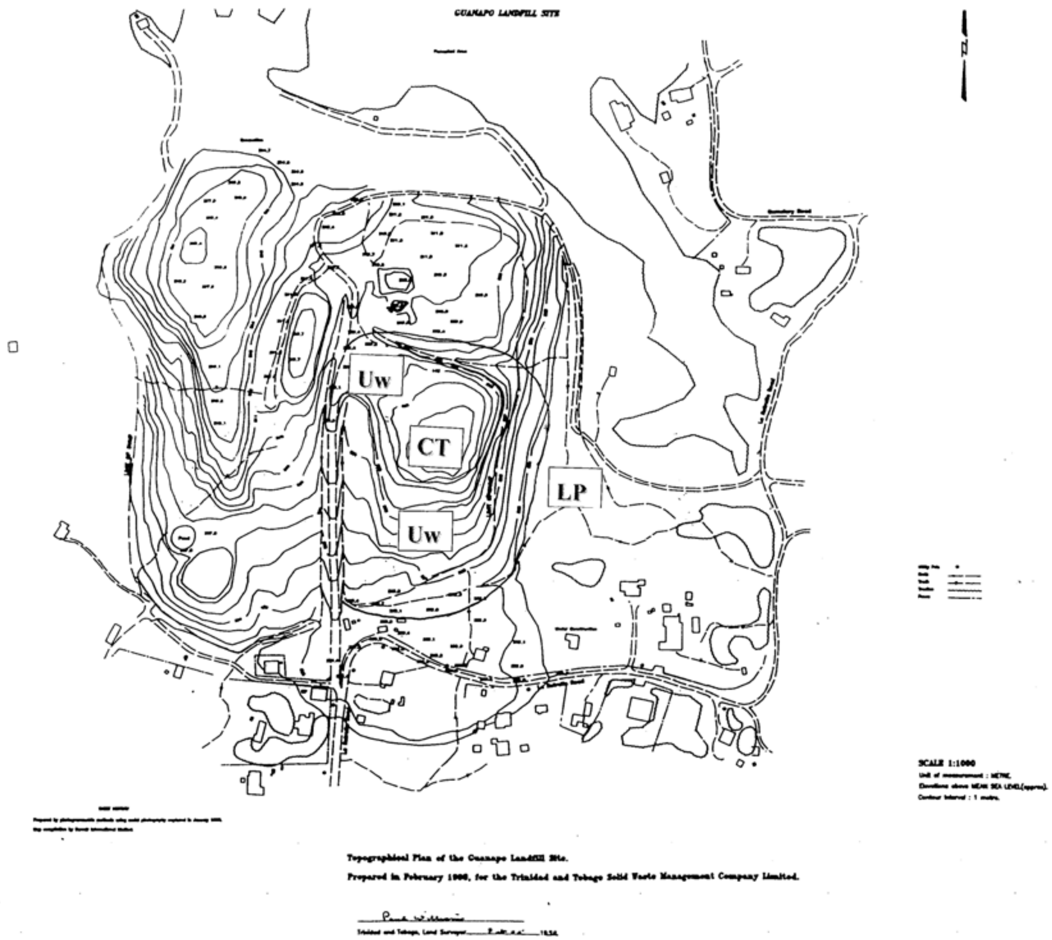
14.1 SITE MAPS

(SEE BELOW)

