



# Port Antonio Water, Sewerage and Drainage Project

*Government of Jamaica/European Investment Bank*



## *ENVIRONMENTAL IMPACT ASSESSMENT for STAGE 1*

XU0396  
April 2006



**KBR**

in Association with  
**WRC, Swindon, UK**  
**RPS Water Services, Exeter, UK**  
**Lawson & Associates Ltd, Kingston, Jamaica**  
**N.O. Whyte & Associates Ltd, Montego Bay, Jamaica**

# **Kellogg Brown & Root Ltd**

*in association with*

**WRC Ltd, Swindon, UK**

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Stage 1 Environmental Impact Assessment**

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## **PREFACE**

The Works proposed for the Port Antonio Water, Sewerage and Drainage Project (PAWSDP) are divided into Stage 1 and Stage 2.

The present Environmental Impact Assessment (EIA) analyses the potential environmental impacts and discusses their mitigation in respect of the Stage 1 Works, which primarily encompass the following within the urban area of Port Antonio:

- The extension and upgrading of the water distribution system;
- The construction of a piped sewerage system; and,
- The rehabilitation of the surface water drainage system.

The Stage 2 Works are concerned with the development of additional water resources and the delivery of collected sewage flows for treatment and disposal.

For a full understanding of the overall impacts of the PAWSDP reference should therefore also be made to the EIA for the Stage 2 Works.

The EIA studies for Stages 1 and 2 were undertaken simultaneously.

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## EXECUTIVE SUMMARY

1. The area covered by the *Port Antonio Water, Sewage and Drainage Project* (PAWSDP) stretches along the North coast of Jamaica from the mouth of the Rio Grande River in the east to Fairy Hill in the west and inland as far as Fellowship, Nonsuch, Cambridge and Sherwood Forest.
2. The recent harbour redevelopment was the first step in the rejuvenation of this once prosperous area. The second, the upgrading of the road to Ocho Rios, has recently commenced. The next step is to improve public health infrastructure. There is currently insufficient water to provide a 24-hour pressurised supply and much of what is distributed is lost to leakage. There is no centralised sewerage system and no facilities for sewage treatment and safe disposal. Coastal waters, including the twin harbours, are therefore seriously polluted. Parts of the town are below sea level and prone to flooding due to the inadequacy of the drainage system.
3. The overall objective of the PAWSDP is therefore to improve the availability of water, provide for the safe and sustainable disposal of sewage, and reduce the risk of flooding to reduce soil and water pollution, improve public health and support economic revival.
4. The project was originally conceived from the 1966 Master Plan and the programme reviewed within a Feasibility Study in 2002. In March 2003 Kellogg Brown and Root were contracted by the National Water Commission, the Project Proponent, to complete detailed design, including Environmental Impact assessment, and undertake construction management.
5. The design horizon is 2025, when the predicted population of the project area will be 48,000, the demand for water 21,000 m<sup>3</sup>/d, and sewage outflow 2000 m<sup>3</sup>/d. The construction proposed under PAWSDP Stage 1 includes:
  - Upgrading of the existing water distribution system;
  - A new sewage collection network;
  - Rehabilitation of the existing drainage system.
6. All Stage 1 works will be undertaken within the built up area of Port Antonio between the Annotto River and Caneside River. Various alternative options, including 'Do Nothing' and 'Do Minimum', were considered during the Master Plan study and the present proposals effectively constitute the 'Do Minimum' option if the objective of the project is to be achieved.

7. All new water and sewage pipelines are to be laid in existing roads. No land acquisition is required, there will be no demolition of buildings, and no residents will be resettled. The principal environmental impacts will be the noise, dust and traffic delays that pipe laying within a busy urban area always entails.
8. To minimise these impacts, mitigation measures will be imposed on the Contractor. Working hours will be limited to reduce noise, dust and traffic delays on rest days and public holidays. Strict limits will be placed on the noise generated by construction equipment and on exhaust emissions from vehicles and stand-by generators. The Contractor shall abide by all standards and regulations currently in force throughout Jamaica, including those of the National Environment and Planning Agency (NEPA), who will be free to undertake their own inspections.
9. Prior to commencing work, the Contractor will prepare a Traffic Management Plan which will detail how traffic delays, the occasional need for temporary road closure and the use of diversionary routes will be managed. To minimise traffic congestion, the installation of pipes and initial reinstatement will follow trench excavation with the minimum of delay. Vehicular access to service such as medical centres, police and fire stations shall be maintained at all times. Pedestrian access to all public building, such a libraries and government offices will also be maintained. The public will receive prior notification of temporary disruptions to access and be agreed with Portland parish Council and the Jamaican Constabulary.
10. With work restricted to the urban area there will be no impact on landscape or biodiversity. The most contentious issue is likely to be the proposal to remove a portion of the mangroves and accumulated silt in the Annotto River between West Street and Port Antonio Marina. Hydraulic modelling has shown this to be a major constraint to the passage of flood flows and a major cause of flooding. Cleaning back to the original river channel is the only practical and readily achievable means of alleviating future flooding.
11. The Stage 1 and Stage 2 PAWSDP works will provide Port Antonio with improved water supply, a safe and sustainable means of disposing of human waste, and protection from flooding. The immediate beneficiaries will be the residents of the main urban area. Visitors and tourists will also benefit, and the availability of these facilities will spur economic growth.
12. In accordance with NEPA requirements, the PAWSDP Stage 1 proposals and the finding of the Environmental Impact Assessment will be the subject of a Public Meeting at a place and date to be advertised locally.

## ENVIRONMENTAL IMPACT ASSESSMENT PROJECT TEAM

The Environmental Impact Assessment (EIA) for the Port Antonio Water, Sewerage and Drainage Project (PAWSDP) has been prepared on behalf of the National Water Commission (NWC) by Kellogg, Brown and Root (KBR) as part of the overall design and execution of the project.

The KBR core team contributing to the EIA Study are as follows:

Dr. John. Davey	Principal EIA Preparer
Dr. David Lee	Local Environmental Expert
Mr. John Mazikiauskas	PAWSDP Project Manager
Mr. Karl McIntosh	PAWSDP Lead Design Engineer

Mr. Gordon Hutchinson of Geotech Exploration undertook the geotechnical survey; and,  
Dr. Dwight Robinson of UWI undertook the Pesticides Study.

KBR would also like to thank the following for their cooperation:

*At the National Water Commission:*

Mr. Randy Maxwell	NWC Project Manager
Ms. Bridget Lawrence	Environmentalist

# 1. INTRODUCTION

## Project Background

- 1.1. Port Antonio, the capital and main settlement of the Parish of Portland and is located on the north-eastern coast of Jamaica. With recent growth, water supply, sewerage and drainage services have become inadequate to sustain quality of life and maintain public health. Much of the water distribution system dates back to the 1920s, the town remains unsewered, and the drainage network is inadequate to prevent flooding.
- 1.2. Notwithstanding these problems, Portland was the first parish to adopt the principles of the Green Globe 21 Programme to promote sustainable environmental and social practices. While the area struggles to attract its share of tourists the potential for development has long been acknowledged and new public health infrastructure will substantially contribute to its realisation.
- 1.3. In 1995 the Urban Development Corporation obtained a loan from the Inter-American Development Bank to develop a Master Plan for water, sewage, drainage and solid waste services<sup>1</sup>. The study was presented in August 1996 but funding for the recommended works was not immediately available.
- 1.4. The first phase proposals of the Master Plan were revisited by the National Water Commission (NWC) in 2002 and a revised programme for water supply, sewerage and drainage prepared<sup>2</sup>. This work effectively constituted the Feasibility Study for the present project.
- 1.5. In March 2003 NWC awarded Kellogg, Brown and Root (KBR) the contract for detailed design and construction management of this project. The work is funded by the European Investment Bank under Contract No. EIB 21.613-2005/01 and the present Environmental Impact Assessment (EIA) is a requirement of this contract.

## Scope and Structure of the Present Report

- 1.6. Initial Screening of the project by the National Environmental Protection Agency (NEPA)<sup>3</sup> identified the need for a full Environmental Assessment (EA), including public presentation, as it may potentially have significant impact upon the human and natural environment, including the marine environment, and affect a wide spectrum of stakeholders. In accordance with national requirements, Terms of Reference were submitted to NEPA on 6th December 2005 and approved on 6th February 2006.

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<sup>1</sup> *Port Antonio Sanitation Study Master Plan Report*. Louis Berger International, August 1996.

<sup>2</sup> *Review of Master Plan for Port Antonio Urban Development Project for Water, Sewerage and Drainage*. Louis Berger international, April 2002.

<sup>3</sup> Formerly the National Resources Conservation Authority (NRCA).

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- 1.7. As required under KBR's Contract with NWC, the Assessment follows a structure typical of a World Bank EA<sup>4</sup> while also fulfilling the requirements of NEPA<sup>5</sup>.
  - 1.8. Section 2 below discusses the need for and objectives of the project, outlines the 'Without Project' situation, and describes the construction to be undertaken, while Section 3 presents an overview of the policy and legal framework under which it will be executed.
  - 1.9. Sections 4 and 5 present the Environmental Baseline Conditions, reviewing biophysical and socio-economic issues respectively.
  - 1.10. Sections 6 to 8 present the assessment of Environmental Impacts. Section 6 gives an overview of the potential temporary impacts that may be suffered during the period of construction. Section 7 defines the potential permanent impacts, while Section 8 details the possible extent and magnitude of post-construction and operational impacts.
  - 1.11. Section 9 discusses the alternative development option that have been considered during the evolution of the project, including the 'Do Minimum' option.
  - 1.12. Sections 10, 11 and 12 comprise the Environmental Management Plan (EMP). Section 10 presents proposals for the mitigation of impacts previously identified in Sections 6 to 8. Section 11 defines the need for environmental monitoring during and after construction, while Section 12 proposes institutional strengthening and capacity building to ensure the EMP is effectively implemented.
  - 1.13. Finally, Section 13 provides information on the consultations with key stakeholders and the general public that have been an integral part of the Assessment.

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<sup>4</sup> World Bank Operational Policies OP.4.01, Annexes B and C. World Bank, January 1999.

<sup>5</sup> Guidelines for Conducting Environmental Impact Assessment. NRCA, July 1997.

## 2. PROJECT DESCRIPTION

- 2.1. This section outlines the need for and objectives of the *Port Antonio Water Sewage and Drainage Project* (PAWSDP), discusses the 'Without Project' situation, and describes the proposed construction.

### Project Need and Objectives

- 2.2. Port Antonio surrounds what is reputed to be one of the most beautiful harbours in the Caribbean. It is a quiet town of narrow streets lined with many fine Georgian buildings. Once renowned as the world's banana capital it became an early holiday destination when returning banana boats brought the first tourists. While many once-popular attractions have closed for the want of visitors the area is generally considered by tour operators to be *the next big thing in Jamaican tourism*<sup>1</sup>. Among the attractions on offer are the scenic Rio Grande Valley set within rolling tropical forest covered hillsides, and spectacular coastal scenery with beautiful secluded beaches such as Frenchman's Cove, Boston Beach, Long Bay and Blue Lagoon.
- 2.3. Recent harbour redevelopment to accommodate cruise ships has been the first step in the process of rejuvenation. There are no large resort complexes and the aim is to attract the type of tourists who wish to experience the beauty and tranquillity of the area. The second step, the upgrading of the extremely poor road links with Ocho Rios and Montego Bay along the North Coast Highway, is already being implemented.
- 2.4. At the present time there are insufficient water resources to provide a 24-hour pressurised supply and much of what is distributed is lost before it reached consumers. Since the 1996 Master Plan NWC has made significant progress in metering but this has only highlighted the problems of leakage, estimated at 70% of water released into supply, and the need for extensive network repair and replacement. To reduce leakage the outlet valve at West Retreat reservoir is closed each night. Empty pipelines create negative pressures and soil water, often highly saline and/or may infiltrate from absorption pits and septic tanks, seeps in through poorly-sealed pipe joints. When the reservoir valve is opened each morning any contaminated water is delivered to consumers' taps.
- 2.5. Port Antonio has no centralised sewerage system and no means for safe wastewater treatment and disposal. The many individual septic tanks and absorption pits are a source of odour, and septic seepage finds its way into the harbour and adjacent bays, elevating the nutrient content to the detriment of yachtsmen, fishermen, bathers, marine vertebrates and coral. Some properties are only served by pit latrines while a few remain without any formal means of disposing of septic waste.
- 2.6. The problems of water distribution and the lack of sewerage are exacerbated in those areas of the town below sea level, where property is prone to flooding from inadequate drainage capacity. Flood waters

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<sup>1</sup> *Jamaica*. Lonely Planet, 2006.

increase infiltration to empty water lines and enter poorly sealed septic tanks and absorption pits causing overflow. The spread of septic drainage by flood water poses a serious possible threat to public health.

- 2.7. The aim of the PAWSDP is therefore to improve the availability of water, to provide for the safe and sustainable treatment and disposal of sewage, and to reduce the risk of flooding, in order to achieve the broader objective improving the public health of direct and indirect beneficiaries, reducing pollution of both terrestrial and marine environments, and supporting further commercial development of the town.

### **The 'Without Project' Situation**

- 2.8. The lack of an efficient water supply system, a modern sewerage network and adequate drainage has long been recognised as an obstruction to future economic growth, improved public health and environmental protection. If PAWSDP is not executed the economy of the area will remain stagnant, its residents will continue to suffer the consequences of poor water supply and sanitation, increased flooding, and continued environmental degradation.

### **Project Location and Proponent**

- 2.9. Port Antonio is located near the eastern extremity of Jamaica's north coast, 105 km by road east of Ocho Rios and 95 km ENE of Kingston. It is the main town within the Parish of Portland and is administered by the Portland Parish Council.
- 2.10. The PAWSDP area extends from the mouth of the Rio Grande 4 km west of Port Antonio to Fairy Hill 7 km to the east and embraces the immediate spheres of influence of the town. The southern boundary of the project area is demarcated by the valley of the Rio Grande as far as Fellowship, up to Breastworks, eastwards along the road serving Nonsuch, Cambridge and Sherwood Forest, and north to Fairy Hill.
- 2.11. The full scope of PAWSDP works extends from the Annotto River, around West Harbour, through the Titchfield Peninsula and around East Harbour as far as Caneside River. Beyond Caneside River a trunk sewer and water transmission main follows the coast road to Turtle Crawl where the sewage will be treated prior to discharge to the sea near Daniel's Harbour. The project also includes work at the Grant's Level wellfield adjacent to the Rio Grande River at Berridale, 5 km south-west of the town. The full project area is shown in **Figure 2.1**.
- 2.12. The Proponent of the Port Antonio Water, Sewerage and Drainage Project is the Government of Jamaica through the National Water Commission whose contact address is:

National Water Commission,  
4, Marescaux Road,  
Kingston 5,  
Jamaica.



Figure 2.1. The Project Area



## Stage 1 Project Description

- 2.13. The work to be executed under the project is divided into two stages, which may be tendered and awarded separately or together. The Stage 2 works comprising the upgrading of the Grant's Level wellfield, sewage pumping stations, sewage treatment plant and long sea outfall are the subject of a separate EIA.
- 2.14. The Stage 1 PAWSDP works comprise the following, for which detailed location plans are presented in **Appendix A**.
- Upgrading of the existing water distribution system to include the following:
    - Replacement of c. 10 km of 100-300 mm diameter water mains;
    - Construction of water pipes across 62 drainage culverts;
    - Installation of isolating valves (83), air valves (12), pressure reducing valves (2), washouts (25) and other fittings;
    - Provision of 950 house connection; and
    - Installation of 45 fire hydrants.
  - A new sewage collection network comprising the following:
    - Construction of a c.1.6 km 250-400 mm diameter trunk sewer between the Annotto River and the Caneside River;
    - Installation of c.4 km of 200 mm diameter collector sewers;
    - Construction of 297 inspection chambers;
    - Installation of 386 100-150 mm service connections, and,
    - Provision for a further 905 service connections.
  - Rehabilitation of the existing drainage system to include:
    - Miscellaneous repairs to existing concrete channels and culverts;
    - Construction of 11 new culverts;
    - Installation of c.1 km of 450-675 mm diameter concrete drainage pipes;
    - Construction of 2 new outfall structures;
    - Repairs to revetment along the Foreshore Road waterfront including the placement of 950 m<sup>3</sup> of new stone;
    - Reinstatement of capacity at the Annotto River outfall by removing c.3,750 m<sup>2</sup> of mangrove and 2,000 m<sup>3</sup> of accumulated silt; and,
    - Reinstatement of capacity in the Caneside River by removing the remains of the old bridge and the provision of new gabion bank protection.
- 2.15. Replaced but serviceable water pipes and fittings, estimated at 60 lengths, will be recovered and returned to NWC for reuse. Increased water resources development to supply the new distribution network at the 2025 demand is being undertaken within PAWSDP Stage 2. The collected sewage flows are drained to a Stage 2 pumping station at Caneside River and pumped to a sewage treatment plant for marine disposal, also part of the Stage 2 works.

## Design Guidelines

- 2.16. The design philosophy and engineering concept adopted by NWC for which KBR have primarily been adopted from the recommendations of the 1996 Master Plan and the 2002 Review/Feasibility Study. The PAWSDP Design Horizon is 2025.
- 2.17. The criteria for KBR's detailed engineering design have primarily been based on the following:
- *Developer's Manual*. Draft Edition, NWC, 2003;
  - *Guidelines of Design and Construction of Housing*. Volumes 1, 2 and 3<sup>2</sup>. Jamaican Institution of Engineers, 1984;
  - KBR's own in-house Design Manuals compiled over time from proven engineering practice and industry 'best practice' in the UK and overseas; and,
  - Advice from acknowledged experts engaged on the present project.
- 2.18. KBR has produced separate Design Reports for the Stage 1 and Stage 2 works<sup>3</sup>. Since much of the Stage 1 works are extended in Stage 2, the Stage 2 report is the essential reference for information on the sewage pumping stations, treatment plant and long sea outfall.
- 2.19. To ensure engineering design is founded on accurate and site-specific information the following surveys and studies were completed during the design stage of the project:
- **Topographical Survey** to provide spot levels along public roads and watercourses. A network of permanent marker stations has been established for use during construction;
  - **Geotechnical Investigations** to assess the ground conditions that may be expected along pipeline routes;

## Principal Design Criteria

### *Design Population*

- 2.20. In the 1996 Master Plan predicted population growth substantially higher up to 2000 on the basis that projects such as the West Port Development and an expected increase in tourism would lead to a boom, which did not materialise. The design population has therefore been recalculated during PAWSDP detailed design using data from the 2001 National Census of 2001 not available at the time of the 2002 Master Plan Review.

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<sup>2</sup> Covering drainage sewerage and water supply respectively.

<sup>3</sup> *Port Antonio Water, Sewage and Drainage Project: Design Report Stage 1*.

KBR Doc.XU0396-400-RP-0002, Sept. 2005

*Port Antonio Water, Sewage and Drainage Project: Design Report Stage 2*.

KBR Doc.XU0396-400-RP-0003, March 2005

2.21. The fundamental concepts behind the new population projections are as follows and the calculated population predictions for the PAWSDP area are shown in **Table 2.1**.

- The Port Antonio population is generally increasing but at a lesser rate than predicted previously;
- Development of the area, particularly focussed on the tourism sector, will result in a development boom, although this has not been apparent within the timeframes predicted by previous studies. It is assumed the PAWSDP will be the catalyst for increased activity and peak development is predicted between 2008 and 2018.
- Being the main town of the Parish of Portland the commercial sector is predicted to grow within Port Antonio with the residential expansion in suburban areas such as Norwich to the west and Anchovy to the east.

**Table 2.1. PAWSDP Design Populations**

2001	2008	2018	2025
32,387	35,253	43,783	48,342

2.22. The Master Plan concluded that only a percentage of the predicted study area population would ultimately connect to the water system; those not connected receiving water from other sources, those living in areas not served by NWC, and those not connected due to cost and use standpipes as an alternative. However, NWC have decided standpipes will not be provided by the project, everyone will potentially be served, and alternative sources are being phase out due to increasing unreliability and decreasing water quality. 100% of the projected population have therefore been catered for in water demand estimates and it is estimated that some 56% of the 2005 population are already connected to the existing NWC supply network.

### ***The Demand for Water***

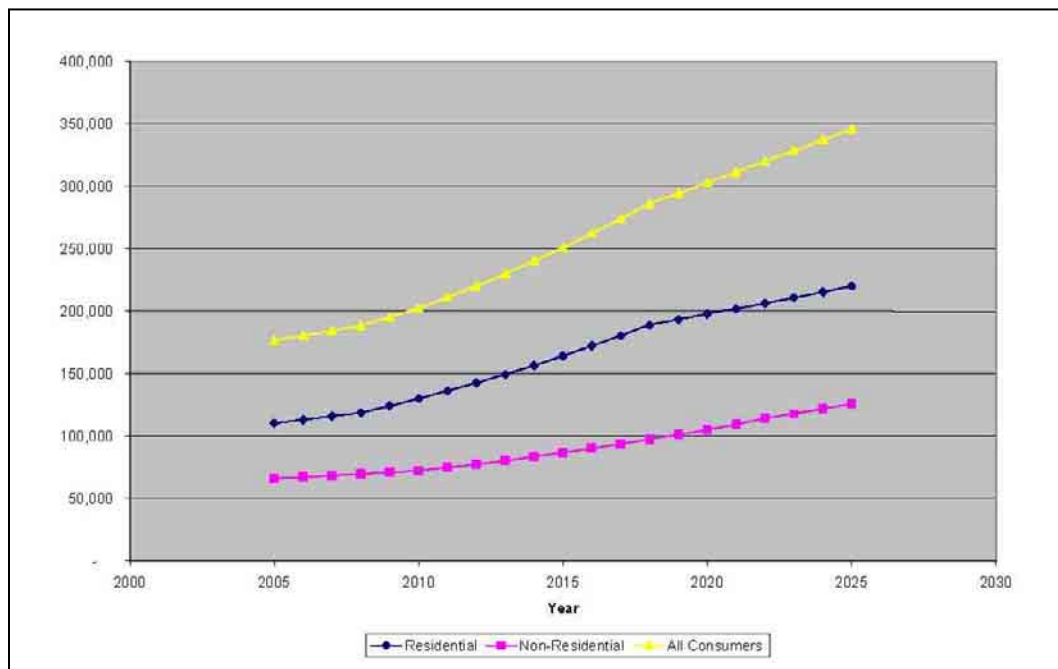
2.23. The requirement for water, encompassing residential, commercial and special demand, has also been comprehensively investigated. Residential properties within the project area are generally considered to be classed as low to middle income. The 2002 Master Plan Review predicted per capita demand (PCD) to be 193 l/d in 2005 and is in line with that used for the Kingston Sanitation Project

2.24. Annual PCD growth rates of 0.6% and 0.3% for the periods 1995-2005 and 2005 to 2020, respectively were adopted within the Master Plan, the higher rate based upon the experiences from tourist induced growth in Negril, Ocho Rios and other North Coast towns. The 0.3% was based upon the generally excepted trend for Jamaica. Although the period of predicted boom has slipped, these growth rates have been adopted for the PAWSDP, and the predicted PCD for 2025 is now 211 l/h/d.

2.25. Non-residential demand has been analysed in four categories and current use elevated on the basis that Port Antonio is the parish capital and is therefore the focus of future commercial and institutional development:

- General commercial demand, including institutional demand;
- Special user demand for the cruise ship Ken Wright Pier, Boundbrook Warf, the fire station and hospital;
- Large hotels and other tourist centres such as San San; and,
- Schools.

2.26. The total calculated water demand from 2005 to 2025 is shown in **Figure 2.2**. The total 2025 demand is assessed to be 10.8 megalitres/day (330,000m<sup>3</sup>/month), somewhat lower than the 13.0 megalitres/day predicted by the 1996 Master Plan but more than the 2002 Review's 8.7 megalitres/day.



**Figure 2.2. Water Demand 2005-2025**

**Water Supply Distribution**

2.27. The Port Antonio area is currently supplied from the Grants Level Treatment Plant via the c.4,800 m<sup>3</sup> West Retreat Reservoir, which will continue to be the prime storage facility for the upgraded distribution. In the absence of definitive records of the existing network, details have been generated from interviews with NWC operational staff and the accuracy of the results remains to be confirmed during construction.