MAP 14.1. TOPOGRAPHICAL MAP OF BEETHAM LANDFILLS SHOWING UNCOVERED WASTE



MAP 14.2. TOPOGRAPHICAL MAP OF GUANAPO LANDFILL SHOWING UNCOVERED WASTE

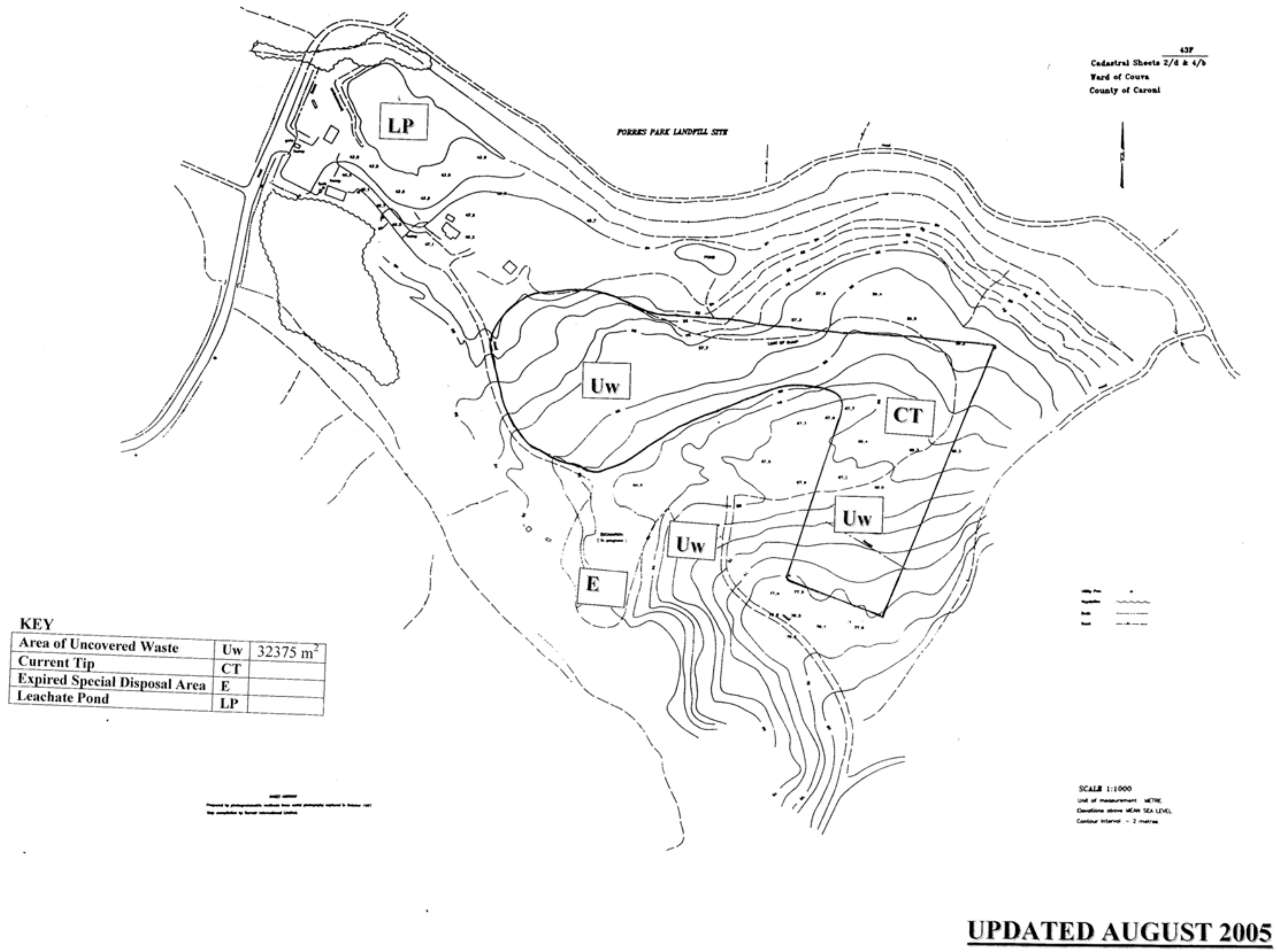


KEY

Area of Uncovered Waste	Uw	40468 m^2
Current Tip	CT	
Leachate Pond	LP	

UPDATED AUGUST 2005

MAP 14.3. TOPOGRAPHICAL MAP OF FORRES PARK LANDFILL SHOWING UNCOVERED WASTE



15 ENVIRONMENTAL LEGISLATIONS, INTERNATIONAL CONVENTIONS AND PROTOCOLS

APPENDIX 15.1 LAWS RELATING TO SPECIFIC ENVIRONMENTAL ISSUES

Air Pollution

(i) Motor Vehicles and Road Traffic Regulations, made pursuant to the Motor Vehicles and Road Traffic Act (rev. 1980), Regulation 38, Rule 13 – Visible emissions.

(ii) Motor Vehicles and Road Traffic (Amendment) Act, No. 25 of 1997, Section 14 - Deregistration for causing an environmental hazard.

(iii) Section 44 of the Customs Act, Ch. 78:0 I (rev. 1980), "The President...may prohibit importation of any goods whatsoever..."

(iv) Petroleum Act (rev. 1980), Section 29 (I) (j) - Prevention of air pollution.

(v) Public Health Ordinance (1950), Sections 69 and 70 - Nuisance.

(vi) Municipal Corporations Act (1990), Section 221 (I) Nuisance.

(vii) Standard Act No. 18 of l997, Section I 5(I) - Power to make environmental standard.

(viii) Consumer Protection and Safety Act (1985), Section 21 (I), - Conduct detrimental to the health of consumers.

(IX) Environmental Management Act (2:000) Sections 49-5 I -Authorizes EMA to develop a legal regime for management of air pollution.

(X) Gas Cylinders (Use, Conveyance and Storage) Act (rev. I 980), Section 2 - Control of gas cylinders.

(XI) Drilling Regulations made pursuant to the Mines, Borings and Quarries Act (rev. 1980), Regulation 18(I) - Prevention of uncontrolled flow of gas.

(XII) Section 4 (2) of the Trade Ordinance No. 19 of 1958 - Prohibiting importation of environmentally harmful products.

Biological Resources

(I) Sections 41-46 of the Environmental Management Act (2000) –Designation of sensitive species and sensitive areas.

(ii) Section 3(I) of the Dogs Act (rev. 1980), - Keeping of Dogs.

(iii) Conservation of Wild life Act (rev. 1980)

(iv) Section 2(I) of the Mongoose Act (rev. 1980), - Importation of mongoose.

(v) Section 14 (I) of the Animals (Diseases and Importation) Act (rev. 1980) - Prohibiting the importation of birds, reptile and insects.

(vi) Section 9(b) of the Beekeeping and Bee Products Act (rev. 1980) - Regulating importation and exportation of bees.

(vii) Section 2 (I) of the Control of Importation of Live Fish Act (rev. 1980) - Importation of live fish.

(viii) Section 3(I) of the Plant Protection Act (1975) - Importation of plants.

(ix) Cocoa (Import and Export) Act, Section 3 - Regulating import and export of cocoa.

(x) Exportation of Fruit Act (rev. I 980), Section 8 - Exportation of fruits.

(xi) Protection of New Plant Varieties Act No.7 of 1997, Section 3 - Rights to new species of plants.

(xii) Sections (16) and 19 of the Summary Offences Act (rev. 1980) –Wounding of animals and damage to plants.

(xiii) Section 17 of the Malicious Damage Act (rev. 1980) - Setting fire to plants.

(xiv) Section 19 - Malicious damage to plants.

(xv) Section 3 of the Plant (Export) Prohibition) Act (rev. 1980) – Prohibiting export of plants.

(xvi) Section 17 (I) of the Agricultural Fires Act (rev. 1980) - Control of fires.

(xvii) Sawmills Act (rev. 1980) - Control of sawmill operations.

(xviii) Section 4(a) of the Slum Clearance and Housing Act (rev. 1980) – land development for housing, gardens, factories etc.

(xix) Housing Act (rev. 1980), which provides the National Housing Authority with wide power for implementing programmes to alleviate housing problems for low income persons.

(xxi) Agricultural Small Holdings Tenure Act (rev. 1980), was created to provide security for small farmers who comprise the majority of agricultural practitioners in Trinidad and Tobago.

(xxii) Section 10 of the Asphalt Industry Regulation (rev. 1980) regulating digging of asphalt.

Biological Resources cont'd

(xxiii) Section 16 of the Petroleum Act (rev. 1980) - Restoration of area subject to petroleum operations. Section 29(I) (;) making of regulations to prevent land. Regulation 42(2) (c) of the Petroleum Regulations (rev. 1980) - Avoiding pollution of tidal areas.

(xxiv) Section 4(I') of the Pipelines Act (rev. 1980) - Permit for laying of pipes.

(xxv) Section 6 (I) of the State Lands Act (rev. 1980), Prevention of squatting and encroachment on state lands.

(xxvi) Section 36 (I) of the Public Health Ordinance (1950) -Permission for erection of buildings.

(xxvii) The Chaguaramas area has been developed pursuant to legislation and the rights vested in the Chaguaramas Development Authority under the Chaguaramas

(xxviii) Development Authority Act (rev. 1980), to do *so.*

(xxix) Disaster Measures Act (rev. I 980) Section 2 (I) -Declaration of disaster areas.

(xxx) Drilling Regulations made pursuant to the Mines, Borings and Quarries Act (rev. 1980), Regulation 18(I) - Prevention of uncontrolled flow of oil or gas; Regulation 20(4) deals with repairing, plugging and abandoning of wells.