2.28. The present supply system has several short-comings that have had to be overcome. These include:

- Because of a shortage of resources, the reservoir outlet valve is closed each night, during which the tank becomes 50-75% full. When supply is restored each morning this volume is used within about 8 hours;

- The network consists of a 400mm diameter transmission main from which there are a series of smaller pipelines, 12.5-37.5 mm, with numerous dead ends and high head losses;
  - Hydrants are present only on main roads;
  - The pipelines are very old and require some 100-120 repairs each month; and,
  - 'Unaccounted For Water' (UFW) is estimated at 70% or more.
- 2.29. The design of the distribution network has been carried out using EPANET computer simulation of hydraulic behaviour in pressurised networks, and the results have been used to indicate the mains replacement programme proposed for the PAWSD Stage 1 works. The model assumed the 2025 predicted demand will be met with UFW 50%,and that the reservoir has sufficient capacity to absorb diurnal fluctuations.
- 2.30. With UFW at 50% there will be some hydraulic deficiencies outside the Project Area for which additional system reinforcement will be required. However, the capital investment for this could be deferred if UFW were reduced and sustained at the 30% level. If UFW is not further reduced and future investment not forthcoming, the scope for pressure management will be limited, which could affect fire fighting capability.

### ***The Generation of Sewage***

- 2.31. No existing central sewage collection system in Port Antonio and disposal facilities are limited to household absorptive systems, preceded in some areas by septic tanks. Some properties depend on pit latrines while others having no formal means of sanitary waste disposal.
- 2.32. Under the PAWSDP Stage I works, some 5 km of sewage network within the urban core of Port Antonio, bordered by Annotto and Caneside Rivers will be provided. While construction will not extend west of the Annotto River, the trunk system has been sized to accommodate future expansion to these areas.
- 2.33. Domestic sewage flows have been based on the estimated 2005 water consumption of 193 l/h/day rising to 211 l/h/day in 2025 and 85% of water consumption being returned to sewers. Sewage generation for the whole of the project area is therefore 165 l/h/day in 2005, increasing to 179 l/h/day in 2025. For the area to be sewered under the PAWSDP Stage 1 works the 2025 projected domestic sewage flow is 716 m<sup>3</sup>/day,when the extension area west of the Annotto River is expected to yield 455 m<sup>3</sup>/day.
- 2.34. Flows from industrial, commercial and institutional premises are based on the National Water Commission's water supply metering records, which since there are no major private water supply schemes serving Port Antonio are considered representative.
- 2.35. While detailed design of the sewerage system has been undertaken for a specific area it will be eventually expanded to other areas. The design therefore considers two scenarios; the 'Proposed System' and the 'Extended System' based on population and development projections to 2025.

- 2.36. The projected 2025 sewage flow, including infiltration, for the PAWSDP project area, 'proposed' and 'extended', is predicted to be 2270 m<sup>3</sup>/day, built up as shown in **Table 2.2**. Of this total, 1621 m<sup>3</sup>/day, 71%, will come from the area of the Stage 1 works and 649 m<sup>3</sup>/day, 29%, from the 'extension' area.

**Table 2.2. 2025 Sewage Design Flows**

Domestic	Hospital and Schools	Commercial	Hotels	Infiltration	Total
1066	264	538	106	296	2270

### ***Sewage Collection***

- 2.37. Hydraulic analysis and design for the proposed sewerage system utilised Micro-Drainage software with the primary criteria listed in **Table 2.3**.

**Table 2.3. Principal Sewer Design Criteria**

Design Feature	Value
Inflow	179 l/h/d
Peaking Factor A	5
Peaking Factor B	0.167
Overflow	0
Infiltration	15%
Minimum Backdrop Height	0.100
Depth from Soffit to GL	1.2 m
Minimum Velocity	0.6 m/s
Minimum Outfall Invert	0 m
Minimum Slope	1:1,000

### ***Storm Water Drainage***

- 2.38. Drainage design has examined the problems identified by the 1996 Master Plan and reviewed the proposed solutions using InfoWorks CS software to investigate hydraulic performance. Where the Master Plan proposals are found to be inappropriate alternative solutions have been developed.
- 2.39. Runoff factors for different types of land use were determined from site inspection and are shown on **Table 2.4**.

**Table 2.4. Runoff Factors**

Land Use	Runoff Factor
Roads & Footpaths	1
High Density Residential	0.4
Low Density Residential	0.3
High Density (heavy) Industry	0.8
Low Density (Light) Industry / Retail	0.75
Undeveloped Urban Areas	0.2
Rural Areas	0.2

- 2.40. The primary design criteria for the proposed drainage works are listed in **Table 2.5** and have been used wherever the limitations of the site allowed.

**Table 2.5. Primary Design Criteria for Storm Drainage**

Design Feature	Value
Capacity of Drains	1 in 10 year storm
Capacity of Major Gullies	1 in 25 year storm
Minimum Velocity	3.0 ft/s (approx. 1m/s)
Minimum Pipe Size for Storm Sewers	450 mm
Minimum Pipe Size for Catch Basin Connections	300 mm
Minimum Cover above Storm sewers	1,200 mm
Minimum Cover above catch basin Connections	900 mm

## Design for Extreme Conditions

- 2.41. The design of the PAWSDP works provides for the impact of extreme conditions in respect rises in sea level and storm surges, hurricanes, and seismic activity as follows:
- **Sea Level Rise** of 5 mm/year, widely accepted as being appropriate to the Caribbean, has been allocated wherever appropriate;
  - **Storms and Storm Surges** have been catered for by allowing for a 1 m storm surge;
  - **Hurricanes** and other strong winds have been allowed for in accordance with the *Caribbean Building Code (CUBiC): Section 2 Wind Loads* and with *British Standards BS 6399 Part 2 1995: Wind loads for Structural Design*; and,
  - **Seismic Activity** has been allowed for through the application of the *Seismology Committee of the Structural Engineers Association of California: Recommended Lateral Force Requirements, 7th Edition 1999* and *ACI Manual of Concrete Practice, Part 3 1999*.

## Proposed Construction Materials

2.42. The construction materials to be used for constructing the proposed works are proven by common experience to be 'fit-for-purpose' and are summarised in **Table 2.6**.

**Table 2.6. Proposed Stage 1 Construction Materials**

Item	Proposed Materials
Water transmission pipelines	uPVC and ductile iron
Trunk sewer pipeline	uPVC
Sewage collection pipelines	uPVC
Inspection chambers (manholes)	Reinforced concrete with cast iron access covers
House connections	PVC
Drainage culverts	Reinforced concrete
Drainage pipelines	Concrete
Foreshore Road revetment	Natural stone cemented in place
Caneside River bank protection	Gabion rock-filled baskets on Reno mattress

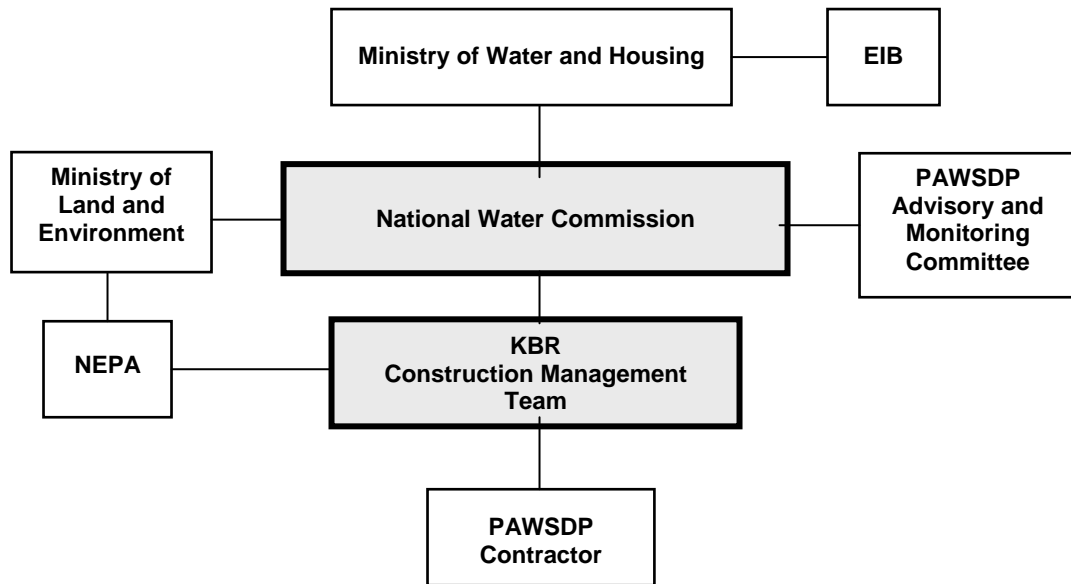


## 12. INSTITUTIONAL STRENGTHENING

- 12.1. This Section of the EIA comprises the third and final part of the Environmental Management Plan and discusses the institutional strengthening and capacity building required to effectively implement the PAWSDP EMP.
- 12.2. The project is not sufficiently large enough to encompass capacity building for GoJ agencies such as NWC and NEPA. NWC staff assigned to the project will attend the briefing sessions to disseminate the requirements and procedures for EMP implementation to those of the Contractor and Construction Manager.

### EMP Implementation Structure

- 12.3. Tendering for the PAWSDP Stage 1 and Stage 2 contracts will be competitive and Tenderers will be post-qualified. NWC is the Project Proponent, Kellogg Brown and Root (KBR) the Construction Manager and the Engineer<sup>1</sup>, and the organisational structure for EMP implementation shown in **Figure 12.1**.



**Figure 12.1. EMP Implementation Structure**

- 12.4. The Contractor will establish project offices and other facilities at Bryan's Bay. These will include provision for the NWC representative on site and the KBR construction management team.

<sup>1</sup> The two roles are almost synonymous but the title 'The Engineer' infers particular responsibility in engineering contract law.

- 12.5. KBR will monitor the Contractor's compliance with his responsibilities under the EMP and issue instructions as and when additional remediation may be required. NWC's Environmental Advisor will provide semi-formal auditing with the preparation of bi-annual (every 6 months) EMP Compliance Reports, copies of which will be submitted to NEPA and presented verbally at meetings of the PAWSDP AMC. Copies of these reports will also be lodged with the PPC, NEPA and NWC in Port Antonio for public reference.
- 12.6. While KBR will work closely with NEPA it will not circumvent their wider responsibilities in respect of environmental protection. NEPA officers will be given free access to all PAWSDP construction and other sites as and when they require, subject to any access and safety restrictions that may need to be imposed at specific sites.
- 12.7. Since the execution of the majority of works will be highly visible to the public, no special provision for generally informing the public of progress will be necessary. Notices of traffic diversions and temporary limitations on access will be issued separately. A visit to specific sites such as the treatment plant for members of the AMC will be organised if requested. Requests for visits by other groups will be accommodated subject to the constraints of construction activity, staff availability and public safety.

### **Training for PAWSDP EMP Implementation**

- 12.8. All NWC and KBR staff associated with the project will need to be made sensitive to the particular requirements of the PAWSDP EMP and briefing sessions will be held as staff are assigned to the project. A similar briefing will be given to the AMC prior to construction with the dual aim of eliciting their comments on the implementation procedures and allowing NWC to promote the vigorous consideration of environmental issues that will be imposed.
- 12.9. Briefing sessions will also be held for the Contractor's site managers and foremen as new or replacement appointments are made.

### **Training for Operational Performance and Monitoring**

- 12.10. As sections of the PAWSDP Stage 1 works are completed and handed over, NWC will assume responsibility for operational performance and monitoring.

### **Summary of Institutional Strengthening Requirements**

- 12.11. A summary of training requirements to achieve the institutional strengthening and capacity building necessary for PAWSDP EMP implementation are listed in **Table 12.1**.

**Table 12.1. Summary of Training Requirements**

<b>Training</b>	<b>Recipients</b>	<b>Duration</b>
EMP Implementation Requirements and Monitoring	KBR and NWC staff assigned to the project	1 Day
EMP Execution and Compliance	Contractor's managers and foremen	1 Day
PAWSDP Environmental Management	AWC and other invited attendees	Half Day

- 12.12. Briefing sessions will be given by the KBR Project Manager and Environmental Consultant. The cost of all training is included in either the cost of KBR's construction management contract or the cost of construction.

## 11. ENVIRONMENTAL MONITORING

11.1. This Section of the EIA presents the proposed Environmental Monitoring Plan for the PAWSDP Stage 1. After defining the Standards against which environmental performance will be assessed the details of the monitoring to be undertaken and how it will be reported is defined.

### Environmental Standards

11.2 NEPA and other Jamaican Standards have been adopted as the primary reference in developing the requirements for monitoring. Where Standards have been drafted but have yet to receive legal backing it is assumed this will be forthcoming during the period of PAWSDP execution and should be implemented as would have otherwise been intended.

11.3. While there are standards for air quality and noise as discussed in Section 4, they are both based on a single measure, PM<sub>10</sub> for air quality and 70 dB(A) beyond 50 m for noise. Given the likely impact of construction noise due to construction activity it is therefore recommended limits, as shown in **Table 11.1**, be placed on particular items of equipment when working within Port Antonio town.

11.4. The other principal standard against which project performance will be measured, the National Sewage Effluent Standard, has previously been presented in Section 2.

**Table 11.1. Proposed PAWSDP Noise Limits for Construction Equipment**

Activity	Source	Day	Night
Earthworks	Bulldozer/excavator	75 dB(A)	55 dB(A)
Piling	Piling machine	85 dB(A)	None
Structural	Concrete mixer/concrete pump	70 dB(A)	55 dB(A)
Surfacing	Roller	70 dB(A)	55 dB(A)

### Scope of Environmental Monitoring

11.5. Having discussed, in Section 10, the mitigation measures to be adopted to minimise potentially negative impacts, their success can only be determined by a programme to:

- Monitor any changes in the biophysical and social characteristics of the environment;
- Determine if these changes result from project or non-project causes;
- Identify and determine the impact of non-compliance with the EMP by the Contractor with particular regard to emissions and discharges that contravene adopted standards;
- Assess the effectiveness of impact mitigation; and
- Highlight any concerns unforeseen in the EMP and recommend additional mitigation.

**Construction Monitoring**

11.6. Whilst the routes of the water and sewerage pipelines are well known, other sites to be used during construction remain to be fully identified. These include the Contractor's Camp and project offices at Bryan's Bay and third party sites such as quarries. The provisions of the EMP and the requirement for environmental monitoring extend to these sites and monitoring during construction will therefore address the issues listed in **Table 11.2**.

**Table 11.2. Issues to be Addressed during Construction Monitoring**

At PAWSDP Construction Sites	At Other Sites used by the Contractor
Temporary obstruction of access; Traffic management; Noise and dust; Maintenance of existing utility services; On-site materials storage; Security of excavations; Disposal of excess spoil; Workers Health and Safety; and, Public Health and Safety.	Arrangements for access; Traffic management; Noise and dust; Wastewater disposal; Solid waste disposal; Materials storage; Workers Health and Safety; and, Public Health and Safety;

11.7. Monitoring by the Construction Manager will be mainly at construction sites and the Contractor's Camp. Monitoring of Other Sites will be undertaken by the Contractor with occasional visits from the Construction Manager. For a project the size of PAWSDP, these issues will be addressed qualitatively rather than quantitatively, except for noise, including construction equipment, and stack emissions from generators, for which the Contractor shall provide appropriate monitoring equipment. On completion of construction this equipment will become the property of NWC and lodged in the sewage treatment plant to be used for operational monitoring.

11.8. For ambient noise measurements to be meaningful, initial readings will be taken at various locations within area of the Stage 1 works prior to the commencement of construction, and effectively constitute baseline monitoring for which no information is otherwise available.

11.9. In conjunction with the Contractor, the Construction Manager will monitor the monthly consumption of materials including aggregates, hazardous materials, fuel, water and electricity, the disposal of surplus earth materials and other solid and liquid wastes.

11.10. The monitoring of Health and Safety shall, include but not be limited to H&S signage, the availability and use of protective headgear, footwear and other clothing, the occurrence of accidents and the potential for accidents in relation to general site condition.

**Complaint-Based Monitoring**

11.11. During the period of construction, monitoring to investigate complaints received from the public will be initiated by the Construction Manager. Complaints arising during operations will be investigated by NWC.

### ***Operational Monitoring***

- 11.12 Operational monitoring for the Stage 1 works will be limited to the visual inspection of sewers at manholes. Routine water meter readings and sewage flow measurements will be also undertaken to monitor leakage and to compare water demand and sewage generation with design expectations.

### **Access Requirements**

- 11.13. For the proposed programme of site inspections and monitoring to be effective it will be necessary for authorised personnel from NWC, the Construction Manager, NEPA and other key agencies to have guaranteed access to all component sites of the project at all times throughout construction and operation. Accordingly, contract documents and operating agreements should incorporate a Clause with intent equivalent to the following:

*Any Officer or Agent authorised in writing by the NWC, NEPA, their agents or other organisation for which from time to time it may be necessary, may at any time enter any premises whether prescribed or otherwise and may:*

- Examine and inspect equipment, control apparatus, monitoring instruments or plant;*
  - Take samples of any material that is emitted, discharged or deposited, or is likely to be, from such premises;*
  - Examine any books, records or documents relating to the performance or use of such equipment, apparatus, instruments or plant, or relating to the emission, discharge or deposit from such premises; and*
  - Photograph such premises as is considered necessary or make copies of any book, records or documents seen in the course of examination.*
- 11.14. The Construction Manager will be responsible for liaising between all involved parties and advising on all environmental issues, particularly those relating to compliance and impact mitigation.

### **Site Inspections**

- 11.15. Site Inspections provide for the day-to-day monitoring of construction activities and are the primary mechanism by which Contractor's performance will be assessed to have met his contractual responsibilities.
- 11.16. These inspections are the responsibility of the Contract Manager and will be carried out on a regular basis but not necessarily to a structured pattern. Any standard checklist or pro-forma used for recording observations should include a separate section under which to record environmental issues including incidents of non-compliance

- 11.17. Copies of all site inspection reports shall be available for reference at each Monthly Project Progress Meeting and 'Environmental Issues' will be a routine item on the meeting agenda and an 'Environmental Summary Sheet' compiled by the KBR Project Manager from previous site inspection reports will be tabled.
- 11.18. NEPA will undoubtedly wish to undertake site visits to satisfy themselves the EMP is being effectively implemented. These visits will be undertaken as and when they consider appropriate. NWC, KBR construction management, contractors and sub-contractors will facilitate free access to sites and data, subject to the same standards of access control and safety requirements applicable to their own staff. Coordination with NEPA will be handled by KBR and copies of NEPA visit reports will be tabled for discussion at monthly progress meetings.

### **Environmental Reporting During Construction**

- 11.19. For environmental monitoring to be both effective and meaningful it will be comprehensively reported to all concerned parties and, perhaps with limited exceptions, made available for public consultation. The primary levels of reporting will be as follows:
- Individual KBR Site Inspection Reports, tabled at Monthly Contract Progress Meetings;
  - Individual site visit reports by NEPA;
  - Bi-annual (6 monthly) EMP Compliance Reports.
- 11.20. These reports will incorporate the results of monitoring undertaken to confirm compliance with the Standards.
- 11.21. The bi-annual EMP Compliance Report will include:
- A review of the last six Environmental Summary Sheets;
  - A summary and discussion of environmental monitoring data;
  - Discussion of any abnormal events that may have influenced the empirical findings;
  - His/her own assessment from a one-day inspection of all project sites;
  - Discussion of any items outstanding from the previous Compliance Report;
  - Discussions with NWC Environmentalist and NEPA; and,
  - Recommendation of actions to be taken and/or improvements to the EMP.
- 11.22. The period of construction is currently expected to be 22 months, necessitating four EMP Compliance Reports. Should this period be extended, reporting will continue at six month intervals. If the final report is due within 3 months of the expected completion date it should be delayed to include discussion of final site clearance and Contractor's demobilisation.

- 11.23. There is no specific provision for formal Environmental Audits during construction. NWC will *de facto* audit the progress reports of the Construction Manager and prepare bi-annual (6-monthly) EMP Compliance Reports. With copies of the latter, NEPA will effectively audit NWC. The Compliance Reports will also be made available for public consultation.
- 11.24. Although the Funding Agency is unlikely to undertake formal auditing, missions during the period of construction may include members with particular responsibility for environmental issues.

### **Environmental Monitoring Costs**

- 11.25. The cost of environmental monitoring to be undertaken by the Construction Manager has already been included in KBR's contract with NWC. Monitoring to be undertaken by the Contractor will be included in the Tender Documents to allow Tenderers to make full provision in their offers. Operational monitoring costs will be borne by NWC.

### **Summary of Environmental Monitoring Requirements**

- 11.26. A full list of environmental monitoring requirements is given in Table 11.3.



**Table 11.3. Summary of PAWSDP Stage 1 Environmental Monitoring Requirements**

Project Phase	Category	Indicators	Location	Method	Duration	Frequency	Purpose	Expertise Required	Responsibility
Construction	Site Inspections	Site Clearance	Annotto River outfall	Visual and Descriptive, against a check list	For the duration of site clearance	Daily	To ensure compliance with the requirements of the EMP including Health and Safety	Experienced site supervision staff with knowledge of EMP and H&S requirements	NWC and Construction Manager
		Disruption to traffic, access and utility services; Materials storage; Disposal of spoil; Health and Safety.	All PAWSDP construction sites	Visual and Descriptive, against a check list	Throughout the period of construction	Daily when sites active			
		Traffic management; Wastewater disposal; Solid waste disposal; Materials storage; Health and Safety.	Contractor's camp	Visual and Descriptive, against a check list	Throughout the period of construction	Monthly			
		Traffic management; Wastewater disposal; Solid waste disposal; Materials storage; Health and Safety.	Other sites	Visual and Descriptive, against a check list	Throughout the period of construction	Quarterly			
	Air and Dust	PM <sub>10</sub> , Ambient Noise	All PAWSDP construction sites and Contractor's camp	Portable air quality monitoring equipment	Over 24 hours, at times to be determined by the Engineer	As deemed necessary by the Engineer	To quantify project impacts	Person trained in the use of the equipment	Contractor and Construction Manager
				Portable noise monitoring equipment	Over 1 hour, at times to be determined by the Engineer				
	Complaint Investigation	Any of the parameters listed above, depending upon the nature of the complaint	At or in the vicinity of all sites for which a specific complaint has been received	As appropriate for the parameter being monitored	As necessary	As necessary	To fully investigate all complaints and to provide a basis for mitigation and/or compensation	As necessary	NWC and Construction Manager
EMP Compliance	Contractor's compliance with Standards and EMP requirements. Low numbers of injuries to workers. Minimal public disturbance.	All sites of construction and project related activity	Site inspection and interrogation of site records	Throughout the period of construction	Every 6 months	To ensure Contractors comply with Standards and EMP requirements	NWC Environmental Advisor	NWC and Construction Manager	
Post-Construction and Operation	Sewer Condition	Sewer degradation	Throughout the gravity sewer network	Visual inspection	Ongoing	Annually	To regularly inspect the sewer network	NWC Inspection Engineer	NWC
	Leakage	No unexplained loss of flows	Throughout the water distribution network	Meter readings	Ongoing	Every 2 years	To reduce losses from the water distribution pipelines		

## 10. IMPACT MITIGATION

- 10.1. The impact mitigation discussed in this Section comprises the first element in the Environmental Management Plan (EMP). The other elements, Environmental Monitoring and Institutional Strengthening/Capacity Building are presented in Sections 11 and 12 respectively.
- 10.2. In addition, a series of Sample Contract Clauses for Environmental Impact Mitigation are given in **Appendix B**. Inclusion of these in the Tender Documents will enable Tenderers to be explicitly aware of their responsibilities to the environment in general and the EMP in particular, enabling them to make appropriate financial provision at the time of tendering.
- 10.3. The proposed mitigation to address the impacts previously defined in Sections 6 to 8 fall into one of the following six categories:
- Pre-Construction Impact Mitigation;
  - Construction Impact Mitigation: On-Site;
  - Construction Impact Mitigation: Off-Site;
  - Permanent Impact Mitigation; and,
  - Operational Impact Mitigation.

### **Pre-Construction Impact Mitigation**

- 10.4. Detailed Design of the PAWSDP Stage 1 has afforded the opportunity to minimise many potential adverse environmental impacts through the appropriate routing and sizing of water and sewer pipelines and drainage channels.

### **Construction Impact Mitigation: On-Site**

- 10.5. The majority of construction-related impacts are temporary and can be mitigated through good construction practice and effective site supervision. The World Bank has published<sup>1</sup> principles on waste management that are applicable to many construction activities and these will be utilised by NWC, their Construction Manager and PAWSDP Contractor.

### ***Disruption to Communication Routes***

- 10.6. The Contractor shall incorporate his programme his proposed arrangements for traffic diversions in the form of a Traffic Management Plan, with details of all necessary signage and any temporary works for approval by the Engineer. The programme shall also contain details of the timing of the proposed closure, dates of closing and re-opening the route, and of any necessary remedial works.

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<sup>1</sup> *Pollution Prevention and Abatement Handbook*. The World Bank, 1989.

***Damage to Public Utilities***

- 10.7. Record drawings of utility services in Jamaica are not always accurate and the Contractor shall accurately locate all services, by trial pitting if necessary, before work commences in any given area. Nevertheless, accidents will occur where small diameter water pipelines and low voltage power cables are unrecorded or where an excavator operator carelessly swing an extended boom into overhead cables. All such incidents shall be reported to the Engineer and the Contractor shall be responsible for the expeditious repair of accidental damage.
- 10.8. Prior to undertaking any works, the Contractor will obtain from the utilities agencies definition and details of all utilities sites within 50 m of the works. These agencies shall include, but not necessarily be limited to, the following:
- Jamaican Public Service Company;
  - Cable and Wireless Jamaica;
  - National Works Agency;
  - Portland Parish Council; and,
  - National Water Commission
- 10.9. Damage to any utility at a defined site shall be made good to the satisfaction of the responsible agency at the Contractor's cost. Damage to utilities not defined prior to construction, despite the Contractor having undertaken all reasonable liaisons with the responsible agencies, shall not be the responsibility of the Contractor. It shall be the responsibility of NWC to ensure the utilities agencies respond in good time to the Contractor's requests for information.
- 10.10. Contractors shall liaise with each of the agencies responsible for the maintenance of utilities that are to be crossed, temporarily diverted or otherwise affected by the works as to the timing and nature of any disruption of service. Where required by Jamaican law, the responsible agency shall be requested by NWC to carry out the necessary works at the time required and at NWC's cost. The Tender Documents shall contain sufficient information on utilities crossings to permit the Contractor to include the cost of the works for which he is responsible in his bid.

***Disruptions to Public Access***

- 10.11. Disruptions to public access shall be identified in the Contractor's Traffic Management Plan, under which suitable notice of intending delays and closures are given to all concerned parties and approved prior to commencing work. Notwithstanding this, all road closures shall be separately notified and agreed with the Portland Parish Council and the National Works Agency as appropriate, and with the Jamaican Constabulary and publicised through notices posted throughout the effected area at least 48 hours in advance of the proposed closure. Partial closures and traffic delays managed with temporary traffic lights or flagmen need not be separately notified.

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- 10.12. Where access to or from an individual property is closed for a period of 2 hours or more, the owner shall be informed at least 24 hours in advance. Vehicular access to and from hospitals, police stations and fire stations shall be maintained through the use of steel road plates over open trenches. Pedestrian access to schools, public libraries, courts, doctor's surgeries, pharmacists, and other premises frequently by the public will be maintained with the use of walking boards. Wheelchair and disabled access shall be maintained.
- 10.13. The laying of pipelines, backfilling and temporary reinstatement shall follow trench excavation as quickly as possible and trenches will not be left open for extended periods. Under normal circumstances, the period between trench opening and temporary reinstatement should not exceed 48 hours. It is recognised that extraordinary circumstances will occasionally arise and this period may be extended to 4 days with the approval of the Engineer. Where a longer period is necessary, the trench should be backfilled and re-excavated when required. Excavations for inspection chambers in roads shall not remain open for longer than 10 days.
- 10.14. All surfaced roads shall be subject to road cleaning and unsurfaced roads to dust suppression, the methodology and frequency of which shall be included in the Traffic Management Plan.

#### ***Derogation of Touristic Attraction***

- 10.15. Public infrastructure construction is noisy, dusty and unsightly, and will to some extent derogate from the architectural and other attractions Port Antonio and adjacent settlements offer tourists. All work sites should therefore be kept as tidy as is practicable, without obvious piles of unwanted material or abandoned equipment.
- 10.16. The Contractor shall consult with the Port Antonio Chapter of the Jamaican Hotel and Tourism Association (JHTA) and the Jamaica Tourist Board (JTB) to obtain their views on construction programming. However, with a construction period of 22 months, work will extend over at least 2 tourist seasons and which the Contractor will be encouraged to accommodate JHTA and JTB concerns he will not be bound by them without the approval of NWC.

#### ***Soil and Water Pollution***

- 10.17. The Contractor shall be required to perform all his activities in a manner that will prevent pollution of the soil by accidental spillage of solid matter, contaminants, debris, and other objectionable pollutants. If a significant spillage does occur, the Contractor shall remove all contaminated soil to a disposal site specified by the Engineer in consultation with NEPA. Appropriate replacement material shall be laid. All the costs of pollution remediation shall be borne by the Contractor.
- 10.18. The Contractor shall comply with all applicable regulations concerning the control and abatement of water pollution. In addition, His activities shall be performed in a manner that will

prevent the entry or accidental spillage of solid matter, contaminants, debris, and other objectionable pollutants and wastes into watercourses and aquifers.

- 10.19. The Contractor shall provide appropriate on-site storage facilities for chemicals in accordance with manufacturers' recommendations, and for fuel, within bunded areas that have the capacity to retain 110% of the volume of the storage tank. Quantities of chemicals retained at an individual construction site shall not exceed those required for short term use and in no circumstances more than is required for work at that site. In the event of a serious spill or contamination the Contractor shall immediately notify the Engineer. Remedial works required shall be undertaken as a matter of urgency by the Contractor or an appropriate specialist at the Contractor's expense. Failure to notify of such incidents will be considered a Breach of Contract.

#### ***Drainage, Erosion, Turbidity and Sediment Load***

- 10.20. Site clearance shall only be undertaken when immediately required to permit adherence to the approved Programme of Work. The maximum permitted elapsed time between site clearance and the initiation of construction shall be 5 days. The Contractor shall adopt a site clearance procedure that separates topsoil and stores it under appropriate conditions for reuse as instructed by the Engineer.
- 10.21. Where short-term construction work in a watercourse, or drainage channel is unavoidable, turbidity levels may be allowed to increase beyond those normally acceptable on agreement with the Engineer and NEPA. In such cases, the Contractor shall submit to the Engineer a programme of work detailing any proposed mitigation and the time frame of the required work, for prior approval.
- 10.22. All temporary discharge points shall be located, designed and constructed in a manner that will minimise erosion in the receiving channels.
- 10.23. The on-site storage of excessive quantities of unwanted spoil and aggregate materials should be avoided. Where storage is necessary, the Contractor shall ensure heaps and stockpiles are located at sites that they do not permit direct runoff into watercourses and are on land sloping at less than 1.5%. All heaps shall be of a size and stability that will ensure the risk of mass movement during periods of high intensity rainfall is minimized.

#### ***Noise and Dust***

- 10.24. Noise from construction activities will primarily be derived from the operation of plant and equipment. The Contractor shall ensure all his equipment is fitted with appropriate noise muffling devices that will reduce sound emissions to below those stipulated in **Table 10.1** and take ambient noise measurements as and when required by the Engineer.

**Table 10.1. Typical Noise Standards for Construction Equipment**

Activity	Source	Day	Night
Earthworks	Bulldozer/excavator	75 dB(A)	55 dB(A)
Trenching	Impact Drill	75 dB(A)	55 dB(A)
Surfacing	Roller	70 dB(A)	55 dB(A)
		70 dB(A)	55 dB(A)

- 10.25. All equipment shall be fitted with appropriate muffling devices in accordance with manufacturers' recommendations. Vehicles that are excessively noisy due to poor engine adjustment, damage to noise amelioration equipment or other inefficient operating conditions shall not be operated until corrective measures have been taken.
- 10.27. The Contractor shall ensure all plant and equipment is loaded and unloaded away from noise sensitive areas. Noise and dust sensitive premises will be identified in the Contractor's Traffic Management Plan. Any plant operated intermittently shall be switched off or throttled down during idle periods.
- 10.28. Operations on site shall be restricted to the hours of 0800-1900. Authorisation to extend the hours of working may be given by the Engineer but only where:
- Additional working is necessary to maintain the safety of the site, of site workers, or the public; and
  - It can be demonstrated that a short period of additional working will provide significant long-term benefits to affected communities.
- 10.29. The Contractor shall comply with all applicable regulations concerning the prevention of air pollution in Jamaica, especially those relating to stack emissions. In the conduct of construction activities and the operation of equipment, Contractors shall utilise all practical methods to control, prevent and otherwise minimize atmospheric emissions. Specifically:
- The methods of handling cement, marl and other fine materials shall include means of minimising atmospheric discharges;
  - Equipment and vehicles showing excessive emissions of exhaust gases due to poor engine adjustment or other inefficient operating conditions shall not be operated until corrective measures have been taken; and,
  - Burning of material from the clearance of trees, bushes and other combustible matter shall not be permitted.
- 10.30. The Contractor shall provide all necessary equipment and means wherever and as often as necessary to prevent dust generated by his activities from causing a public nuisance. Specific dust suppression measures will include:
- Damping down of sites and access roads;
  - Use of appropriate hoardings in the vicinity of sensitive sights;

- Covering all vehicles transporting materials likely to give off excessive dust; and,
- Not permitting lorries to be overloaded.

### ***Disposal of Surplus Materials***

- 10.31. The disposal of all surplus construction materials and debris shall be carried out in accordance with the regulations of the Jamaican Solid Waste Management Authority. The normal manner of disposal shall include all necessary precautions for minimising water and air pollution, drainage impedance, the risk of fire, and damage to ecosystems.
- 10.32. Surplus soil and rock materials shall be disposed of promptly in order to minimise the time of storage at the construction site and the risk of erosion and sediment discharge. Where it is known these materials will be required later in the Programme of Work they shall be stored in an appropriate manner.

### ***Public Safety***

- 10.33. Along pipeline routes, warning signs, warning tapes and notices will deter access to trenches. The excavation of trenches ahead of pipe laying and backfilling shall be limited such that the period from the time of opening a trench to temporary reinstatement shall not normally exceed 48 hours unless exceptional circumstances agreed with the Engineer prevail.
- 10.34. Work crews on roads shall include flagmen to provide for the safe passage of traffic and all work sites shall be adequately watched and lit during the hours of darkness.

### ***Worker's Safety***

- 10.35. The Contractor shall present a Health and Safety Policy for approval by the Engineer prior to commencement of work. This will contain normal internationally accepted procedures in relation to the risks imposed by the nature of the work to be undertaken, and equal or exceed the provisions contained in NWC's Health and Safety procedures.
- 10.36. The Contractor shall ensure all authorised persons present on all sites, be they his own staff, representatives of the Project Proponent or the Construction Manager, or other visitors, are aware of any site-specific safety requirements and are supplied with hard hats and other protective clothing appropriate for the work being undertaken. All PAWSDP Stage 1 sites shall be designated 'Hard Hat' sites.

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## Construction Impact Mitigation: Off-Site

### *Construction Camp*

- 10.37. The present proposal is for the PAWSDP construction camp, including site offices, to be located at Bryan's Bay, a largely industrial area on the western approach to Port Antonio.
- 10.38. For the safe and sustainable disposal of wastewater the Contractor shall supply a self-contained collection and disposal system, for which he shall obtain the approval of the Engineer and NEPA prior to installation. Where practical, the Contractor shall recover, treat and re-use wastewater. Tenderers will be expected to submit details of their proposed plant and arrangements for the ultimate disposal of treated effluent and sludge with their tender.
- 10.39. Tenderers shall include a list of the potentially polluting substances they intend to keep on site to enable NWC to consult with the NEPA on the precautionary measures required for their storage and handling. It is expected these will include, at a minimum, specific operational requirements such as:
- Definition of any materials to be isolated from each other;
  - Use of proper protective clothing and equipment by employees;
  - Definition of proper handling techniques;
  - Other safety requirements, ventilation, fire fighting equipment; and,
  - Any measures needed to contain and isolate spills and leakages to specific areas through the use of hard standings, internal drainage and the construction of holding tanks<sup>2</sup>.
- 10.40. The Contractor shall set aside a building or covered secure enclosure for the storage of lubricating and hydraulic oils, greases, solvents and other hazardous materials required for his operations. For the storage of petroleum for vehicles and fuel oil for generators and other machinery he shall utilise tanks composed of a material approved for the purpose securely fenced with access to authorised personnel only. The area beneath each tank shall be enclosed by a bund adequate to retain 110% of the volume of the tank. An area not less than 20 m beyond each compound shall be designated 'No Smoking or Naked Lights'. The Contractor's site records shall include details of chemical and fuel deliveries and their subsequent dispersal to site, to include date, quantities and responsible persons.
- 10.41. In the event of a serious spill or contamination, the Contractor shall immediately notify the Engineer. Remedial works required shall be undertaken as a matter of urgency by the Contractor or an appropriate specialist at the Contractor's expense. Failure to notify of such incidents will be considered a Breach of Contract.
- 10.42. For the disposal of waste other than surplus soil and rock, it is normal practice for a construction camp to be included in the existing municipal solid waste collection and disposal

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<sup>2</sup> In all matters related to Health and Safety it is preferred the Contractor submit a Community Affairs, Health, Environment and Security (CASHES) Plan for approval by NWC.



process. From their review of the materials to be stored on site, NWC should notify Contractors of any solid waste expected to be generated that may require special handling and treatment, and hence separation from other waste for collection and disposal.

- 10.43. If it is not feasible or desirable to incorporate the camp into established waste collection systems the Contractor will himself transport solid waste to an authorised NWSMA landfill or other disposal site approved by the Engineer.
- 10.44. A joint initiative<sup>3</sup> between GoJ and lead acid battery industries has recently been established to collect used batteries for export to recycling facilities. Collection centres have been set up in each parish and in Portland it is the Petcom Service Centre in Bryan's Bay. Used batteries are both toxic and corrosive and the Contractor will be required to deliver those he expends to this centre.
- 10.45. Mitigation of the impacts from construction traffic at the camp should primarily take three forms; access control, road cleaning and the definition of approved routes. Access control will require the restriction of turning movements to approved access points to and from existing highways, the erection of appropriate signage and, at night, adequate lighting. Road cleaning will be required to ensure major roads are kept in a safe condition, with oil, mud and other materials removed regularly. Wide or abnormal loads shall be transported between 2300 and 0500 hours with routes to be agreed with the Jamaican Constabulary, Portland Parish Council and other relevant authorities.

#### ***Other Sites***

- 10.46. The use of pre-existing already licensed quarries will reduce the potential for additional environmental damage. However, the prevailing practices of existing industries may be far from optimum. Any existing quarry to be utilised for the project shall therefore be subject to inspection by NEPA prior to its approval for use. In effect, it may be possible, to use the project to influence existing industries to improve their operational practices through incentive programmes, pre-qualification criteria, and environmental examination.
- 10.47. Of particular concern in the approval of quarries and other sites will be the following:
- Operations are restricted to daylight hours;
  - Noise and dust shall not impact on environmentally or socially sensitive areas; and,
  - Wastewater does not enter watercourses without control of sediment load, discharge velocity and wastewater quality.

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<sup>3</sup> The 2005 National Used Lead Acid Battery Project

## **Permanent Impact Mitigation**

### ***Induced Development***

- 10.48. Induced development of a type that is desirable and sustainable within the aspirations of the Port Antonio community is a major aim of the PAWSD and will therefore be viewed positively. For this to be achieved future development must be undertaken within the framework of proactive government policy and strict planning and environmental enforcement.
- 10.49. It is also vitally important that the new infrastructure, particularly the sewerage system, be made fully operational as soon as possible, if necessary with incentives, perhaps in the form of tax relief on connection charges or interest-free loans, to ensure all existing property owners are quickly connected to fully realise the benefits of the project.

## **Operational Impact Mitigation**

- 10.50. The most effective means of mitigating the majority of impacts arising from the operation of water, sewage and drainage infrastructure is effective management and operation, including preventive maintenance and the rapid response to emergencies.

### ***Water and Sewage Overflows***

- 10.51. The expeditious repair of pipe breakages will largely mitigate actual and potential sewage overflows.

### ***Odour***

- 10.52. As with air pollution and noise, the most effective means of combating the propensity of raw sewage to create odour is to maintain pipelines and ensure efficient operation.

### ***Soil and Water Pollution***

- 10.53. The mitigation of events most likely to result in soil and water pollution has been discussed above. In readiness for incidents NWC should develop an Emergency Response Procedure so the quantity and type of spilled material, and the measures and materials needed to clean it up can be identified without delay. At the same time NEPA, WRA and other potentially affected utility providers, adjacent land users and others would be advised of the potential hazard, the likely duration of adverse effects, and any special measures required.

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**Maintenance**

- 10.54. As with many other issues, the mitigation of impacts arising from the general maintenance of the water and sewerage networks will be programmed preventive maintenance and the rapid and effective response to emergencies.
- 10.55. It is surprisingly easy for minor problems to escalate due to the lack of appropriate documentation. The Contractor shall be responsible for the production of 'As Built' drawings and a set should be retained locally in a location to which maintenance crews have 24/7.

**Solid Waste**

- 10.56. The relatively small volumes of solid waste generated by pipe repairs can easily be dealt with by NWC's current waste disposal practices. All waste should be considered for recycling prior to disposal.

**Public and Worker's Health and Safety**

- 10.57. Public safety in respect of operational impacts is best secured through the prevention of unauthorised access.
- 10.58. Operational staff will be trained in and comply with all the provisions of the NWC's Health and Safety requirements.

**Environmental Enhancement Measures**

- 10.59. No particular measures for environmental enhancement are proposed under the project other than the overall objective of providing clean water and safe sewage disposal which will have a major positive impact on public health and the general improvement of the environment.

**Summary of PAWSDP Stage 1 Impact Mitigation**

- 10.60. The mitigation measures proposed for the PAWSDP Stage 1, together with the likely costs, is summarised in **Table 10.2**. Sample contract clauses for inclusion in the Tender Documents for construction are given in **Appendix B**.

**Table 10.2. Summary of PAWSDP Stage 1 Impact Mitigation Requirements**

Impact/Issue	Mitigation Measure	Responsibility	Comment
<b>Pre-Construction Impact Mitigation</b>			
Water Demand	Adequacy distribution pipework sizing	NWC and KBR	Implemented during Detailed Design.
Sewage Flows	Appropriate pipeline sizing, gradients and materials.		
Drainage Flows	Appropriate channel capacities		
<b>Construction Impact Mitigation: On-Site</b>			
Communication Routes	Disruptions to be identified in Traffic Management Plan; Inform the public of forthcoming delays; Use appropriate signage.	Contractor	'Good Practice' only
Public Utilities	Document all utilities within 50 m of work sites; Coordinate works with utility companies; Damage to defined utilities to be repaired at Contractors' expense.	Contractor and utility companies	'Good Practice' only
Public Access	Disruptions to be identified in Traffic Management Plan; Inform impacted owners ahead of disruption; Maintain vehicular access to emergency services; Maintain pedestrian access to public buildings; Use appropriate signage; Keep roads clean.	Contractor, PPC and NWA	'Good Practice' only
Tourism	Remove unwanted materials and equipment from work sites;	Contractor	'Good Practice' only
Soil and Water Pollution	Duty of Care to avoid spillage of all polluting materials; Comply with regulations regarding pollution abatement; Contaminated soil to be removed and replaced; Chemical storage to accord to manufacturer's recommendations; Fuel to be stored within bunded areas; All spillage to be reported; Remedial action to be undertaken as a matter of urgency; Incidents to be remediated at Contractors' expense.	Contractor	'Good Practice' only
Drainage, Erosion, Turbidity and Sediment Load	Site clearance ahead of construction to be restricted; Disruptions to drainage channels to have prior approval; Any short-term increases in turbidity to be approved; Dewatering works to avoid excessive turbidity; Store stripped topsoil in manner suitable for reuse; All stock piles and soil heaps to remain stable. Excess spoil and materials not to be stored.	Contractor	'Good Practice' only

Noise and Dust	All equipment to be fitted with appropriate muffles; Equipment/vehicles in poor condition not to be used; Noisy equipment to be located away from sensitive sites; Plant not left to run on idle; Restricted working hours, particularly for piling; Extension of normal working hours to be approved; All relevant Jamaican standards to be complied with; Cement handling to limit atmospheric discharge; Burning of debris from ground clearance not permitted; Damping down of sites and access roads; Hoardings to be used where appropriate; Vehicle loads likely to emit dust to be covered.	Contractor	'Good Practice' only
Surplus Materials	All solid waste regulations to be complied with; Unwanted materials disposed of promptly; Spoil for later use to be appropriately stored.	Contractor, NWC and PPC	'Good Practice' only
Public and Worker's Safety	Adequate warning tapes and signage to be provided; Flagmen to provide safe ingress and egress to work sites; Contractor to implement strict Health and Safety procedures; All visitors to be made aware of site safety requirements; Protective clothing and safety equipment to be provided.	Contractor	'Good Practice' only
<b>Construction Impact Mitigation: Off-Site</b>			
Construction Camp	Appropriate facilities for sewerage be installed; Treated wastewater to be re-used where possible; Polluting substances to be identified, stored and handled in accordance with manufacturers' recommendations; Fuel storage to be fully bunded; All spillage to be reported; Remedial action to be undertaken as a matter of urgency; Incidents to be remediated at Contractors' expense; Proposals for solid waste disposed to be approved; Lead acid batteries to be taken for recycling; Access control, including signage, to be implemented; Adjacent public roads to be kept clean; Wide or abnormal loads to be delivered at night.	Contractor, NWC, PPC and NEPA	'Good Practice' only
Other Sites	Priority to be given to the use of existing licensed quarries; Quarry operation restricted to daylight hours; Dust and noise to be suppressed as appropriate; Operations to be restricted to times of low wind velocities; Wastewater only discharged to watercourses after sediment load, velocity and quality control; Aggregate traffic to be subject to access control.	Contractor, NWC and site operators	'Good Practice' only

<b>Permanent Impact Mitigation</b>			
Induced Development	All future development to be undertaken within a framework of strict planning and environmental enforcement.	UDC and PPC	Beyond PAWSDP scope
<b>Operational Impact Mitigation</b>			
Water and Sewage Overflows	Broken pipes and other repairs to be undertaken without delay; Pumping station to be adequately maintained; No untreated sewage will be discharged during heavy rain.	NWC	
Odour	Effective maintenance of all elements of the sewerage system.	NWC	
Soil and Water Pollution	An Emergency Response Procedure to be developed.		
Maintenance	'As built' drawings and O&M manuals to be kept on site; Use of chemicals to accord with manufacturers' recommendations.	NWC	
Solid Waste	Application of strict waste disposal policy; Lead acid batteries to be taken for recycling; Other waste to be sold for recycling where possible; Appropriate final disposal of be decided after public consultation.	NWC	
Public and Worker's Health and Safety	Sites to be secure against unauthorised access; Operational staff to be trained in NWC health and safety procedures.	NWC	

## 9. ANALYSIS OF ALTERNATIVES

- 9.1. The history of the Port Antonio Water, Sewage and Drainage Project and the formulation of the proposals subject to the present environmental assessment have been summarised in Section 1. Investigations into a viable scheme were effectively curtailed with the tendering of detailed design and construction management in Contract in February 2003.
- 9.2. Recent investigations have therefore only been aimed at the downstream facilities beyond the Stage 1 works within Port Antonio town rather than revisiting the concepts and decisions concluded by previous studies<sup>1</sup>.
- 9.3. Water and sewage pipelines and storm water drainage are primarily located and designed to deliver specific levels of service to particular areas and there are no viable alternatives if these are not to be compromised. Participants at the EIA Scoping Session held on January 26th 2006 clearly recognised the benefits of the proposed levels of service and these need no be discussed further.
- 9.4. There are therefore few alternatives to consider in respect of the Stage 1 works, although 'Do Nothing' and 'Do Minimum' options are also available. The 'Do Nothing' or 'Without Project' option has previously been discussed in Section 2. The only alternative options analysed in the present section are therefore:
- 'Do Minimum'; and,
  - Alternative means of draining the Annotto River to West Harbour.