(xxxi) Section I O (I) of the Malaria Abatement Act (rev. 1980) - Regulating conduct over swampy lands.

(xxxii) Marine Areas (Preservation and Enhancement) Act (rev 1980) Designation of marine areas for protection purposes.

Biological Resources cont'd

(xxxiii) Litter Act, Ch. 30:52 (rev. 1980), as amended by the Litter (Amendment) Act (1981) creates the principal offence of littering. As per Section 3(I). This offence occurs when "a person who without reasonable excuse deposits any litter in or on any public place".

(xxxiv) As per Section 232(1) of the Municipal Corporations Act (rev. 1980),

(xxxv) Municipal Corporations are responsible for the "maintenance. Control and enhancement of the physical environment including monitoring water-courses, beaches and water-front areas, swamps, forests, game sanctuaries, savannas,. parks and other open spaces.

(xxxvi) Tourist Board Act T&T) as amended by the Tourist Board. (rev. Amendment) Act (1989) - Development of tourism facilities.

(xxxvii) Section 3(I) of the Oil Pollution of Territorial Waters Act (rev. 1980) - Prohibits the discharge of oil from vessels.

(xxxviii) Territorial Sea (Amendment) Act No. 22 of 1986 Section 6A (I) - Right to deal with vessels that infringe health laws.

(xxxix) Fisheries Act (rev. 1980). - Protects the fisheries of Trinidad and Tobago.

(xL) Section 3 I) of the Continental Shelf Act (rev. 1980). As amended by the Continental Shelf (Amendment) Act (1986) - Rights over natural resources in the sea.

(xLi) Archipelagic Waters and Exclusive Economic Zone Act (1986) -This Act vests control over the Exclusive Economic Zone.

(xLii) Section 24 of the Harbours Act (rev. 1980) - Pollution of wharves

Biological Resources cont'd

(xLiii) Municipal Corporations Act (1990) Section 232(1) - Municipal Corporations are responsible for the maintenance of parks. beaches, water fronts. swamps forests. game sanctuaries etc

(xLiv) Queen's Park Act (rev.1980) - Control over the Queen's Park Savannah.

(xLv) San Fernando Recreation Ground Act (rev. 1980) - Control over the San Fernando Recreation Ground.

(xLvi) Botanic Gardens Act (rev. 1980) - Establishment of the Botanic Gardens.

(xLvii) Section 2(I) of the Recreation Grounds and Pastures Act (rev. 1980) - Authorisation for the making of regulations to govern the use of any public recreation ground or pasture...

(xLviii) Section 29(I) (i) of the Petroleum Act (rev. 1980) - The President may make any such regulations...for the prevention of pollution of... water....and for compensation thereof.

(xLix) Litter Act, Ch. 30:52 (rev. 1980), as amended by the Litter (Amendment) Act (1981), creates the principal offence of littering. A public place is generally defined as every place where that the public has access or area owned by the state and includes ... "(iii) any waters to which the public has access without payment of any fee for bathing or for other recreational purposes.

(L) Section 36(3) of the Highways Act (rev. 1980) - Obstructing water ways close to highways.

(Li) Second Schedule, Part IV, Clause 8 of the Town and Country Planning Act rev. 1980), provides that development plans can make provisions for prohibiting the pollution of rivers etc.)

Biological Resources cont'd

(Lii) Section 9 of the Malaria Abatement Act (rev. 1980) - Obstructing flow of drainage channels

(Liii) Section 9 of the Dry River Act (rev. 1980) - Prohibits pollution of the Dry River.

(Liv) Section 18 (I) of the Waterworks and Water Conservation Act (rev. 1980)Polluting water courses.

(Lv) Section 72 of the Summary Offence Act (rev. 1980) - Pollution of Maraval River. Section 73 - Pollution generally of rivers.

(Lvi) Section 145 of the Municipal Corporations Act (1990) - Prohibits impeding of water courses.

(Lvii) Drilling Regulations made pursuant to the Mines, Borings and Quarries Act (rev. I980), Regulation 20(4) - Plugging wells that could pollute water.

(Lviii) Section 53 of the Water and Sewerage Authority Act (rev. 1980) - Prohibits pollution of waters.

(Lix) Sections 36(1), 37, 55-60, 68, 70 and 80 of the Public Health Ordinance (rev. 1980) - Sets our regime for dealing with water pollution.

(Lx) Environmental Management Act (2000) Sections 52 - 54 - Authority to establish legal regime for management of water pollution. - Sets our regime for dealing with water pollution.