### **'Do Minimum' Alternatives**

#### ***'Do Minimum' - Water***

- 9.5. At the present time the residents of Port Antonio do not enjoy a 24/7 demand -led pressurised water supply. Outflow from the West Retreat service reservoir is curtailed each night to allow storage to build up so as to be available to supply the following day's demand rather than being lost to leakage, which is over 50%.
- 9.6. The proposed PAWSDP Stage 1 works are only upgrading the present distribution network within the town centre to reduce leakage and provide better control, in readiness for additional water being made available under the Stage 2 works. The design horizon of 2025 is reasonable and any proposal this should be earlier on the basis pipelines could be smaller cheaper, would be wholly

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<sup>1</sup> Primarily the 1996 Master Plan and the 2002 Master Plan Review.

uneconomic for the required cost outlay and would be likely to require demand management such that available per capita quotas were below those required for the maintenance of good public health.

- 9.7. The Stage 1 works therefore already constitute the only viable 'Do Minimum' option and will still leave NWC to make future connections to the urban area west of the Annotto River and other suburban areas.

#### ***'Do Minimum' - Sewage***

- 9.8. Port Antonio currently has no centralised sewage collection network and no facilities for the safe and sustainable disposal of septic wastes. The existing absorption pits, some preceded by septic tanks, and pit latrines in use throughout the town produce odour and discharge untreated effluent to storm water drainage channels, watercourses and the sea, rendering the twin harbours and adjacent bays highly polluted.

- 9.9. The network of sewers design under the project comprise a 'proposed' system and an 'extended' system, the former serving the present town centre area, the latter urban areas to the west beyond the Annotto River. Under the proposed PAWSDP Stage 1 works only the 'proposed' system will be constructed, albeit with trunk sewers sized to take the ultimate 2025 flow when NWC complete the 'extended' system in the future. Again the Stage 1 works reflect the only viable 'Do Nothing' option; any less will effectively be 'Do Nothing'.

#### ***'Do Minimum' - Drainage***

- 9.10. As previously discussed in Section 4, those areas fronting Bryant's Bay in the west, East Harbour east of Caneside River, and much of Port Antonio town centre are prone to flooding from the under-capacity of the existing drainage network and at some locations houses are flooded and roads damaged during less than 1 in 10 year storm events.

- 9.11. The proposed Stage 1 works are what have been identified to be the essential repair and rehabilitation that will enable all areas to withstand 1 in 10 year events. As with water and sewage, these drainage works are already the 'Do Minimum' and no reduced scheme would be either practical or cost effective.

#### ***Public Perceptions of 'Do Minimum'***

- 9.12. The majority of residents will understand that short term sacrifices such as noise and dust have to be suffered for long term gain, improved water and sanitation. Projects must therefore be extensive and far-sighted enough to solve serious problem permanently rather than temporary fixes for which the ultimate cost of solution will be far greater.



## Annotto River Drainage Options

- 9.13. Perhaps the only potentially controversial issue of the PAWSDP Stage 1 works is the proposal to reinstate the discharge capacity in the lowest section of the Annotto River between West Street and the Marina to alleviate flooding, which occurs with a 1 in 5 year storm.
- 9.14. The Annotto River rises some 3.5km south of Port Antonio and its upper catchment is characterised by steep slopes that generate considerable runoff and flow velocity. The river reaches Port Antonio in the Boundbrook area from where it turns sharply eastwards under Rice Piece Road to flow behind some 14 properties fronting West Palm Avenue before turning sharply again, northwards across West Street, to discharge into the Marina. The channel seaward of West Street is seriously constrained by mangrove and the Stage 1 proposal is to remove a portion of this growth together with accumulated silt over a length of nearly 200 m to reinstate the original river channel 20 m wide at its base, 30.4 m at its top and 1.3 m in depth to accommodate 1 in 25 year peak flood flows. The total required clearance is estimated to be c.3,750 m<sup>2</sup> of mangrove and 2,000 m<sup>3</sup> of silt.
- 9.15. Even though it is only intended to take out a portion of the existing mangrove, impact mitigation to overcome this loss could include compensatory planting of mangrove at Turtle Crawl and/or an alternative site to prevent a reduction in the overall mangrove coverage in the Port Antonio area.
- 9.16. Several alternatives to this proposal are possible but perhaps not feasible:
- Reduce the clearance of mangrove and provide for, say, 1 in 15 year rather than 1 in 25 year lows;
  - Construction of an overflow pipeline, box culvert or similar from Rice Piece Road bridge, northwards along this road, across Boundbrook Crescent, under the disused railway line, along main road and to the sea, a distance approaching 300 m;
  - Construction of an overflow through one of the plots fronting West Palm Avenue, across the railway sidings and to the sea, a distance of 150-200;
  - Construction of a diversion pipeline or culvert from the west side of the West Street bridge towards the sea, a distance of some 100-120 m;
  
  - Reduction in the clearance of mangrove would do little to protect the existing growth as regular pruning, perhaps every six months and at least annually would be required to maintain channel capacity.
  
  - The construction of an alternative route to the sea designed to take off the peak flows would be extremely expensive to construct, require extensive maintenance, and would probably prove not to be feasible after the detailed study that would be needed prior to design. The three options suggested above are not exhaustive, but serve to illustrate the

possibilities. Overflows further from the town centre are further from the sea. The longer the route the greater the cost, the nearer the town centre the greater the disruption to traffic and to the public. The third outflow alternative from West Street bridge would require extensive excavation across the new Marina Gardens. The longer routes would probably need to be constructed by tunnelling.

## **Summary of Alternatives**

9.17. A summary of the PAWSDP alternatives discussed above is presented in Table 9.1.

**Table 9.1. Summary of PAWSD Alternatives**

<b>Alternative</b>	<b>Potential Environmental Impact</b>	<b>Ease of Mitigation</b>	<b>Capital and Recurrent Costs</b>	<b>Suitability to Local Conditions</b>	<b>Institutional Requirements</b>	<b>Training Needs</b>	<b>Monitoring Requirements</b>
<b>Proposed Project</b>	Sustainable	Satisfactory	US\$ 20 million (in 2002)	Good, and provides a long term solution	Moderate	Moderate	Low
<b>Without Project</b> (See Section 2)	Serious	Difficult	Zero capital costs. Very high recurrent costs	Will become worse and further derogate Public Health with time	Moderate	Minor	None. 'Crisis' management only
<b>Do Minimum</b>	Less serious	Unknown	Unknown	Good, but only provides a short term solution	Moderate	Moderate	Low
<b>Annotto River Drainage</b>	Serious	Extremely Difficult	Unknown but very high	Poor	None	None	Moderate

## **8. POTENTIAL OPERATIONAL IMPACTS**

- 8.1. In this section the potential environmental impacts that may result from the long term operation and maintenance of the PAWSDP Stage 1 works are identified. Again, discussion of their mitigation is given in Section 10.

### **Water and Sewage Overflows**

- 8.2. Once the water distribution network is laid, tested and commissioned there should be no impact except for rare accidental breaks and leaks.
- 8.3. Sewage pipelines laid at a suitable depth with appropriate bedding material and adequate depth of cover should also be largely trouble free. Again occasional breakages may occur, but more frequent there may be blockages due to the disposal of inappropriate materials such as food waste, plastics and other household refuse where individuals are unaware of the limitations on sewer capacity.

### **Odour**

- 8.4. Odour emitting from sewer pipelines is indicative of septicity taken place within the line rather than under controlled conditions at the treatment plant. Given the Port Antonio sewers have been designed with appropriate pipe diameters and gradients to maintain self-cleansing velocities, there will be little potential for odour.

### **Soil and Water Pollution**

- 8.5. With the proximity of parts of the Stage 1 sewage collection network to the coast any overflow will quickly contaminate the surrounding soils, nearby water courses and ultimately near-shore environments.

### **Maintenance**

- 8.6. Solving any problems with water and sewage mains is likely to involve temporary road excavation to affect repair, resulting in traffic delay or diversion. Significant but short-term noise and dust will be generated and surplus spoil may remain to be disposed of. Service to consumers and customers is likely to be temporarily disrupted.

### **Solid Waste**

- 8.7. Solid waste produced from operation and maintenance of the Stage 1 works will primarily comprise excess spoil, broken concrete and road surfacing, broken pipes and fittings, from the repair of pipelines and inspection chambers. Overall, volumes will be insignificant.

## Public and Worker's Health and Safety

- 8.8. There will only be a risk to workers and the public if repair and maintenance crews do not abide by NWC's Health and Safety procedures.

## Employment

- 8.9. NWC will need to employ additional repair and maintenance crews to manage the new water and sewer pipelines and keep drainage ditches clear of accumulated debris. The numbers to be employed are not known but will be derived from the local community.

## Summary of Potential PAWSDP Stage 1 Operational Impacts

- 8.10. A summary of the potential risks from operational environmental impacts accruing from the PAWSD Stage 1 works is provided in Table 8.1 and their proposed mitigation is discussed in Section 10.

**Table 8.1. Summary of Potential PAWSD Stage 2 Operational Impacts**

Issue	Potential Operational Impact	Risk
<b>Water and Sewage Overflows</b>	Raw sewage leakage and due to pipe breakage	Minor, but short term if repair expedited
	Overflow from blocked pumping stations	Moderate
	Overflow from treatment ponds during heavy rain	Major
<b>Noise and Vibration</b>	Noise created during the excavation of pipes for repair	Moderate but for short periods only
<b>Air Quality</b>	Dust from excavations for pipeline repair	
<b>Odour</b>	Odour from sewers	Minor but none expected
<b>Soil and Water Pollution</b>	Overflow from broken pipelines and blocked manholes	Minor
<b>Traffic</b>	Vehicular movements of operational staff	Minor
	Septage tankers	Moderate
	Disruptions during network repairs	Moderate but for short periods only
<b>Solid Waste</b>	Broken road surfacing and soil from pipeline repairs	Minor
<b>Public and Workers Health and Safety</b>	Accidents due to unimpeded public access	Major

## 7. POTENTIAL PERMANENT IMPACTS

7.1. There are potentially no adverse environmental impacts arising from the PAWSD Stage 1 works.

### Public Health

7.2. The provision of safe and sustainable water and sanitation for a community such as Port Antonio will have a major positive impact on public health. For the full scope of benefits to be achieved, existing septic tanks and absorption pits should be taken out of service and made safe, and households and businesses connected to the improved water distribution and sewage collection networks with the minimum of delay.

### Induced Development

7.3. With the installation of improved water, sewage and drainage, Port Antonio will increase in popularity. Modern infrastructure induces development, stimulates investment and employment and helps improve marginal investment opportunities.

7.4. The extent to which development becomes a positive or negative impact will be determined by the effectiveness of the planning framework. With an ineffective framework the overall impact could be substantially negative. However, given one of the objectives of the PAWSDP is to create an atmosphere for environmentally acceptable residential and commercial expansion, it may be viewed more positively. Without an effective planning framework, vacant land in the vicinity of water and sewage pipelines may become prime targets for squatters who will make their own unauthorized connections.

### Summary of Potential PAWSDP Stage 1 Permanent Impacts

7.5. A summary of the potential permanent environmental impacts from Stage 1 of the project is provided in **Table 7.1**. The proposed mitigation of the potential impacts is discussed in Section 10 of the present report.

**Table 7.1. Summary of Potential PAWSDP Stage 1 Permanent Impacts**

Issue	Potential Permanent Impact	Risk
<b>Public Health</b>	Provision of safe and sustainable water and sanitation	Major and Positive
<b>Induced Development</b>	Unplanned development in the vicinity of water and sewerage services	Minor if planning system is effective

## 6. POTENTIAL TEMPORARY IMPACTS

- 6.1. This section identifies and discusses the potential impacts to be suffered during the period of construction, both at construction sites within the project and at other locations such as those of materials suppliers.

### Disruption to Communication Routes

- 6.2. The excavation of trenches and pipe installation along main roads within the town will result in considerable and unavoidable delays to traffic flows. At the present time, and until the Contractor has agreed a detailed Programme of Work the exact timing and duration of delays and the overall impact upon the community is difficult to assess. The impact upon vehicular movement will generally be confined to increased journey time and the costs associated with delays, which in the majority of cases will only be of minor inconvenience. Effective traffic management will be key in determining the severity of impacts.
- 6.3. Delays will be most noticeable during morning and evening peak 'rush-hours' even though these are relatively modest in Port Antonio. Resulting delays will be most serious when they impact ambulances, fire engines, blood bank vans and other emergency vehicles. There are expected to be no significant impacts to non-vehicular traffic.

### Disruption to Public Utilities

- 6.4. During the installation of new subsurface infrastructure it is very easy to damage existing service cables and pipelines or temporarily interrupt supplies to consumers. The levels of potential impacts arising from disruption damage to public utilities are summarised in **Table 6.1**.
- 6.5. Investigations during detailed design suggest there are few services within the vicinity of PAWSDP Stage 1 works. Telecom lines, including cable television, have been installed underground but most power and telephone cables are above ground. Also underground are water supply pipelines that are assets of the project proponent. A small number of telegraph poles and will need to be moved but disruption of services should otherwise be minimal.

### Disruption of Public Access

- 6.6. In addition to the general disruption of communications, pipe laying will result in the temporary loss of access as work progresses past individual property entrances. This will be most serious when crossing roads and in front of public building and emergency service centres.

### Derogation of Touristic Attraction

- 6.7. Construction sites are inherently unsightly and the PAWSDP Stage 1 works will be within Port Antonio town. At the present time, construction is programmed to commence within the early 2006-2007 peak tourist

season, but given it will continue for 22 months, through 2 or 3 tourist seasons, some impact, albeit probably minor, must be expected. Tourists will also share the impacts of traffic delays, noise and dust with the resident population.

**Table 6.1. Potential Impacts of Disruption to Public Utilities**

Utility	Nature of Impact	Severity
High Voltage Electricity Cables	Interruption of Supply	Severe production loss and public inconvenience
	Personal Injury	Likely death of operator
	Cost of Repair/Delay to Works	Very severe
Medium Voltage Electricity Cables	Interruption of Supply	Severe production loss and public inconvenience
	Personal Injury	Probable death of or serious injury to operator
	Cost of Repair/Delay to Works	Severe
Low Voltage Electricity Cables	Interruption of Supply	Localised but severe public inconvenience
	Personal Injury	Possible serious injury to operator
	Cost of Repair/Delay to Works	Minor production loss. Short public inconvenience
Trunk Distribution Pipelines	Interruption of Supply	Significant production loss and public inconvenience
	Personal Injury	Possible injury to operator
	Cost of Repair/Delay to Works	Severe
Local Water Networks	Interruption of Supply	Localised but significant public inconvenience
	Personal Injury	Unlikely
	Cost of Repair/Delay to Works	Minor
Telephone Cables	Interruption of Supply	Severe disruption to national and international telecommunications
	Personal Injury	Possible injury to operator
	Cost of Repair/Delay to Works	Limited
Telecom Cables	Interruption of Supply	Extreme disruption to national and international telecommunications
	Personal Injury	Unlikely
	Cost of Repair/Delay to Works	Very Severe

## Soil and Water Pollution

- 6.8. The risk of soil pollution at PAWSDP Stage 1 construction sites is relatively minor, and generally limited to accidental spillages of hydraulic oil, fuel oil and petroleum. Of particular concern is the potential for spillages to pollute watercourses and drainage ditches from where they will quickly reach the sea.

## Drainage, Erosion, Turbidity and Sediment Load

- 6.9. Some temporary dislocation of existing drainage systems is likely rehabilitation and pipeline construction. Adverse environmental impacts may include ponding, a threat to public health and safety, and damage to adjacent property.



6.10. In the vicinity of existing watercourses and drainage ditches short-term increased rates of erosion and sedimentation may result from:

- Installation of temporary discharge points, particularly in areas of friable soils; and,
- Loose and unconsolidated aggregate, fill and spoil heaps stored pending re-use.

**Noise and Dust**

6.11. Certain levels of noise and dust pollution are unavoidable in the vicinity of construction sites and some elevation of background levels is normally acceptable for limited periods. Excessive noise, particularly when experienced continuously, outside normal working hours and on rest days, can be a nuisance to both workers and the public. In extreme cases it may become a health hazard. Typical noise emissions for plant and equipment likely to be deployed in the PAWSDP Stage 1 construction are listed in **Table 6.2** together with typical international standards and the NEPA noise limit.

6.12. Night operations will therefore exceed these standards and most day operations will be uniformly excessive up to a distance of 20 m. Only the noisiest operations are likely to produce excessive noise at 50 m above the NEPE limit.

**Table 6.2. Noise Emission Levels for Various Types of Construction Plant**

Type of Plant	Distance between Plant and Observer			Typical International Standard		NEPA Limit
	5 m	20 m	50 m	Day	Night	
Loader	90	78	70	75	55	70
Grader	90	78	70	75	55	70
Vibration Roller	86	74	66	75	55	70
Bulldozer	86	74	66	75	55	70
Generator	98	86	78	75	55	70
Impact Drill	87	75	67	75	55	70
Concrete Mixer	91	79	71	70	55	70
Concrete Pump	85	70	62	70	55	70
Pneumatic Hammer	84	86	78	75	55	3

Figures in dB(A)

6.13. Although the frequent rain showers experienced in Port Antonio will suppress dust from excavation and on roads it may be a general nuisance for short periods within a broad corridor adjacent to the road, which may include gardens and areas used for drying household laundry.

**Disposal of Surplus Materials**

6.14. Wherever the material excavated from pipeline trenches is suitable, it will be reused, as general backfill, for example, around inspection chambers. The silt from the Annotto River will have a high water content and will

need to be dried before reuse, possibly as landfill cover. It is not expected that surplus material will need to be sent to a municipal landfill.

## **Employment**

- 6.15. Primarily a positive impact, the project will create significant temporary employment for construction workers, equipment maintenance and support staff. While a small number of senior project managers may come from overseas and other specialists from elsewhere is Jamaica, the majority of project staff are expected to be recruited locally from within the Port Antonio workforce. The number of temporary jobs created during both Stage 1 and Stage 2 of the PAWSDP is likely to be 100-150.

## **Public Safety**

- 6.16. Given the limited scale of construction for the PAWSDP Stage 1 the risk to public safety, in both physical extent and the types of risk posed, will be restricted. The most serious threats will be in the vicinity pipeline trench and inspection chamber excavations along public roads where they will be easily accessed. Other areas of public danger will include:

- Where heavy plant and equipment moves in and out of the Contractor's yard;
- Construction materials and fuel storage areas.

- 6.17. There will also be an increased risk of traffic accidents where delays and diversions are imposed or altered without adequate warning.

## **Workers' Safety**

- 6.18. All construction sites are inherently unsafe and for those employed on the project the risks are varied and omnipresent. They are however well understood and documented, and providing normal, accepted Health and Safety procedures are followed are easily minimised.

## **Construction Camps**

- 6.19. All major construction projects require a large area for site offices, the storage of construction materials and depending on the contractor's preference, facilities for the concrete and tarmac manufacture, concrete pre-casting and workers accommodation.
- 6.20. For the PAWSDP, an area adjacent to the A4 at Bryan's Bay, immediately west of Port Antonio town, has been identified but not fully delimited by the Portland Parish Council as the preferred location for the site offices and contractors facilities. The facilities to be provided will need to include 5-6-prefabricated offices and parking areas for the administration and technical staff of the Contractor, specialist sub-contractors, the Supervising Engineer and NWC. These will also include areas for materials testing and storage, and

equipment cleaning and maintenance. The contractors will be asked to maximise the employment of people from the project affected area and the need for residential accommodation is likely to be minimal.

- 6.21. The storage of materials will primarily comprise pipes and fittings. Pipe bedding material, aggregate, marl for treatment plant pond embankments and other quarried materials are readily available within Portland and are expected to be procured on-demand with only limited volumes held in the Contractor's storage areas. There should therefore be no requirement for rock crushing and grading within the Contractor's camp. Similarly, any pre-cast concrete items, such as inspection chambers are expected to be manufactured at a site already licensed for such activities. It is understood there are no asphalt plants in the Parish of Portland but since the need to tarmac in road reinstatement is limited it is expected this will also be brought in as and when required rather than produced by the Contractor locally.

### ***Access and Construction Traffic***

- 6.22. Ease of access to and from the site will be a fundamental requirement and proximity to the A4 is a pre-requisite. All points of contact between construction and existing traffic will potentially give rise to accident black spots due to the number of turning movements by construction traffic, its relatively low speed, increased damage to the road surface and the deposition of mud, chippings, oil and other foreign matter.

### ***Consumption of Water***

- 6.23. A significant adverse impact of construction camps is the consumption of water and even a small project can require 100 m<sup>3</sup>/day of water. It is expected that most fill material will generally be compacted dry. The pressure testing of pipelines will be carried out with compressed air. For PAWSDP, the testing of water retaining structures such as pumping stations, water will be used but limited to a single filling of the structure.

### ***Pollution***

- 6.24. Construction camps are major sources of a variety of polluting materials, including:
- Sewage from offices, accommodation blocks and canteens;
  - Wastewater containing high suspended solids;
  - Oil residues and industrial fluids from the washing of plant and vehicles;
  - Spilt fuel oil around fuel storage tanks;
  - Waste oil, grease and de-greasing solvents from vehicle and plant servicing; and
  - Solid waste, including paper, discarded packaging and crates, redundant plant, used tyres, and broken or failed concrete products
- 6.25. The major threat of pollution will be to surface and ground waters from the effluent produced by cleaning vehicles and plant with industrial detergents and solvents. There will also be some risk from the accidental

spillage of, and/or leakage from industrial materials stored on site, primarily fuel, other hydrocarbon products and construction chemicals such as concrete accelerators and hardeners.

- 6.26. Notwithstanding such a range of risks, all are relatively easily mitigated through effective management. The most substantial source of pollution from construction camps is therefore likely to be dust, noise and sediment load in surface watercourses.

### **Other Sites**

- 6.27. Other Off-Site areas include those from where aggregate and other construction materials are supplied by third parties and waste disposal sites. Materials from locations outside the direct control of the Contractor should only be sought from companies already registered and licensed to undertake the requisite activities, and who are able to satisfy the requirements imposed on such sites in the Environmental Management Plan. Only waste that cannot be directly re-used, sold or passed on for recycling should be discarded, and then only via a licensed waste management facility.

- 6.28. A potentially significant threat in respect of quarries will be the risk of accidents due to:

- Increased heavy traffic on certain sections of the A4 and some local roads;
- The increase in HGV turning movements and the implications for the free flow of existing traffic; and
- Foreign matter such as mud and loose chippings being deposited on roads.

### **Resource Consumption**

- 6.29. Significant quantities granular material will be used in the project for pipe bedding, general trench backfill, and road reinstatement. It is expected this material will be supplied from quarries from within 25-30 km of project sites and that no Borrow Areas will be required.
- 6.30. Obtaining these materials and disposing of any excess spoil and other waste materials will necessitate haulage, and hence the consumption of fuel.

### **Summary of Potential PAWSDP Stage 1 Temporary Impacts**

- 6.31 A summary of the potential risks from temporary environmental impacts during PAWSDP Stage 1 construction is given in **Table 6.3**. The proposed mitigation of the potential impacts identified above is discussed in Section 11 of the present report.

**Table 6.3. Summary of Potential PAWSDP Stage 1 Temporary Impacts**

<b>Issue</b>	<b>Potential Temporary Impact</b>	<b>Risk</b>
Existing Communities	Disruption to communications routes	Major
	Disruption of public access	moderate
Public Utilities	Interruption of supply, danger and cost	Variable. See Table 6.2.
Tourism	Imposition of unattractive activities	Moderate
Soil and Water Pollution	Pollution due to temporary activities	Moderate
	Pollution at the construction camp	Major
Drainage, Erosion and Sediment Load	Disruption of existing drainage networks	Minor
	Erosion from spoil heaps, stock piles and other loose materials	Minor
	Increased sediment loading in watercourses	Moderate
Noise and Air	Noise pollution from construction machinery	Major
	Air pollution from construction machinery	Major
	Mud on public roads	Major
Demolition	Public and Worker's safety	Minor
Use of Explosives	Public and Worker's safety	Minor
Surplus Spoil	Excess fill from pipeline trenches	Minor
Employment	Temporary local job opportunities for construction workers	Moderate and Positive
Public Safety	General construction activity	Major
	Traffic at construction camps	Major
	Heavy equipment movement and operation in public areas	Major
	Changes in existing traffic circulation	Moderate
Worker's Safety	Accidents common on construction sites	Moderate
Other Sites	Increased HGV turning movements at sites	Moderate
	Increased HGV movements on certain sections of the A4	Minor
	Mud and chippings on roads	Minor
Resource Consumption	Water use at construction camps	Moderate
	Use of aggregate resources	Minor
	Water use for construction	Minor
	Haulage	Moderate

## 5. ENVIRONMENTAL BASELINE CONDITIONS: SOCIO-ECONOMIC ISSUES

5.1. This section outlines the socio-economic conditions under which the project will be implemented, including the role of women and the importance of young people, using data from publications of the Statistical Institute of Jamaica (STATIN) relating to the 2001 Census and more recent information from the STATIN web site.

### Population

5.2. The last national census was last held on 10th September 2001 when the population of Jamaica was 2,607,632, of which 1,283,547 (49.2%) were male and 1,324,085 (50.8%) female. The previous census in 1991 recorded a population of 2,380,667, a growth rate of 8.7% over the intervening decade. By 2005 the total populations was estimated to have reached 2,731,832<sup>1</sup>.

5.3. The corresponding 2001 totals for the Parish of Portland were as follows:

- 2001 Total: 80,174, 3.1% of the national total, of which
- Males: 39,951 (49.8%)
- Females: 40,223 (50.2%)
- 1991 Total: 76,317
- 1991-2001 Growth Rate: 4.8%

5.4. 23.4% of Portland's 2001 population were urban and 76.6% rural. The corresponding figures in 1991 were 20.8% and 79.2%, indicating modest migration from the countryside to the towns, of which the largest is Port Antonio with a 2001 population of 14,541, up from 13,795 in 1991.

### Population Structure

5.5. The age structure of the Port Antonio population is shown in **Table 5.1**. 32% is under 15 years of age, 59.9% 16-64 and 8.1% older than 65. The national situation is similar and Jamaica has one of the most rapidly ageing populations in the developing world. Between 1970 and 2001 the proportion of 0-14 year olds fell from 44.8% to 33% while those 15-64 rose from 49.8% to 57.7% and 65+ from 5.4% to 9.3%. The reasons include increased life expectancy, declining fertility and continued high levels of external migration, 23,200 in 2002. Internal migration also affects a significant loss to Portland as shown in **Table 5.2**.

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<sup>1</sup> *World Fact Book*. US Central Intelligence Agency, November 2005.

**Table 5.1. The Age Structure of the Port Antonio Population**

	0-4	5-14	15-24	25-64	65+	Total
<b>Total</b>	1,461	3,199	2,542	6,183	1,184	14,569
<b>%</b>	<b>10.0</b>	<b>22.0</b>	<b>17.4</b>	<b>42.5</b>	<b>8.1</b>	<b>100</b>
<b>Male</b>	725	1,660	1,223	2,859	515	6,982
<b>%</b>	49.6	51.9	48.1	46.2	43.5	Mean 48.0
<b>Female</b>	736	1,539	1,319	3,324	669	7,587
<b>%</b>	50.4	48.1	51.9	53.8	56.5	Mean 52.0
	<b>Pre-School</b>	<b>School</b>	<b>Tertiary Studies or Working</b>	<b>Working</b>	<b>Retired</b>	

**Table 5.2. Internal Migration in the Parish of Portland**

Period	Total Migration	Males	Females
1970 - 1982	6,112	2,365 (38.7%)	3,747 (61.3%)
1982 - 1991	3,535	1,090 (30.8%)	2,445 (69.2%)

### ***Household Structure***

- 5.6. The 2001 census showed the average household size to be 3.4 persons in urban communities and 3.7 persons in rural communities. This is a significant reduction in the overall household size of 3.9 persons recorded in 1991. For Port Antonio the average household size was even smaller at 3.0.
- 5.7. Households in the poorest consumption quintile (41.1%) averaged 5.2 persons while those in the wealthiest quintile averaged only 2.3. The average number of children in households varied from 2.4 in the poorest down to 0.4 in the wealthiest. The head of 44.7% of all households was female.
- 5.8. Large households with more than 8 members were just 4.1% in 2001, substantially lower than the 15.6% recorded in 1975. Single member households comprised 27.5% of urban areas outside the Kingston Metropolitan Area (KMA) and 21.6% in rural areas.

### **Housing**

- 5.9. The majority of the population live in detached houses although shared houses and apartments are more common in the KMA, as shown in **Table 5.3**. The majority of houses, 63.3%, are constructed from blockwork

or steel although a significant proportion, 23.8%, are made from wood. Those in the poorest consumption quintile occupy 39.5% of all wooded houses whereas the wealthiest occupy only 15.2%.

**Table 5.3. Types of Housing**

	KMA	Other Towns	Rural Areas
Detached	52.0	78.9	88.7
Semi-Detached	6.7	2.1	0.7
Part of House	34.1	17.3	8.0
Apartment/Town House	6.0	1.2	0.7

Excluding institutional housing

- 5.10. The standard indication of housing stock is The Housing Quality Index (HQI), calculated from parameters such as type of premises, construction materials, the availability of electric light and indoor water taps, and the exclusive use of flush toilets and kitchens. The HQI for Jamaica in 2001 was 69.8, unchanged from 2000 and significantly better than the 61.3 recorded in 1991. There is little difference between the HQI for KMA (73.1) and other towns (72.1), but the Index is significantly lower for rural areas (65.7).
- 5.11. Just over half (57.3%) of all households own the property they live in, while 18.3% live rent-free and 22.9% pay rent. 1.3% of households are regarded as squatters. The total number of dwellings in Port Antonio in 2001 was 4,331.

## Public Utilities

- 5.12. Public utilities include services such as water supply, sewerage and electric power. 70.9% of households have access to public piped water supply, 13.1% to a public standpipe, while 3.1% use river and/or spring sources, 11.6% depend on rainwater harvesting, and 1.3% have private wells. Overall accessibility to 'safe' water is 84%. The proportion of houses with indoor water taps is 71.6% in the KMA, 60.2% in other towns and only 22.8% in rural areas. The sources of water for households in Port Antonio are shown in **Table 5.4**.

**Table 5.4. Sources of Household Water in Port Antonio**

Public Source				Private Source		Spring/ River	Other	Not Reported
Piped into Dwelling	Piped into yard	Standpipe	Catchment	Piped into Dwelling	Catchment			
59.35%	18.88%	9.58%	0.65%	0.65%	2.14%	3.67%	3.90 %	1.19%

- 5.13. Nationally, 61.8% of households have access to a flush toilet while 36.5% rely on pit latrines. However, only 18.3% of those with a flush toilet are connected to a centralised sewage collection and disposal system. The availability of toilet facilities in Port Antonio is shown in **Table 5.5**.
- 5.14. Jamaica generated 3,302 GWh of electricity in 2001, 3,525 GWh in 2002, but its availability remains elusive for many households. 94.2% of KMA homes had electric light, 88.1% in other towns and 79.5% in rural



areas. 11.3% of all households continue to rely on kerosene and 1.3% had no source of lighting. Outages due to power plant and distribution network failures are common.

**Table 5.5. Household Toilet Facilities in Port Antonio**

SHARED			NOT SHARED			No Facility	Availability and Type not reported
Water Closet	Pit	Not reported	Water Closet	Pit	Not reported		
9.97%	12.94%	0.18%	51.68%	20.82%	0.22%	2.00%	2.18%

## Community Services

5.15. Port Antonio is the commercial and administrative centre for other settlements within about 50 km and affords an appropriate range of community services which include:

- Primary, secondary and post-secondary schools;
- The East Campus of the College of Agriculture, Science and Education;
- A 150-bed public hospital, health clinic and dental clinic;
- National health service regional administration offices and public health laboratories;
- Regional offices of the Ministry of Education, NWC, NEPA and the National Works Agency;
- PPC offices, an infirmary, market and market administration, and a poor relief office;
- Divisional police headquarters, court with resident magistrates and a Bailiff's office;
- A fire station and post office;
- Government department offices including Inland Revenue, Customs and Excise, Motor Vehicle Examination and Social Security; and,
- Places of worship for several different confessions.

5.16. Access to Port Antonio and communications with other communities are at best difficult. The roads to Ocho Rios and Kingston are narrow, winding and generally in poor condition with frequent pot holes, although a new section of the North Coast Highway is under construction. Bus and route taxi services are available but inevitably slow. Both fixed line telephone and cellular network services are widely available.

5.17. The rail connection to Kingston and other towns was badly damaged by a hurricane in 1980 and never repaired. Although international air passengers have always had to transit via Kingston or Montego Bay, the Ken Jones Airstrip near St. Margaret's Bay used to receive internal and occasional chartered flights but has now closed due to the lack of capacity. Although cruise ships increasingly call at Port Antonio there are no regular ferry services to or from the town.

## Education

5.18. Taking 15-16 year olds as the most indicative group, 95% of those within the wealthiest quintile but only 67.6% in the poorest were enrolled in education in 2001. For those potentially involved in full-time education,

3-24 years of age, 73.7 % are enrolled, 92% in public schools and colleges and 8% in private institutions. The rates of enrolment by age for the upper and lower quintiles of the population are given in **Table 5.6**.

**Table 5.6. Rates of Enrolment in Education in Jamaica**

Age Group	Poorest Quintile		Wealthiest Quintile	
	1992	2001	1992	2001
3-5	63	87.6	81	100
6-11	97	99.5	99	100
12-14	93	96.4	98	100
15-16	65	67.6	92	94.6
17-19	11	21.7	40	71.9
20-24	1	2.2	5	15.0

- 5.19. Across all members of households not enrolled in education in 2001, 3.5% held a degree, 15.4% had passed CXC and/or A level exams, and 74.3% had no formal qualification. 86% of those in the poorest consumption quintile fell into the latter group but 52.3% of those in the wealthiest quintile also had no qualification. The present literacy rate in Jamaica is 79.9% and has remained at this level for the past 5 years.

## Employment

- 5.20. In April 2001 the Jamaican labour force was 1.106 million with 63% of the population 14 and over participating. Males are better represented than females, with 73% of 14+ males against 53.6% of 14+ females. By 2002 male participation had fallen to 72.6% while that of females had risen to 55.4%. 89.7% of the males and 79.5% of the females were employed when overall employment at 84.5% was somewhat less than elsewhere in the Caribbean (Barbados 87.7%, Suriname 89.4%, Bahamas 92.2%).
- 5.21. The spread of the labour force between the different occupational groups is shown in **Table 5.7** for April 2001. Females strongly dominate within the '*clerks, service workers ...*' group and just dominate the '*professionals, ...*' and '*elementary occupations*' groups. In those occupational groups where men outnumber women, they do so very strongly. Males tend to leave education earlier and the 2001 graduate classes from the University of West Indies and the University of Technology were respectively 71.1% and 59.5% female. In the parish of Portland the 2001 labour force was 25,200 of which 61.5% were male and 38.5% female.
- 5.22. The unemployment rate in Jamaica in 2001 was 15%, down from 15.5% in 2000. The male rate was 10.3% while the female rate was 21%. By 2004 this had dropped to 11.7% nationally, 7.9% among males and 16.4% among females. Unemployment among young people is most serious, as illustrated by the April 2001 figures shown in **Table 5.8**. Of those outside the labour force, 74.6% had no qualification, a fate shared almost equally between the sexes (male 74.1%, female 74.9%).

**Table 5.7. Division of the Labour Force across Occupational Groups**

Occupational Group	Proportion of Labour Force			Proportion of Group
	Total	Male	Female	Female
Professionals, senior officers and technicians	16.1%	12.3%	21.6%	55.7%
Clerks, service workers, shop and market sales workers	25.6%	14.4%	41.7%	68.6%
Skilled agricultural and fisheries workers	18.9%	26.0%	7.9%	17.7%
Crafts and related trades workers	16.3%	24.0%	5.3%	13.7%
Plant and machine operators and assemblers	6.3%	9.4%	1.9%	20.4%
Elementary occupations	17.1%	13.9%	21.6%	52.8%

**Table 5.8. Unemployment among Young People**

Age Group	Total	Male	Female
14 -19	47.4%	36.6%	64.5%
20 - 24	28.1%	21.4%	36.8%
25 - 34	13.9%	8.0%	20.6%

## Economic Activity

- 5.23. Jamaica enjoys a relatively stable economy with 2001 GDP at 2001 prices J\$ 334.7 billion. Production was 39.4% of GDP while services, including tourism, were 84.2%. Total exports were 17% of GDP and total imports 41%. After several years of single digit inflation, 7% in 2001, this has recently increased and is estimated to have been 12.4% in 2004. Public debt was 146.1% of GDP in 2004.
- 5.24. Traditional exports such as bauxite, alumina, sugar and bananas were worth US\$ 897 million in 2001 when Bauxite exports rose 120% from a historic low in 2000. Sugar and banana exports fell 14.7% and 8% respectively. Non-traditional exports, such as clothing, has fallen significantly in recent years, from US\$ 149.1 million (2000) to US\$ 88.5 million (2001) US\$ 15.9 million (2002).
- 5.25. Tourism contributed 85% of the Services proportion of GNP. In 2001 Jamaica hosted 2.12 million tourists, most, 1.12 million, 'long-term' while some 840,000 were short-term cruise passengers. By 2004 total visitors had reached 2.5 million and cruise ship passengers had exceeded 1 million. Hotel occupancy rates have averaged more than 56% for several years and tourism foreign exchange earning in 2001 were US\$1.24 million, slightly down from 2000 (US\$ 1.33 million) due to global security fears and Jamaica's reputation for high crime. Hotel occupancy on Port Antonio is the lowest of all the large coastal towns, 17.3% in 2000, down from a high of 25.4% in 1998.
- 5.26. Agriculture accounted for 6.6% of GDP in 2001 but fell to 5.5% in 2004. The main activities are the growing of sugar cane, bananas, coffee, citrus, yams and vegetables, the rearing of poultry and goats, and aquaculture. Arable land only accounts for 16% of all land and permanent crops occupy another 10%.

Irrigated land only accounts for 250 km<sup>2</sup>, 2.3% of the total island's 10,991 km<sup>2</sup> area. In recent years the Agricultural Production Index for both domestic and export arable crops have fallen while that for poultry, livestock and fishing has increased. Fisheries took over 5,000 tonnes of marine fish and over 2,000 tonnes of shellfish, (excluding aquaculture) and employing some 23,500 persons (including aquaculture) in 2000.

- 5.27. Agriculture in the Parish of Portland is best developed along the valley of the Rio Grande River and its tributaries, and this area receives substantial input from the EU-funded Banana Support Programme as well as CDB-funded support for the sugar industry.

### **Consumption and Poverty Reduction**

- 5.28. Mean annual per capita consumption of commodities in 2001 was J\$ 82,248, ranging from J\$ 116,176 in the KMA, 141% of the mean, to J\$ 85,687 in other towns and J\$ 59,138 in rural areas, 72% of the mean. The apportionment of consumption across the commodity groups is shown in **Table 5.9**.

**Table 5.9. Per Capita Consumption across the Main Commodity Groups**

<b>Commodity Group</b>	<b>KMA</b>	<b>Other Towns</b>	<b>Rural Areas</b>
Food and Beverages	37.8	45	50
Fuel & Household Expenses	3.4	4.7	6
Housing and Household Expenses	22.2	21.4	11.3
Personal Care	2.4	2.5	2.8
Health Care	2.9	3.4	3.8
Clothing and Footwear	6.5	6.7	7.2
Transportation	14.6	7.5	10.4
Education	6.1	5.1	4.9
Recreation	1.7	0.7	0.7
Miscellaneous Consumption	1.5	1.5	1.6

- 5.29. The poorest 10% of the population enjoy only 2.7% of consumption while the wealthiest 10% enjoy 30.3%. Even though GoJ efforts at poverty reduction are proving successful, an estimated 19.7% of the population, 10.9% of households, remained below the Poverty Line in 2002, with the prevailing incidence of poverty 7.6% of the population in the KMA, 13.3% in other towns and 24.1% in rural areas.
- 5.30. Despite a 17% rise in consumption between 2000 and 2001 the additional poverty reduction was only 1%, reflecting (i) the depth of prevailing poverty, and (ii) the increase in consumption being primarily taken by the higher consumption groups. The percentage of the population living on less than US\$ 2/day is estimated<sup>2</sup> at 13.3% and those on less than US\$ 1/day, 2%.
- 5.31. GoJ has a number of social welfare programmes, the most ambitious and far-reaching being the Social Safety Net (SSN) Reform Programme. The centrepiece of this is PATH, under which three earlier

<sup>2</sup> Jamaica's Human Development Report. United Nations, 2002

programmes, Poor Relief, Food Stamp and Public Assistance, have been merged. The scheme targets some 236,000 poor recipients; children 0-17 years (71% of target), those 60+, the disabled, pregnant and lactating women, and a limited number of 'special case' other adults.

## Health and Welfare

- 5.32. The health of the Jamaican population is fairly stable. Rural areas show a higher prevalence of illness and injury than the KMA or other towns but there is no correlation between illness and consumption group. In 2001 63.5% of the population sought healthcare services of which 38.7% exclusively used public facilities and 54.8% the private sector. Mean life expectancy is 73.3 years, shorter for males (71.5 years) than females (75.1 years).
- 5.33. Overall fertility has fallen significantly from 5.5 children/women in 1970 to 3.0 in 1993 and 1.95 in 2001. The crude birth rate was 21/1000 population and infant mortality 24.5/1000 live births. A surprising large proportion of babies are born out of wedlock; 83% nationally in 2001 and 84% in Portland. The average age at which mothers first give birth is 20.4 years and maternal mortality is 1.1/1000 population.
- 5.34. For common diseases such as polio, diphtheria, BCG and measles, immunisation of those 6-59 months is 93-96% with no difference between parishes, sexes or consumption groups. The WHO 'z-scores' for infant nutrition indicate only 6.4% of those 0-59 months are of low weight for their age, 5.9% are low height for their age (stunted), while just 2.8% are low weight for their height (wasted). Again these figures do not vary with parish, sex or consumption group.
- 5.35. In 2001 there were 15,511 recorded deaths, of which 431, 2.8% were in the Parish of Portland. The seven most common causes of death in 2000 are shown in **Table 5.10**.

**Table 5.10. Most Common Causes of Death in Jamaica**

Cause	Of All Deaths	Of Male Deaths	Of Female Deaths
Cerebrovascular Diseases	12.62%	10.56%	14.95%
Diabetes Mellitus	10.11%	6.82%	13.84%
Ischaemic Heart Diseases	5.94%	5.11%	6.89%
Other Heart Diseases	5.77%	4.79%	6.88%
Hypertensive Diseases	5.67%	5.29%	6.09%
Malignant Neoplasm of the Prostrate	3.32%	6.25%	n/a
HIV/AIDS	3.00%	3.48%	2.45%
Pneumonia	2.50%	2.49%	2.52%

## The Role of Women

- 5.36. The right of women to work and participate in the development process without hindrance or discrimination is enshrined in Jamaican Law and there are no sectors of employment from which females are barred by

law. They comprise 51% of the population and head nearly 45% of all households. Nationally, 54% of 14+ women participate in the labour force (38.5% in Portland).

- 5.37. Although women enjoy better educational attainment this does not manifest itself in practice. In 2001, 21% of females were unemployed compared to 10% of men. Within the 14-19 age group 64.5% of females were unemployed but even among those who may have taken education to higher levels, 25-34 year olds, female unemployment was still 20.6% as opposed to 8% for males. The average income of females in 2001 was US\$ 2,696, 60% of that of males (US\$ 4,492). Nevertheless, it is estimated that women, including those only working in the home, are primarily responsible for awareness and education, and frequently control 70% or more of total family resources.
- 5.38. It has long been recognised that the availability of clean water for drinking, food preparation and sanitary facilities for the disposal of human waste is a major element in the protection of public health. Equally recognised secondary benefits include improved family relationships and better educational attainment. Unsanitary living conditions put a strain on marital relationships and a child who arrives at school clean and having eaten hygienically prepared food will be in a better frame of mind to learn. Women are more commonly the prime mover in maintaining the home, providing food and child rearing, whether or not they are also employed. It is therefore inevitably that women and children are the major beneficiaries of projects to improve public infrastructure such as the PAWSDP.

### **The Importance of Young People**

- 5.39. The Youth of Jamaica, those under 29 years of age<sup>3</sup>, comprise 64% of the island's population (62% in the Parish of Portland) and with an average of 145 live births each day but only 47 deaths this proportion will continue to grow for the foreseeable future.
- 5.40. Today most young Jamaicans have unprecedented access to basic healthcare, education, and other services and have a positive view of their future<sup>4</sup>. Education and training is the most important factor in determining future qualifications, attitudes, and capabilities, and the well being of Jamaican society. Positive values and productive skills quickly translate into increase productivity and competitiveness.
- 5.41. Securing satisfactory employment at reasonable rates of remuneration is the prime concern of young people in the increasingly competitive job market. They have a strong desire to participate in decision-making and to end what many perceive to be their marginal role in society. The challenge is to formulate policies and practices that offer the freedom young people need to develop to their full potential as productive citizens.

<sup>3</sup> As defined by the United Nations Development Programme

<sup>4</sup> *National Youth Policy*. National Centre for Youth Development, 2003.

- 5.42. The improved living conditions resulting from the PAWSDP, both in individual homes and in the community, will make it easier for young people to keep themselves healthy, encourage them to take greater advantage of education opportunities, and develop better relationships inside and beyond their immediate family. With modern infrastructure the presently depressed economic conditions in Port Antonio will improve. Consequential employment opportunities will be created and young people may be less tempted to migrate to other parts of the island.

### **Project Affected Persons**

- 5.43. There is no requirement for land acquisition or involuntary resettlement in respect of the PAWSDP Stage 1 works.

## 4. ENVIRONMENTAL BASELINE CONDITIONS: BIOPHYSICAL ISSUES

### Climate

- 4.1. Jamaica enjoys a tropical climate with temperatures fairly constant all year due to the moderating influence of the warm Caribbean Sea. On the coast average maximum and minimum temperatures are 30.3°C and 22.0°C respectively, with an average of 26.2°C<sup>1</sup>. Inland temperatures vary with elevation. The warmest months are June to August and the coolest December to April.
- 4.2. The long term mean average rainfall between 1881 and 1990 was 1895 mm, the maximum being 2690 mm in 1933 and the minimum 1895 mm in 1920. The highest rainfall is experienced in the mountains, often more than 5080 mm/year, and the lowest, less than 890 mm, along the south-east and southern coast. There are two distinct wet seasons, May to June and September to November, and the driest months are December to March. Short duration rainstorms are common throughout the year and in Portland rain can fall for several days with little respite.
- 4.3. For much of the year winds are dominated by the Northeast Trades. By day along the north coast, sheltered from ocean swells by Cuba 150 km to the north, sea breeze combines with the trades to give an ENE wind with an average speed of 15 knots. Between December and March local winds are a combination of trades, sea breezes and a northern or north-westerly component associated with cold fronts and high pressure.
- 4.4. By night, the trades combine with land breezes and north coast night winds often have a southerly component with a mean speed of 5 knots. By day in June and July, mean offshore winds often reach 23 knots along the north coast. Overall, winds are lighter inland and towards the west, stronger towards the east. Wind roses for the North Coast of Jamaica are shown on **Figure 4.1**.
- 4.5. Variations in the hours of sun vary little during the year but are greater between coastal and inland areas. The maximum length of day, over 13 hours, occurs in June with the minimum, 11 hours, in December. Mean hours of sunshine are 6 hours in the mountains and up to 8 hours along the coast. Afternoon showers are the major cause of daily variations in relative humidity. Values on the coast at 7am may average 84% for temperatures in the mid 20°C and 71% at 1pm
- 4.6. Mean monthly climatic data for Port Antonio between 1951 and 1980 are given in **Table 4.1** with mean rainfall and temperature variations illustrated in **Figure 4.2**.
- 4.7. Jamaica is located within the Caribbean hurricane belt and there is a long history of strong tropical storms and hurricanes causing damage on the island. Winds of 60 miles/hour or more were recorded 35 times in the 135 years to 2005 for the island as a whole and 26 times in Port Antonio with average frequencies of

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<sup>1</sup> Source: National Meteorological Service of Jamaica



once every 3.86 years for the island and once every 5.19 years for Port Antonio. Jamaica as a whole is directly hit<sup>2</sup> once every 27 years and Port Antonio every 10.4 years. The tracks of historic hurricanes across Jamaica are shown in **Figure 4.3**.