(Lxi) Standards Act No. 18 of 1997, Section 15(I) - Power to make environmental standards.

(Lxii) Consumer Protection and Safety Act (1985), Section 21 (I), - Conduct detrimental to the health of consumers.

Noise Pollution Legislation

(i) Public Health Ordinance (1950), Section 69 - Nuisance.

(ii) Municipal Corporations Act (1990), Section 221 (I) - Nuisance.

(iii) The Air Navigation and Aerodromes Ordinance (1950). basically provides for English Air Navigation laws between 1920 and I <)49 to be applicable to T&T Section 43{1) (c) of the Airports Authority Act (rev. 1980), states "The Minister may make regulations...for...regulating and controlling the use of airports by aircraft, whether civil or otherwise...

(iv) Regulations' 38, Rule 12(I), 43 and 49 of the Motor Vehicles and Road Traffic Regulations (rev. 1980) - Noise from vehicles.

(v) Section 12A of the Maxi Taxi Act (1992) - Prohibits music in maxi taxis.

(vi) Section 55 (I) of the Summary Offences Act (rev. 1980) -Prohibits noisy instruments

(vii) Section 63 - Noise from premises.

(viii) Section 64 (I) - Noisy Instrument.

(ix) Section 120 - Operating loud speakers.

(x) Section 5 1 of the Environmental Management Act (2000) - The EMA provided with the authority to address noise pollution

(xi) Theatres and Dance Halls (Amendment Act) No. '5 of1997. Section4C (I) - Changes to licenses from causing excessive noise.

(xii) Pesticides and Toxic Chemicals Act (1979), as amended by the Pesticides and the sale and composition of fertilizers and feeding stuff are also controlled according to the Fertilizers and Feeding Stuffs Act (rev. 1980).

(xiii) Explosives Act (rev. I 980) Section 4(I) prescribes the rules for the appointment of explosive magazines and the power to expand such rules

(xiv) Section 4 (2) of the Trade Ordinance No. 19 of 1958 - Creates the legal authority to ban importation of chemicals.

(x) Section 44 of the Customs Act, Ch. 78:0 I (rev. 1980) - Authorises the President to prohibit the importation of goods.

(xi) Sections 59 and 60 of the Environmental Management Act (2000) – These sections authorise the EMA to establish a legal regime over hazardous substances.

Waste

(i) Environmental Management Act (2000), Sections 55-57 - These sections vest responsibility in the EMA for developing a legal regime for waste management in Trinidad and Tobago.

(ii) Regulation 4(I) of the Pesticides (Registration and Import Licensing) Regulations (1986) made pursuant to Section I 2(I) of the Pesticides and Toxic Chemicals (1979) - This provides for safe disposal of pesticide waste.

(iii) The Town and Country Planning Act (rev. I 980), Class IV (2) of the attached Schedule of the Town and Country Planning (General Development) Order - This provides permission for the developers of industrial undertakings to provide for the deposit of waste material.

(iv) Section 44 of the Customs Act, Ch. 78:0 I. (rev. 1980) - Authorises the President to prohibit the importation of goods including waste materials.

(v) Section 4 (2) of the Trade Ordinance No. 19 of 1958 - Creates the legal authority to ban importation of waste materials.

(vi) Drilling Regulations made pursuant to the Mines, Borings and Quarries Act (rev. I980), Regulation 18(I) - Prohibits waste of petroleum products.

(vii) Litter Act, 'Ch. 30:52 (rev. 1980), as amended by the Litter (Amendment)

(viii) Act (198 r) - Deals with littering.

(ix) Sections 54(1)(o), 57(D), 57E(I), 58A, 59C, 59E, 64, 67 and 141 of the Public Health Ordinance (1950) - Places control over mainly domestic waste.

(x) Sections 136 and 232(j) of the Municipal Corporations Act (1990) -Assigns responsibility for municipal wastes to corporations.

(xi) Section 4(I) (a) of Quarantine Act, Ch. 28:05 (rev. 1980) - Authorises regulations to protect danger to public health from ships etc.

(xii) Regulation 43(s) of the Petroleum Regulations, made pursuant to the Petroleum Act (rev. 1980), - Requires a licensee to take all reasonable precautions and safety measures to prevent waste.

(xiii) Section 5 of the Factories Ordinance (1950) - Requires the keeping of factories clear of waste

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