**Table 4.1. Mean Monthly Climatic Data for Port Antonio 1951-1980**

	J	F	M	A	M	J	J	A	S	O	N	D
Max Temp (°C)	28.1	27.6	28.6	29.3	29.5	30.7	30.7	30.7	03.5	29.8	29.2	28.5
Min Temp (°C)	19.2	18.9	19.4	20.1	21.1	21.6	21.8	21.8	21.8	21.7	20.8	20.6
Rainfall (mm)	224	144	113	170	299	339	257	250	277	352	359	298
Rel. Hum 7am (%)	86	88	87	86	87	87	88	87	86	86	87	87
Rel. Hum 1pm (%)	78	77	77	77	76	78	75	75	77	80	81	81
Sunshine (hr)	6.1	6.3	6.8	7.4	7.2	7.0	7.6	7.6	7.2	6.9	6.5	6.1

4.8. Notable past tropical storms and hurricanes effecting Port Antonio include:

- 1874: 90 mph winds;
- 1880: 80 mph winds, over 20 people killed;
- 1912: 150 mph winds, massive storm surge, over 100 killed island wide;
- 1917: Very high storm surge along the northern coast;
- 1944: Heavy damage with thousands left homeless island wide;
- 1951: 85 mph winds with much higher gusts causing heavy damage;
- 1980: Moderate damage;
- 1988: Moderate damage;
- 2004: 155 mph winds, moderate damage; and,
- 2005: 110 mph winds, severe damage locally from wind and heavy rain.

4.9. The official Hurricane Season lasts from 1st June to 30th November but tropical weather systems can occur from April to December. There is common public perception that the frequency of severe storms is increasing as a result of global warming. While statistics appear to support this view the long term significance of recent storms and the cause for any increase remains to be proven.

## Geology and Structure

4.10. Jamaica is situated on the northern margin of the Caribbean Plate near where it abuts the North American Plate, The plate margin is the tectonically active east-west trending Cayman Trough that separates Jamaica from Cuba.

4.11. Structurally the island comprises an east-west trending anticline upon which has been superimposed two dominant sets of block faulting. A series of east-west strike-slip faults and two sets of rift faults divide the island into three major blocks; the Hanover Block in the west, the Clarendon block in the centre and the Blue Mountain Block to the east.

<sup>2</sup> A 'direct hit' is defined as the centre passing within 40 miles.

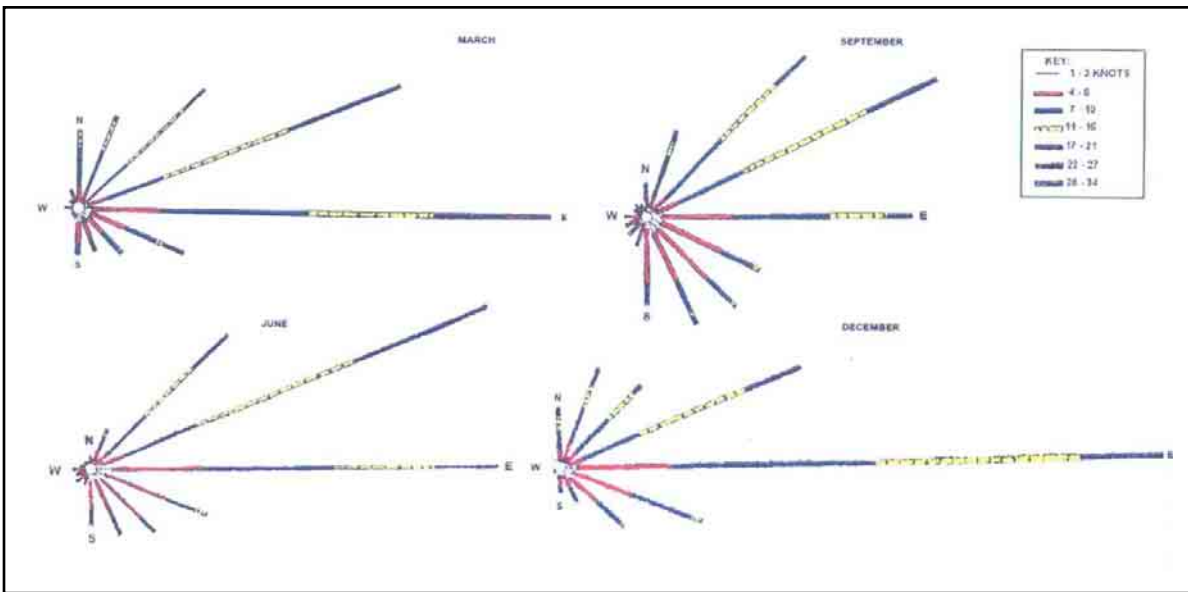


Figure 4.1. Wind Roses for the North Coast of Jamaica

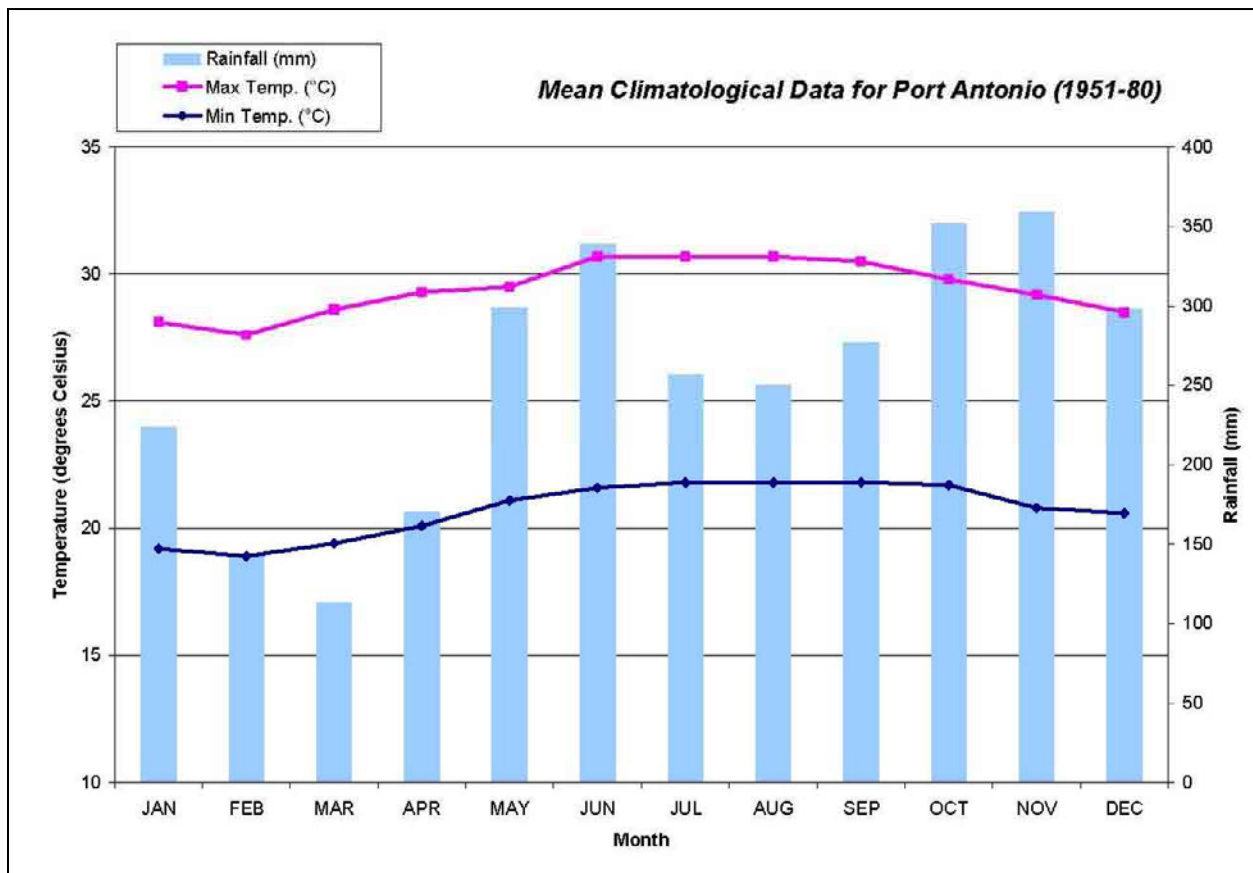


Figure 4.2. Mean Rainfall and Temperature Data for Port Antonio 1951-1980

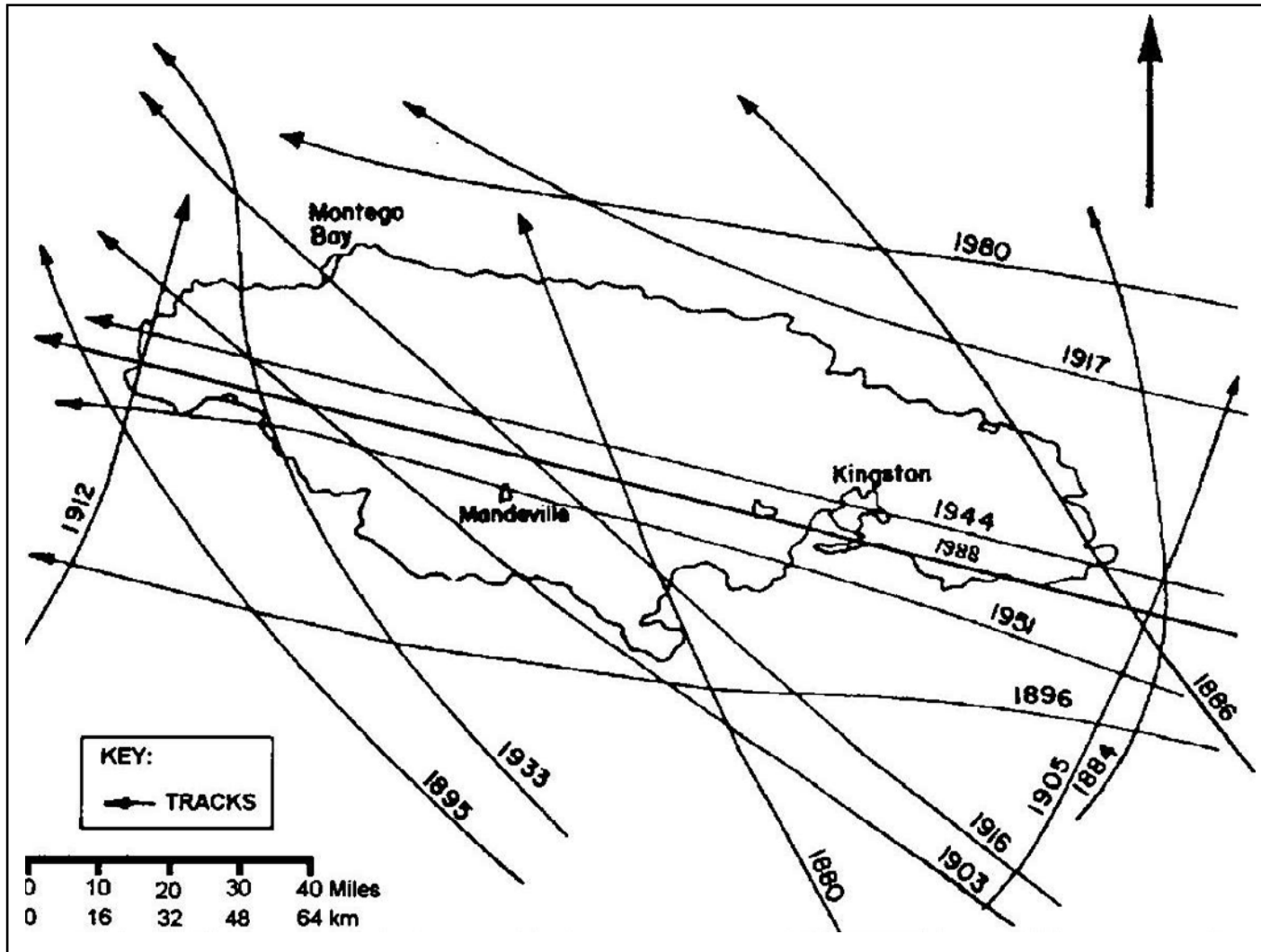


Figure 4.3. Historic Hurricane Tracks 1880-1988

4.12. Stratigraphically the island comprises three major components:

- Tertiary limestones;
- Post-Cretaceous trough sediments, volcanics and intrusives; and,
- Cretaceous basement complex.

4.13. In the area where the limestone cover is breached, older rocks, sedimentary, igneous and metamorphic, are exposed as a series of inliers. The largest is the Blue Mountain Inlier, with Port Antonio located at its northern end, for which and the stratigraphical succession is given in **Table 4.2**. A simplified geological map of the area is presented in **Figure 4.4**.

**Table 4.2. The Stratigraphy of the Port Antonio Area.**

Age		Group	Formation
<b><i>Sedimentary Strata</i></b>			
Q	Quaternary and Recent	Alluvial deposits along major watercourses. Elevated Reef adjacent to the coast.	
Mm	Lower Miocene to Middle Eocene	White Limestone Group	Montpelier Formation
Egb			Gibraltar-Bonny Gate Formation
Ef	Middle Eocene	Yellow Limestone Group	Font Hill Formation
Er	Lower Eocene	Wagwater Group	Richmond Formation
Cb	Upper Cretaceous		Bellvue Formation
<b><i>Igneous and Metamorphic Rocks</i></b>			
	Upper Cretaceous	Granodiorites	

4.14. Quaternary and Recent sedimentary rocks are common throughout the coastal plain. The majority of PAWSDP Stage 1 pipeline routes will be in and clays and other superficial material with a high proportion of Made Ground.

4.15. Jamaica is well known as one of the world's major producers of bauxite used in the production of aluminium but it also contains extensive deposits of other minerals, including gold, with extractable reserves estimated at 75,000 tonnes<sup>3</sup>. Non-metalliferous minerals are also important and include:

- Limestone, for the chemical industry;
- Crushed stone aggregate for construction;
- Marble for decorative stone;
- Clay for bricks, pottery and ceramics; and,
- Gypsum/Anhydrite for chemicals and construction.

<sup>3</sup> Jamaica Promotions Corporation, www.investjamaica.com

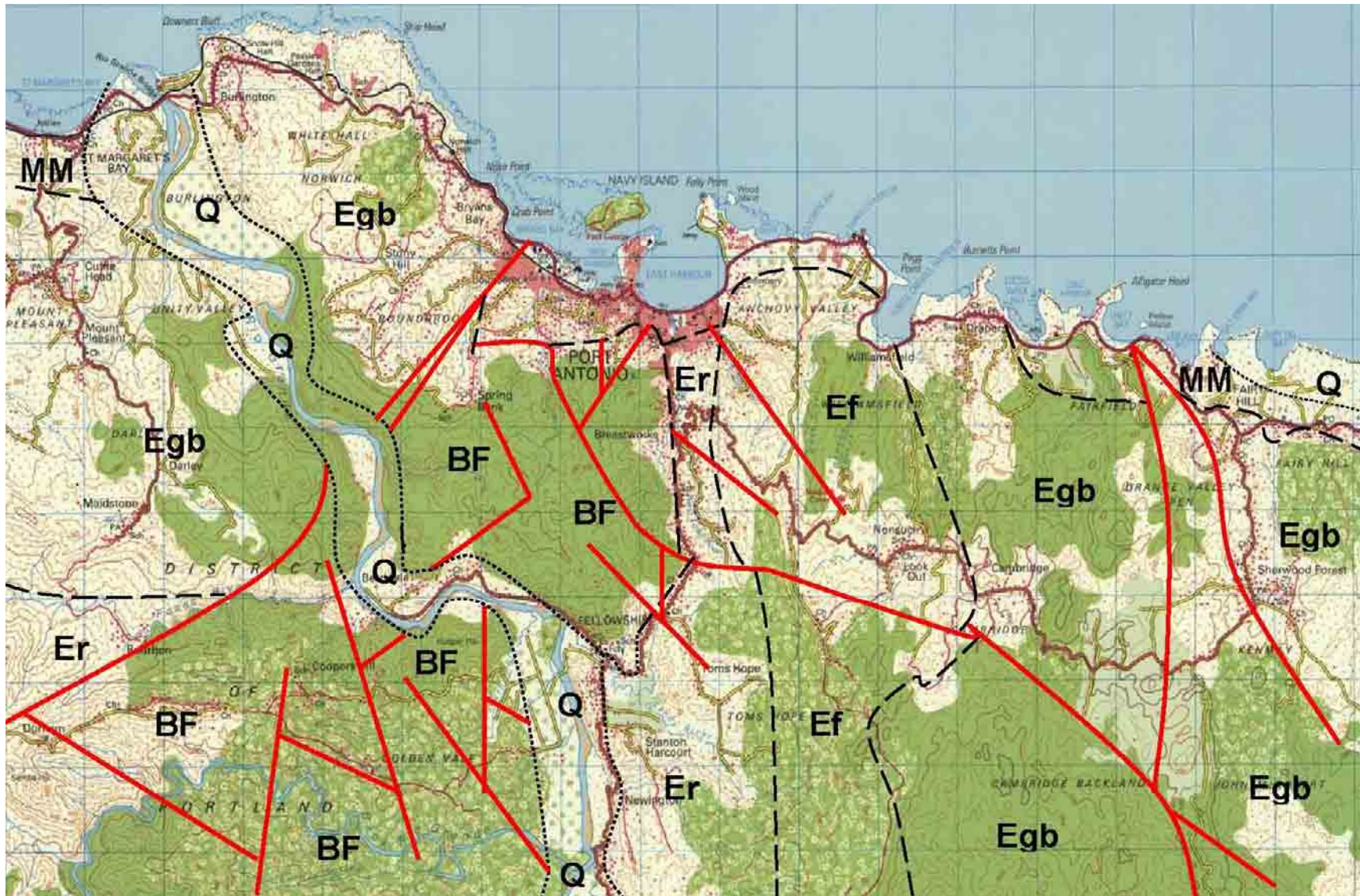


Figure 4.4. Simplified Geology of the Port Antonio Area

- 4.16. Quarrying is practiced in every parish and in accordance with the Quarries Control Act of 1983 the Mines and Geology Division of MLE has established the quarry zones shown in **Figure 4.5**, to reduce the wide dispersion of quarries while satisfying the demand for aggregate. The Parish of Portland is relatively 'quarry-free' with just one zone west of Buff Bay, some 25 km west of Port Antonio.

### Topography and Land Use

- 4.17. Port Antonio is located north of the Blue Mountains and John Crow Mountains. The Blue Mountains rise steeply within 5 km of the coast and reach a maximum height of 2256 m, the highest in Jamaica, at Blue Mountain peak some 18 km SW of Port Antonio. The John Crow Mountains rise more gently from the east and reach a height of 1,140 m. The two ranges are separated by steep valley of the Rio Grande River.
- 4.18. Although most of the project area falls within the John Crow Mountain Range the influence of the Blue Mountains is substantial since their steepness and height largely influences rainfall, while the river and alluvial sediments of the Rio Grande determine the nature and extent of agricultural activities.
- 4.19. The coastal plain below the two mountain ranges is dissected by perennial and seasonal streams. West of Port Antonio the richly vegetated slopes extend to the shoreline, which is dominated by steep cliffs 5-20 m in height. At Port Antonio the coastal plain widens to its maximum and partially encloses two deep embayments, East Harbour and West Harbour. A short distance from the Tichfield Peninsular that separates the twin harbours is the 26 ha richly vegetated Navy Island. East of Port Antonio the coastal plain again narrows and there are several smaller embayments around which are varying degrees of flat or gently sloping land. Inland are richly vegetated gentle to steep hills which rise to 200 m and an extensive network of secondary and tertiary roads serve small-medium sized farming communities.
- 4.20. The built-up area of Port Antonio follows the narrow coastal plain and the PAWSDP area does not exceed 20 m above mean sea level. The majority of the PAWSDP Stage 1 works will be undertaken along public roads or in existing drainage channels or watercourses within the existing built up area of the town. Water and sewage pipes will be laid within the existing road corridor, beneath the road pavement or within the grass verge.
- 4.21. There is no requirement to acquire land for the PAWSDP Stage 1.

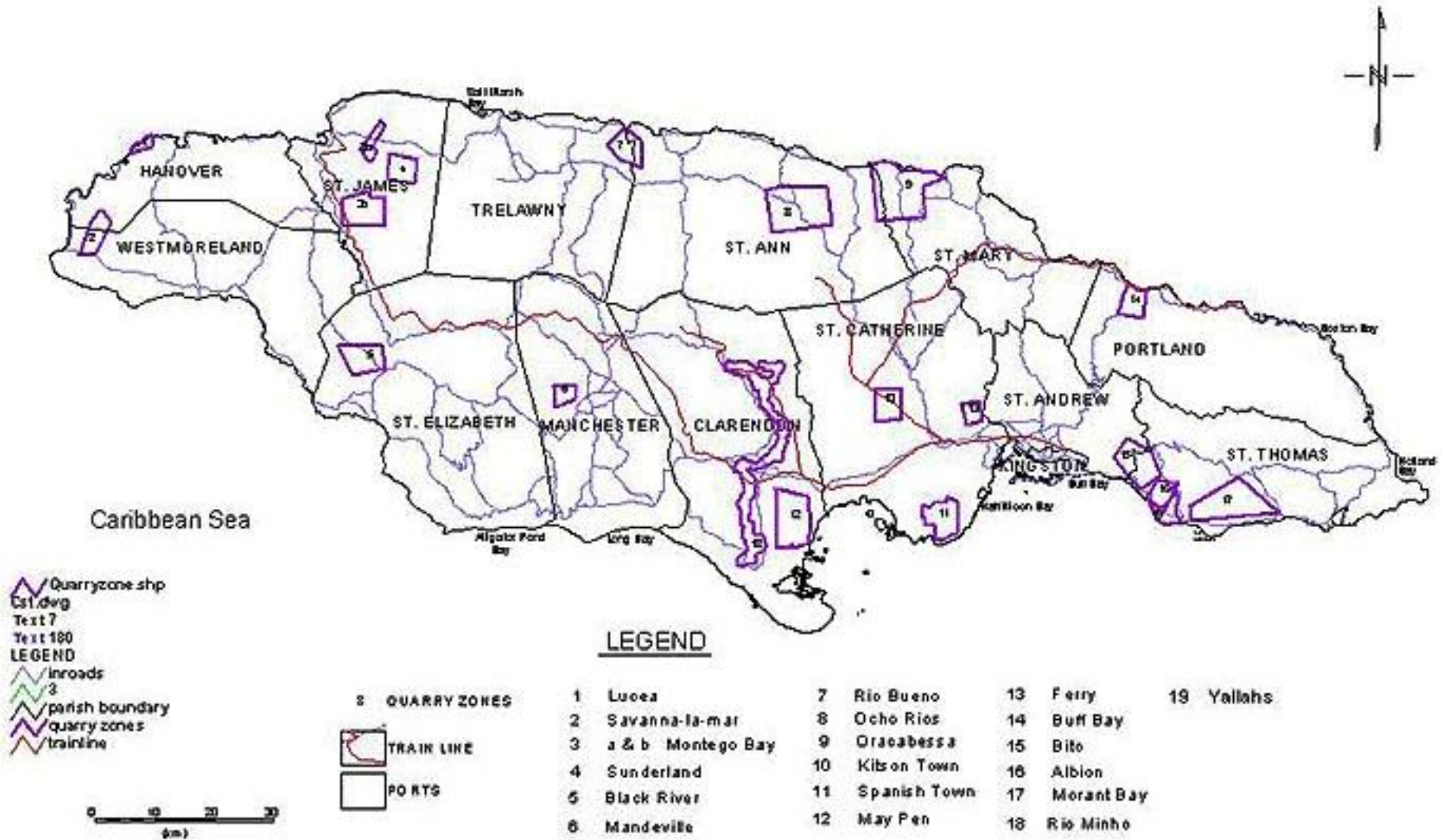


Figure 4.5 Quarry Zones in Jamaica

## Surface Water Catchments

- 4.22. The project area is characterised by the lower reaches of the Rio Grande catchment to the south west and four poorly defined coastal catchments elsewhere, which together with the major watercourses are shown in **Figure 4.6**.
- **The Rio Grande Catchment (I)** is one of the largest in Jamaica. The river is 34.3 km in length and drains an area of some 286 km<sup>2</sup>. It provides large perennial flows and is a popular site for rafting and other tourist activities. Recharge into the adjacent alluvial aquifer at Berridale provides Port Antonio with its primary source of water at the Grant's Level wellfield. In its upper reaches the river is bounded by steep heavily wooded slopes, some of which have been cleared for agriculture. On the gentler slopes and alluvial flood plain of its lower reaches banana, cocoa, coconut, pimento and other crops are grown. The WRA maintains a community-based Flood Warning System for the Rio Grande but within the project area the catchment is not heavily populated;
  - **The White Hall - Norwich - Boundbrook Catchment (II)** occupies the steep slopes rising east of Port Antonio's West Harbour. It includes much of the town and is the most heavily populated catchment within the project area. The slopes have been heavily denuded for development and agriculture, and this has resulted in widespread flooding of parts of the town after heavy rain. The catchment drains to several unconnected short streams, the largest the Annotto River, sustained by spring issues in the hills;
  - **The Port Antonio East - Anchovy Catchment (III)** is more gently sloping with generally longer watercourses. The built-up area drains to the Caneside River and its tributary West Town River, and by the East Side River. To the east, the West River valley takes the watercourse below the uncontrolled landfill at John's Town where it picks up pollution from refuse tipped over the hillside.
  - **The Williamsfield - Drapers Catchment (IV)** drains to the Banana River to the west and the larger Turtle Crawle River to the east, both discharging into Turtle Crawle Harbour. The main settlements in the catchment are Nonesuch, Cambridge and Drapers, and there has been much land clearance for development and lumber.
  - **The Orange Valley - Fairy Hill Catchment (V)** is at the extreme east of the project area and drains to a number of minor spring-sourced watercourses that are frequently lost underground as they approach the coast only to re-emerge as springs near the shoreline. There is significant housing development and existing resort properties include San San Bay, Blue Hole, Dragon Bay and Fairy Hill. Slopes are gentle with banana cash crop cultivation common.
- 4.23. In all catchments the removal of natural vegetation for agriculture and development, with consequential erosion, siltation and pollution, has increased the occurrence of flooding and caused degradation of near-shore and marine environments.
- 4.24. The majority of water courses are short and react quickly to heavy tropical storms. Water slows as it reaches the coastal plain and where channels are especially tortuous, blocked with silt or refuse, or otherwise of inadequate capacity to allow unimpeded flow to the sea, overtops its banks. Port Antonio is particularly prone to flooding and the main area at risk, which include the town centre, are shown on **Figure 4.7**.



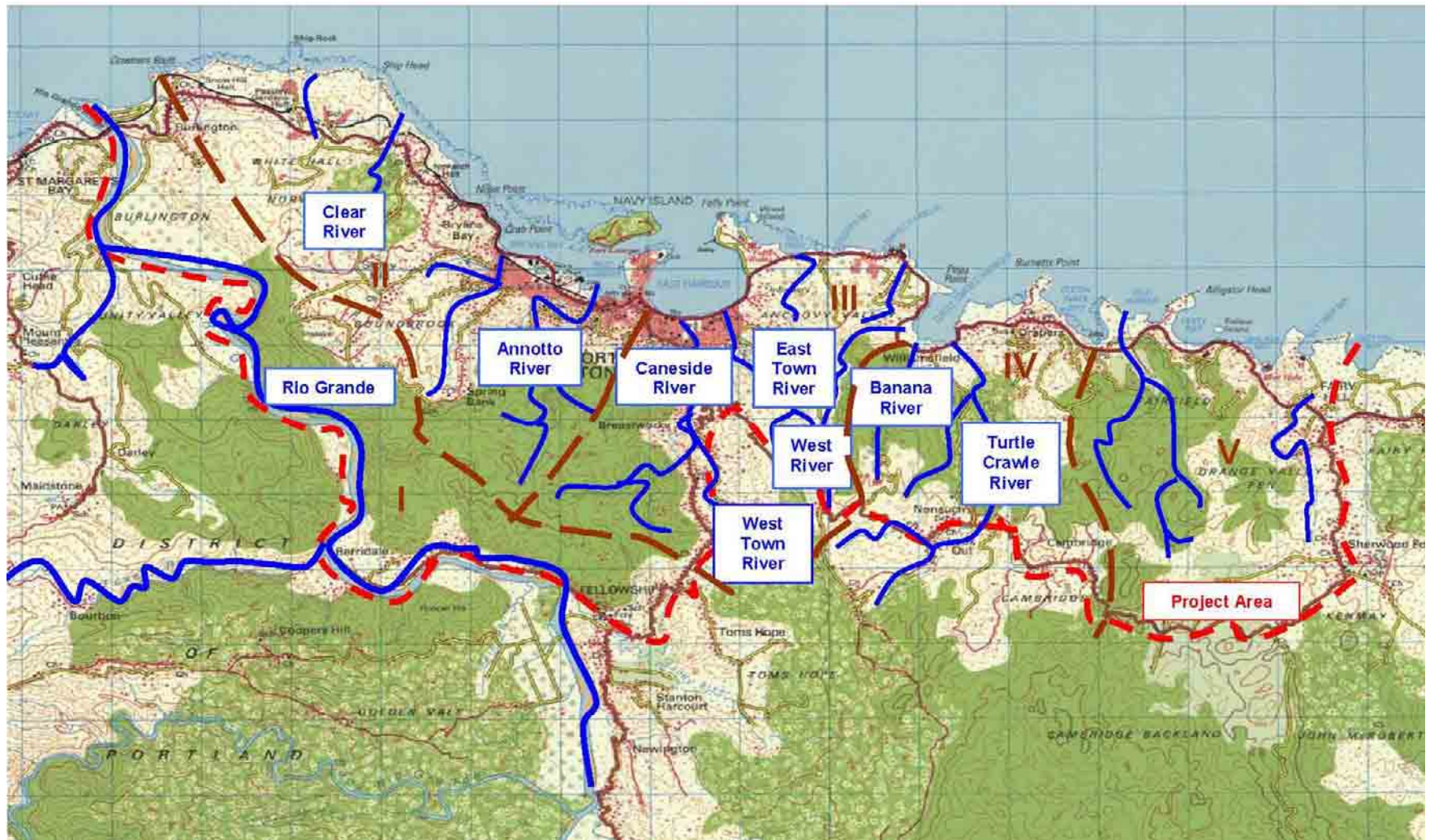
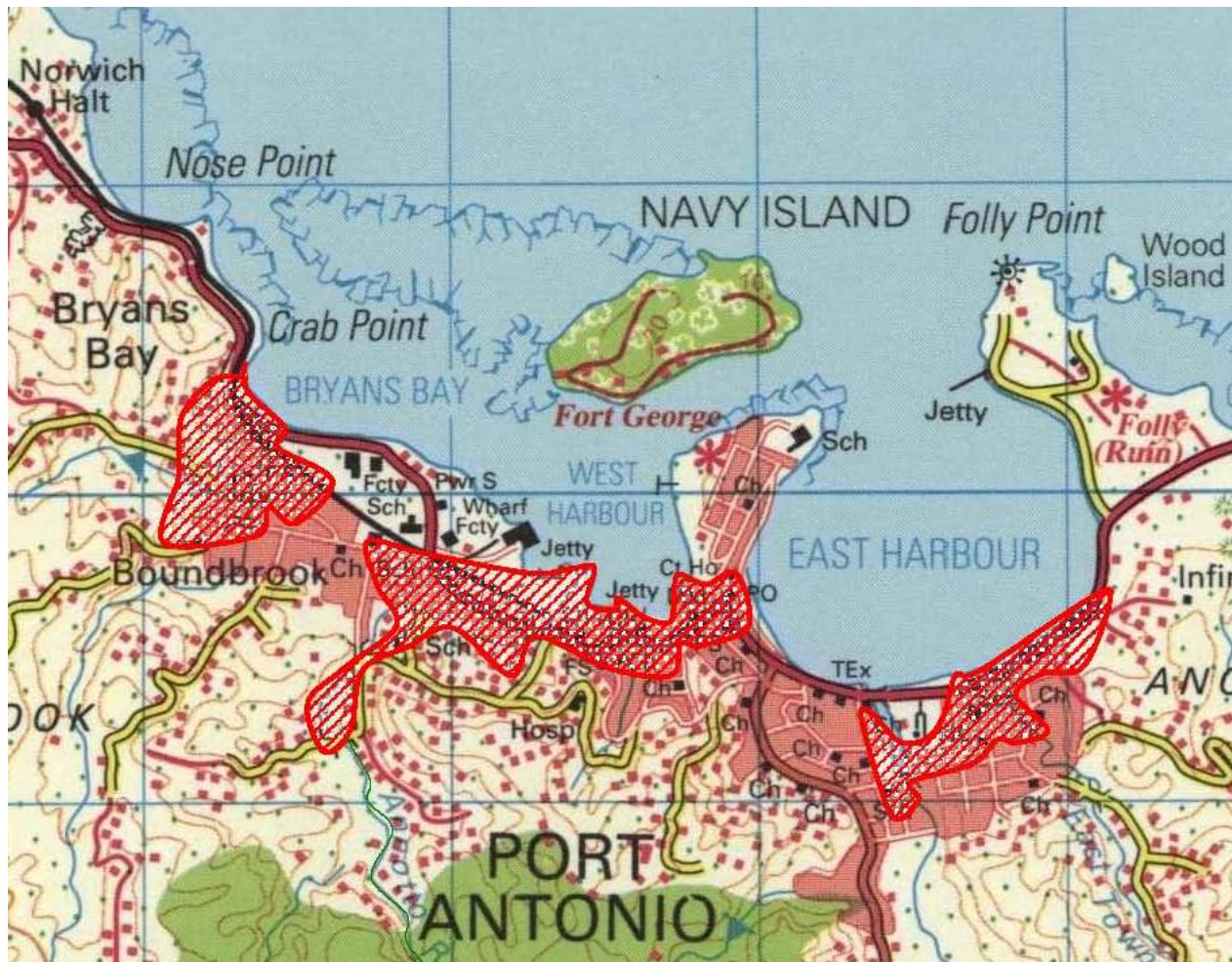


Figure 4.6. Surface Water Catchment Areas and Major Watercourses



**Figure 4.7. Flood Prone Areas in Port Antonio**

- 4.25. Many areas can flood during only a 1 in 2 year storm and in recent events up to 600 houses and businesses have been inundated. The principal areas at risk are:
- Boundbrook (residential);
  - Mannings Avenue (residential);
  - Prospect (residential);
  - Harbour Street (residential and commercial); and,
  - West Street (commercial).
- 4.26. Most open drains are heavily contaminated with seepage from absorption pits and septic tanks, and it is not unusual for drainage channel discharge to the sea to have a faecal coliform content of up to and exceeding 80,000 MPN/100 ml. In addition to the general disruption caused by flooding, it also poses a most serious threat to public health.

## Ground Water and Springs

- 4.27. The occurrence of groundwater in the Port Antonio area is not well understood because resources exploited for public supply have been taken from the alluvial aquifers of the Rio Grande or from springs and whilst these have sustained supply there has been little impetus to investigate alternative sources. However, many of the traditional sources have increasingly experienced problems in maintaining yield and/or water quality and **Table 4.3** gives the recommendations of the 1996 Master Plan for future exploitation.

**Table 4.3. Traditional Sources of Water Supply for the Port Antonio Area**

Source	Yield (1966)	Recommendation for Future Use
Grant's Level Wellfield	10,681-11,138 m <sup>3</sup> /d	Expand to become the primary water source
Norwich Spring (Clear River)	227-455 m <sup>3</sup> /d	Abandon due to poor quality
Turtle Crawl Spring	682-1,136 m <sup>3</sup> /d	Abandon due to yield fluctuations and high turbidity
Fairy Hill Well	455-682 m <sup>3</sup> /d	Abandon due to falling yield and increasing salinity
Stony Hill Spring	11-14 m <sup>3</sup> /d	Abandon as unreliable chlorination only
Nonsuch Spring	45-90 m <sup>3</sup> /d	Abandon as chlorination of river water only
Cambridge Spring	150 m <sup>3</sup> /d	Abandon. Dries up on occasions
Seaman's Valley Spring	< 227 m <sup>3</sup> /d	Abandon due to poor quality

- 4.28. For some years the main source of water has been Grant's Level wellfield located approximately 3.5 km SSW of Port Antonio. This will continue and under PAWSDP Stage 2 abstraction will be increased to supply the upgraded Stage 1 water distribution networks and meet the 2025 requirement.

## Biodiversity

- 4.29. The extent of Jamaica's rich bio-diversity is illustrated in **Table 4.4**.

**Table 4.4. Summary of Bio-Diversity in Jamaica**

	Higher Plants	Mammals	Breeding Birds	Reptiles	Amphibians	Fish
No. Known Species (1992-2002)	3,308	24	75	49	24	200
No. Threatened Species (2002)	206	5	12	8	4	1

- 4.30. 27% of the higher plants are unique to the Island, more than 200 species of flowering plants have been classified and there are 579 species of fern. Trees such as cedar, mahoe, mahogany, logwood, rosewood, ebony, palmetto palm, coconut palm, and pimento (allspice) are common, and mango, breadfruit, banana, and plantain were introduced commercially. Forests covered 35% of the island in 19990 but logging and land clearance for development and agriculture had reduced this to 30% by 2000 and it continues to fall. Important coastal species include red, white and black mangrove.

- 4.31. The bird population is highly diversified with parrots, hummingbirds, cuckoos, and green todys especially abundant. There are 116 species of butterfly, 17 of which are endemic and 450 species of snail. There are 61 species of reptiles and amphibians but no large indigenous quadrupeds or venomous reptiles.
- 4.32. By comparison to other Caribbean islands there are fewer fish species due to over-fishing, particularly along the North Coast where the submarine shelf is narrow and fishing is concentrated. Large breeding shoals of parrot fish (*Scarus croicensis*) are a tenth of what they were in the 1970s and sturgeon are no longer numerous in the lagoons.
- 4.33. For its size Jamaica has a wide range of bio-geography. Twelve separate zones are recognised<sup>4</sup> as shown on **Figure 4.8**. The Parish of Portland lies astride the Blue Mountain (BMO) and John Crow Mountain (JCM) zones, which meet on the North Coast at Port Antonio. Most of the PAWSDP Stage 2 works lie just on the John Crow Mountains side where the wet limestone forest of the BMO gives way to the JCM montane forest. There are no areas of particular ecological interest within the area of the PAWSDP Stage 1 works.

## Marine Conditions

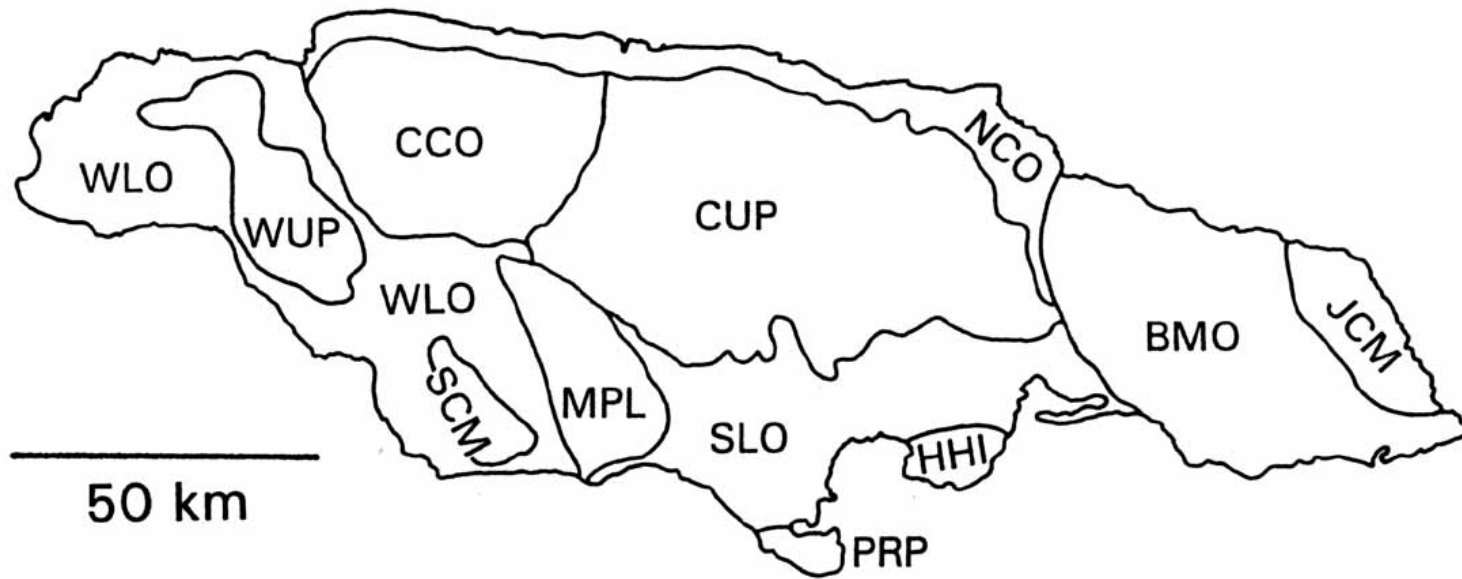
- 4.34. The North Coast of Jamaica is characterised by a shallow shelf with water often less than 10 m for distances of up to 150 m. Thereafter the sea bed slopes off and at a distance of 250-500 m from the shore drops steeply from a depth of 20-40 m to over 100 m within a distance often no more than 30 m. Tidal range is about 0.5 m. Dominant currents along the Port Antonio coastline are strongly orientated westwards<sup>5</sup> as shown in **Figure 4.9**. Embayments complicate the situation inshore but the uniform flow further out induces circulation in all but the smallest.
- 4.35. After the tropical forests, ecological interest in Jamaica primarily focuses on its coral reefs. They were the first in the Caribbean to be studied and as many as 65 species of stony coral have been recognised. They afford an important natural resource, providing the bulk of Jamaica's fisheries and marine bio-diversity, sources of beach sand on which tourism is based, and protection of the shoreline from high seas.
- 4.36. The majority of coral research in Jamaica has been carried out in Discovery Bay, some 100 km west of Port Antonio where the University of West Indies has its Marine Research Laboratory. The zonation of the coral there, shown in **Figure 4.10**<sup>6</sup>, is similar to that elsewhere along the North Coast and for present purposes provides a reasonable model for the Port Antonio area.

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<sup>4</sup> *Distribution Patterns of Amphibians in the West Indies*. Hedges, S. B. In, Duellman, W. E. (Ed.) *Patterns of Distribution of Amphibians: A Global Perspective*. The Johns Hopkins University Press, Baltimore, 1999.

<sup>5</sup> From the 1996 Master Plan.

<sup>6</sup> *Discovery Bay, Jamaica*. Gayle, P.M.H., and Woodley, J.D. *Environment and Development in Coastal Regions and Small Islands*. UNESCO.



BMO Blue Mountains, CCO Cockpit Country, CUP Central Uplands, HHI Hellshire Hills, JCM John Crow Mountains, MPL Manchester Plateau, NCO North Coast, PRP Portland Ridge Peninsula, SCM Santa Cruz Mountains, SLO Southern Lowlands, WLO Western Lowlands, WUP Western Uplands.

**Figure 4.8. Biogeographical Zones of Jamaica**

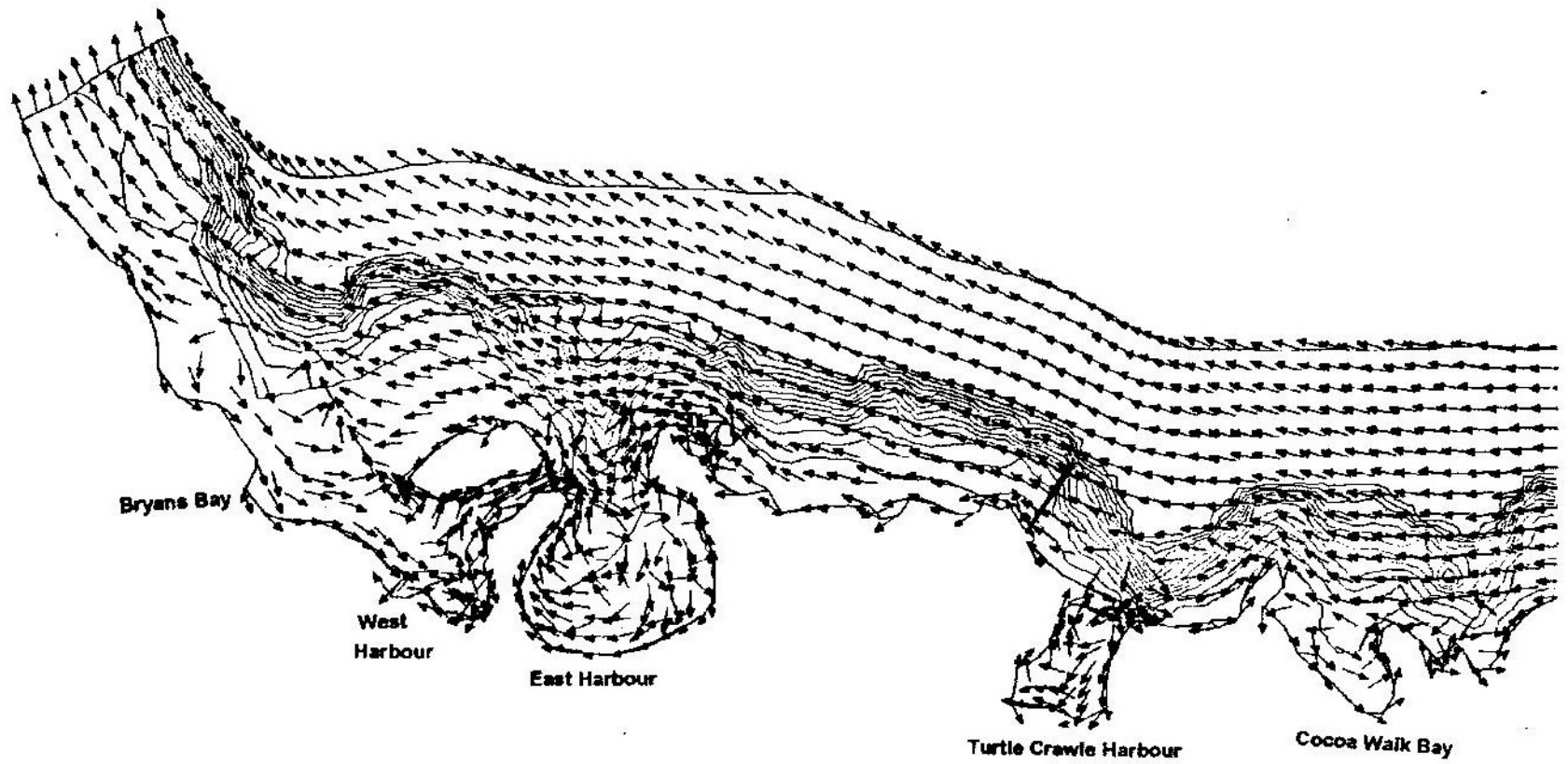


Figure 4.9. Dominant Currents along the Port Antonio Coast.

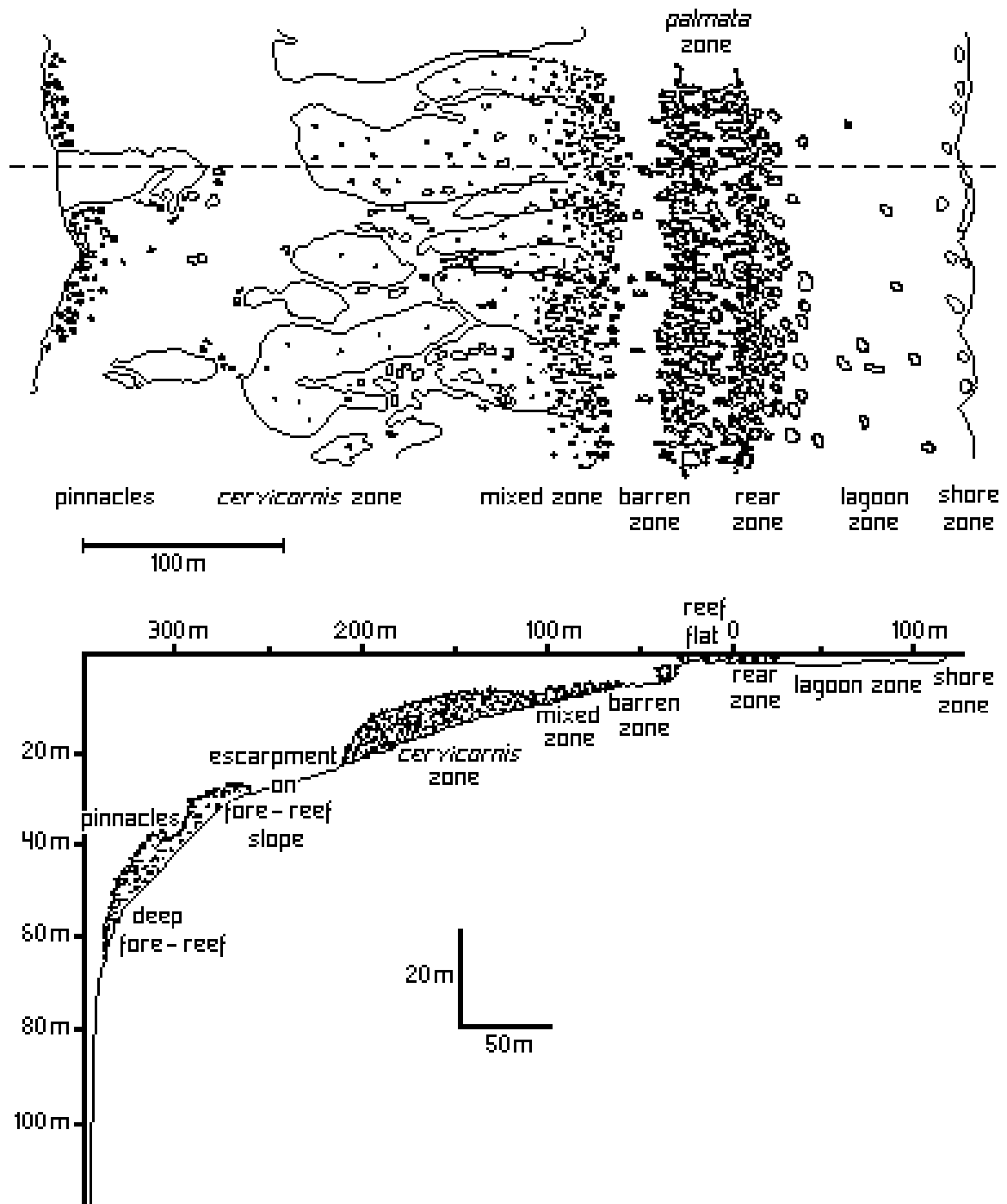


Figure 4.10. The Zonation of Coral on the North Coast of Jamaica

- 4.37. Beyond the barren zone, the area of continuous shallow wave action, the most common coral is *Acropora cervicornis* which on the shallow terrace, 5-20 m depth, is dissected by sub-parallel sand drainage channels that terminates at a depth of 15-30m. Beyond, on the edge of the drop-off into deep water, *Montastraea annularis* forms pinnacles with *Agaricia* sp. to depths of up to 70m.
- 4.38. In most areas the reefs have been significantly degraded with coral being replaced by fleshy algae which overshadow coral and prevent them from settling, support limited fish populations, reduce water clarity and offer no coastal protection or new sand<sup>7</sup>.
- 4.39. The increasing abundance and diversity of algae species suggests eutrophication has become a general phenomenon island-wide. Along the North Coast of Jamaica between 1977 and 1993 average coral cover dropped from 52% to 3% while the abundance of seaweed increased from 4 to 92%<sup>8</sup>. The Port Antonio area has not been exempt, with eutrophication now reported to be visible in all the populated bays, but generally absent off un-populated shores.

### Legal Status of Habitats

- 4.40. The proposal for the nearly 18 km of coastal zone from the mouth of the Rio Grande in the west to Fairy Hill in the east to be designated as *The Port Antonio Marine Park*, as shown in **Figure 4.11**, has been under consideration for more than 10 years<sup>9</sup> but no formal recognition or protected status has yet been granted. The ability to reduce pollution from raw sewage discharges along this coast provided by PAWSDP may encourage formal acceptance.

### Conservation Practices

- 4.41. Over the last decade the Jamaican Government has embarked on a number of initiatives towards the effective management conservation and protection of the natural resources within the context of sustainable development<sup>10</sup> and Section 3 of the present report has highlighted some of the large body of statutes that seek to address environmental protection. Of particular significance to the present project are the *Wildlife Protection Act* and the *Endangered Species Act*. As is normal, enforcement of these regulations is somewhat more difficult in practice. Recent policy initiatives and draft proposals related to the management of natural resources and the promotion of sustainable development include *Towards a Beach Policy for Jamaica*, the *Coral Reef Protection and Preservation Policy and Regulation*, and the *Wetlands Policy*.
- 4.42. Portland is fortunate to have one of leading and most active local environmental NGO's, the Portland Environmental Protection Agency (PEPA) who are proactive in all conservation issues throughout the parish.

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<sup>8</sup> Hughes, T. P. Science 265, 1994.

<sup>9</sup> Before the publication of the 1996 Master Plan

<sup>10</sup> Jamaica's Commitment to the Conservation and Management of Natural Resources: Ten Years in Retrospect. NEPA, March 2002.



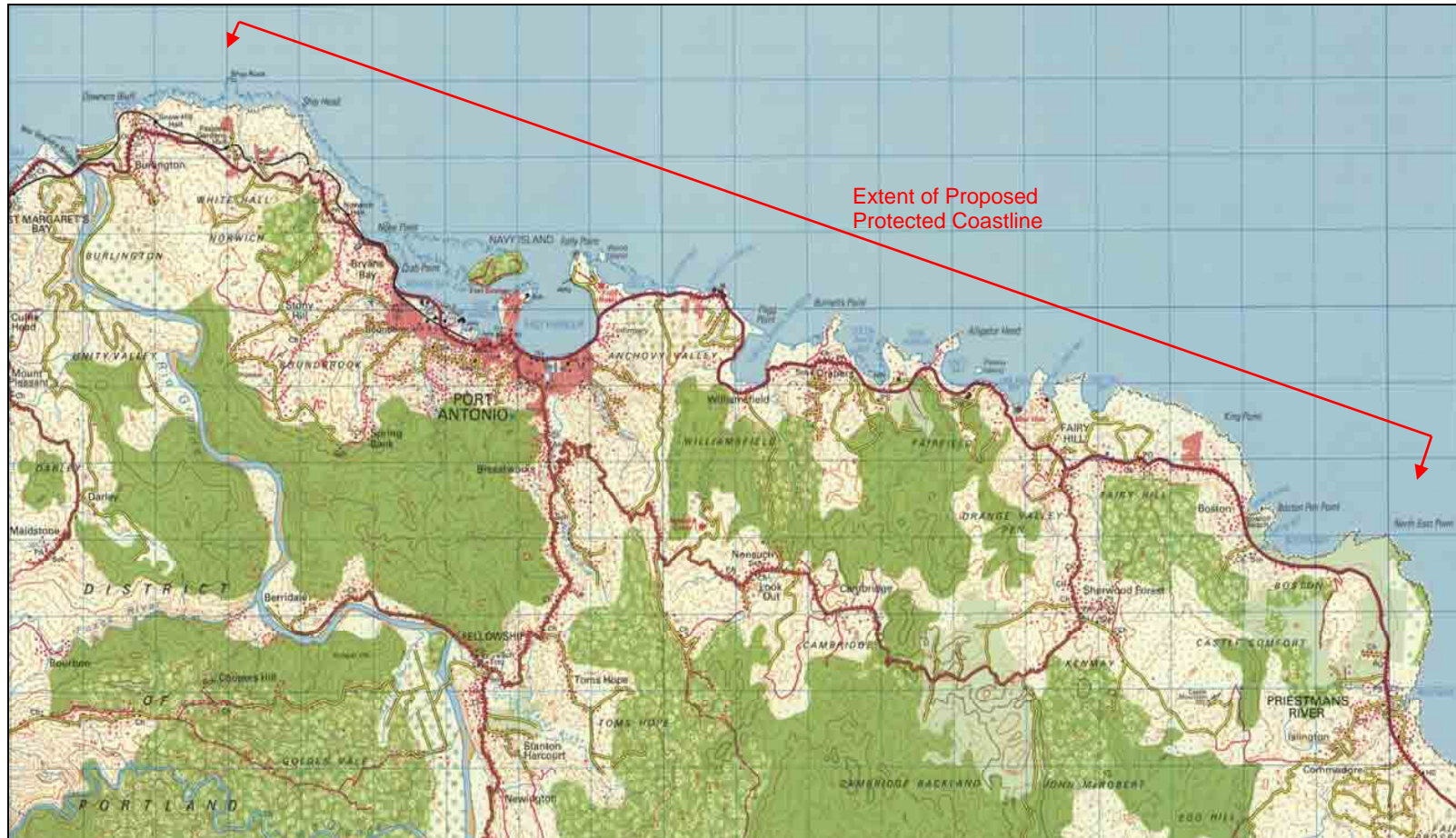


Figure 4.11. The Proposed Port Antonio Marine Park

## Air Quality and Noise

4.43. Air pollution in Jamaica mainly comes from industrial activities and motor vehicles. The main industrial air pollutants are bauxite/alumina mining and processing, electricity and steam generation, cement and lime manufacture, chemical and petroleum refining. The motor vehicle fleet doubled between 1993 (171,000 vehicles) and 1999 (348,000 vehicles). Even before this increase vehicle contributions to air quality were substantial<sup>11</sup> as shown in **Table 4.5**.

**Table 4.5. Estimated Emissions from Motor Vehicles 1993**

Emission	Quantity
Carbon Dioxide (CO <sub>2</sub> )	65,415 tonnes
Nitrous Oxides (NO <sub>x</sub> )	11,230 tonnes
Volatile Organic Carbons (VOCs)	9,867 tonnes
Lead (Pb)	156.8 tonnes

4.44. GoJ has been successful at reducing the per capita consumption of ozone-depleting chlorofluorocarbons (CFCs) from 424 tonnes in 1990 to 49 tonnes in 2000.

4.45. While there is currently no island-wide routine air quality monitoring a number of standards and regulations have been introduced to prevent further deterioration. These include:

- Ambient Air Quality Standards 1996;
- Vehicle Emission Standards 1996;
- Stack Emission Standards 1996; and,
- Ambient Air Quality and Stack Emission Regulations (Draft) 1999.

4.46. The vehicle emission standards currently apply to heavy duty vehicles, light duty vehicles and light duty trucks such as those common on construction projects. Other than motor vehicles, there are no particularly significant air pollutants in Port Antonio.

4.47. The Noise Abatement Act of 1997 primarily deals with the noise generated at public and political meeting, through the use of public address and other amplification equipment. Where a noise occurs in the vicinity of any dwelling house, hospital, hotel infirmary, nursing home or guest house between 0200 and 0600 hours on a Saturday or Sunday morning and is audible for a distance exceeding 100 m it is automatically presumed to be causing annoyance. For other days of the week the prescribed time period is midnight to 0600 hours.

4.48. The *Ambient Air Quality and Stack Emission Regulations* have still to be enshrined in law but NEPA routinely apply them when assessing permit and licence applications. The essential requirements may be summarised as follows:

<sup>11</sup> From NEPA web site.

- In respect of air quality,  
Particulate Matter up World Bank Health and Safety Guidelines to 10 micrometres, PM<sub>10</sub>, must not exceed 150 microgram/m<sup>3</sup> in any 24 hour period; and,
  - In respect of noise,  
the maximum allowable limit is 70 dB(A) 50 m from the perimeter of the site on which the noise is emitted.
- 4.49. There are no Jamaican limits on sulphur dioxide, nitrous oxides, carbon monoxide or other air quality parameters regulated in other countries. There is also no differentiation of acceptable noise levels between day and night, or between residential, commercial and industrial areas. Given that the majority of people are unable to sleep soundly with ambient noise greater than about 50-55 dB(A), the requirements would seem lax.

### **Indigenous People**

- 4.50. The Blue Mountains were once the stronghold of the Windward Maroons<sup>12</sup> and communities still remain at Moore Town, 16 km south of Port Antonio and at Nanny Town, a further 16 km south-west on the north-eastern flank of Blue Mountain Peak. Moore Town, the largest Maroon settlement in Portland was founded in 1739 and affords clearer signs of an African origin than many Jamaican villages. Other larger maroon communities are found in the Parishes of Trelawny and Westmoreland in the west of the island.
- 4.51. Today the Maroons are almost fully integrated into Jamaican society although communities such as Moore Town are run semi-autonomously and while they are remote from the impact of PAWSD Stage 1 construction they will benefit generally, as will other villages, from the long term improvement in services and economic potential of their regional centre.

### **Historical and Cultural Heritage**

- 4.52. Port Antonio surrounds what is reputed to be one of the most beautiful harbours in the Caribbean. It is a quiet town of narrow streets centres on the square with a clock tower and backed by a redbrick Georgian Courthouse topped by a cupola. North of the square is the Village of St. George, a 3-storey complex with a Dutch-style frescoed exterior. Other fine Georgian buildings include the neo-Romanesque Anglican Church (1840), the gingerbread Demontevin Lodge (1881) and several dozen other houses on the Titchfield Peninsular, and Fort George (1729). Just outside the town on a prominent headland lies the ruin of Michell's Folly (1905), a 60-room mansion constructed from concrete in pseudo-Grecian style, and Folly Point Lighthouse (1888). Navy Island, just off the twin harbours, was once owned by Errol Flynn.
- 4.53. Recent harbour redevelopment to accommodate cruise ships has been the first step in the process of rejuvenation. There are no large resort complexes and all efforts at revitalising Port Antonio's flagging tourist

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<sup>12</sup> Recognised as an Indigenous People by UNESCO.

industry are focused on those who wish to experience the beauty and tranquility of the area. Among the many attractions are hiking or rafting through the deep valleys of the Rio Grande, trekking across the forest-covered hillsides of Blue Mountains and John Crow Mountains to Nonsuch Caves and Somerset Falls, or the less energetic pleasures afforded by the beaches of Fisherman's Cove, Boston Beach, Long Bay and Blue Lagoon.

### **Shortcomings in Biophysical Baseline Data**

- 4.54. There are no particular shortcomings in biophysical environmental data that need to be addressed for the effective implementation of the PWSDP Stage 1 works.

### 3. POLICY AND LEGAL FRAMEWORK

- 3.1. This section presents an overview of the policy and legal framework under which the Port Antonio Water, Sewage and Drainage Project (PAWSDP) has been designed, the present EIA prepared, and the proposed works will be executed.

#### Policy Framework

- 3.2. Sustainable Development is one of the stated goals of the Government of Jamaica (GoJ) and the objectives inherent in this explicit policy include (i) effective conservation of the environment, and (ii) sustainable use of natural resources. The basis for action was *The Framework for Local Sustainable Development Planning in Jamaica* which provides opportunities for 'greening' both government and private sector environmental performance. This framework was published by the Statistical Institute of Jamaica which act as the technical clearing house for environmental management systems. The draft *EMS Policy and Strategy* was developed by NEPA and sent to Cabinet in January 2001. Almost concurrently the *Draft Policy on Ocean and Coastal Zone Management* (Green Paper 9/01) was issued. An earlier paper, *Towards National Biodiversity Conservation Strategy and Action Plan* (Green Paper 3/01) was Jamaica's response to the Convention on Biological Diversity.
- 3.3. Following the publication of *Jamaica Environment 2001 - Environmental Statistics and the State of the Environment* by NEPA/STATIN, Local Sustainable Development Plans (LSDPs) were produced with aid from the Canadian International Development agency for Environmental Action (ENACT). Achievements include the adoption of LSDPs by Parish Development Committees. In Portland, a *Sustainable Development Profile* and a *Vision for Sustainable Development in Portland* have been produced.
- 3.4. In 2001 Cabinet established the National Integrated Watershed Management Council to provide a considered approach to watershed issues. This included NEPA's 'Ridge to Reef' policy for watershed management, started in the Great River and Rio Grande watersheds.
- 3.5. The *Jamaica National Environment Action Plan* was first drafted in 1995 and has been updated in 1999/2000. It has several strategies on environmental management in Jamaica, e.g. environmental education, national parks, watershed management, forestry reserves, etc.

#### Legislative Framework

- 3.6. Jamaica is a signatory to the following international environmental conventions and treaties:
- Vienna Convention and the Montreal Protocol on substances that deplete the Ozone Layer;
  - UN Framework Convention on Climate Change and the Kyoto Protocol;
  - Convention on Biological Diversity and Biosafety Protocol;

- 
- Convention in the International Trade of Endangered Species of Wild Fauna and Flora (CITES);
  - Convention on Wetlands of International Importance especially as Waterfowl Habitats (RAMSAR);
  - The Basel Convention on the Trans-Boundary Movement of Hazardous Waste;
  - International Convention on the Prevention of Pollution by Ships (MARPOL);
  - Convention for the Protection and Development of the Marine Environment to the Wider Caribbean Region; and,
  - The UN Convention to Combat Desertification in those countries experiencing Serious Drought and/or Desertification
- 3.7. Jamaica already enjoys significant legislation for the protection of the environment with responsibility for execution and enforcement resting with different Government departments and agencies. Those most relevant to the execution of the PAWSDP proposals are:
- The Natural Resources Conservation Authority (NRCA) Act, 1991;
  - The Town and Country Planning Act, 1958;
  - The Land Development and Utilisation Act, 1966;
  - The Watershed Protection Act, 1963;
  - The Beach Control Act, 1956;
  - The Endangered Species (Conservation and Regulation of Trade) Act, 2000;
  - The Wildlife Protection Act, 1975;
  - Fishing Industry Act, 1968; and,
  - The Forest Act, 1995.
- 3.8. **The Natural Resources Conservation Authority (NRCA) Act** provides for the management, conservation and protection of Jamaica's physical environment through the Natural Resources Conservation Authority. Section 9 provided for the declaration 'Prescribed Areas' in which specified activities require a permit for which applicants are obliged to provide an Environmental Impact Assessment. *The Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order of 1996* declares the entire island Prescribed and lists the categories of enterprise, construction or development that require a permit. The Act also addresses sewage and trade effluent discharges.
- 3.9. The 1991 Act requires new environmental regulations to incorporate the 'polluter pays' principle. Although NRCA responsibilities were transferred to the National Environment and Planning Agency (NEPA) in 2001, the Act remains the primary instrument of environmental and planning legislation pending the passing of a NEPA Act at some future date.
- 3.10. In addition to the NRCA Act, the principal laws for controlling environmental and associated issues are the following:

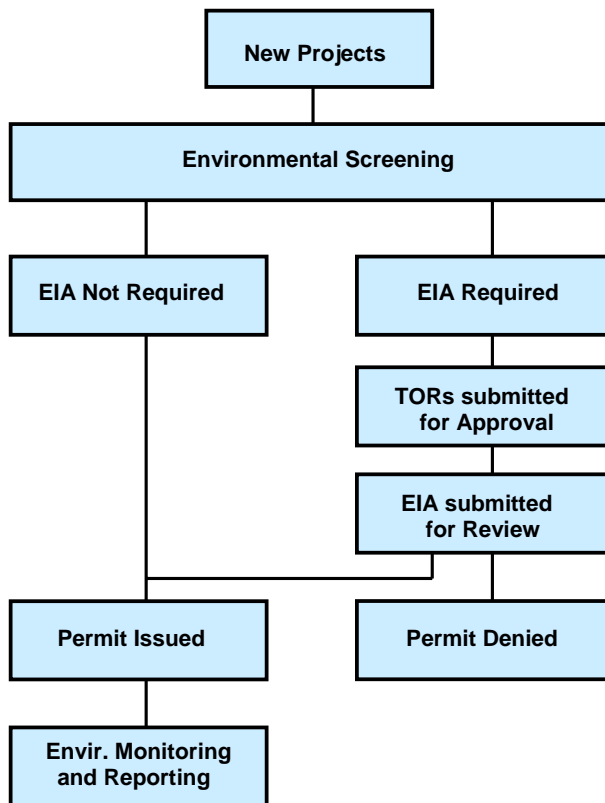
- **The Town and Country Planning Act** is administered by the NEPA and designates the Government Town Planner and the Town and Country Planning Authority as the responsible agencies for with planning control the legislation;
  - **The Land Development and Utilisation Act** is also administered by the NEPA and designates the Land Development and Utilisation Commission as the responsible agency for land development. Development Plans for designated areas are written under this Act.
  - **The Beach Control Act** provides for the proper management of Jamaica's coastal and marine resources through the licensing activities on the foreshore and seabed. The Act also addresses access to the shoreline and other rights associated with fishing and public recreation, and marine protected areas;
  - **The Endangered Species (Conservation and Regulation of Trade) Act** of 2000 concerns with the protection of specified species of fauna but recent review has identified the need for amendments to address the management and conservation of natural resources and the inclusion of flora. This Act was promulgated to document Jamaica's obligations under the Convention for the International Trade in Endangered Species and governs international and domestic trade in endangered species in and from Jamaica;
  - **The Wildlife Protection Act** is concerned with the protection of particular species of fauna declared under the Act. It has undergone review, particularly in the areas of increased fines and the number of animals now enjoying protected status. Further amendments are being undertaken to address a variety of other issues relating to the management and conservation of natural resources, and the inclusion of flora;
  - **The Public Health Act** is enforced by Inspectors working with the Parish Councils across the island and the Environmental Control Division of the Ministry of Health. Standards and practices to ensure public health are set, including that persons involved in construction, repair or alteration must take precautions to prevent particulate matter from becoming airborne.
- 3.11. Forthcoming legislation includes **The National Environment and Planning Agency Act (Draft)**, which is intended to combine the Environment and Planning Laws now administered by NEPA under one Act;

### **Environmental Assessment Legislation and Procedures**

- 3.12. Under Section 10 of the 1991 NRCA Act an Environmental Impact Assessment is required before defined categories of industrial, development and other projects are given a permit. These categories are defined under Section 38(1)(b) and the PAWSDP Stage 1 proposals are subjected to the EIA process on the basis they encompass:
- pipelines and conveyors over 15 cm diameter; and,
  - river basin development;
- 3.13. The scope and content of an EIA is explained in *Guidelines for Conducting Environmental Impact Assessment* (NRCA, July 1997). Once Terms of Reference to a particular project have been approved by NEPA the expected content of the EIA report includes the following:

- Executive Summary;
- Policy, Legal and Administrative Framework;
- Description of the environment;
- Description of the Proposed Project in detail;
- Significant Environmental Impacts;
- Socio-economic analysis of Project Impacts;
- Identification and Analysis of Alternatives;
- Mitigation Action/Mitigation Management Plan;
- Environmental Management and Training;
- Monitoring Programme;
- Public Involvement;
- List of References;
- Appendices including;
- Reference documents, photographs, unpublished data;
- Terms of Reference;
- Consulting team composition; and,
- Notes of Public Consultation sessions.

3.14 The EIA report is submitted to NEPA for review and construction permitting, in which other government agencies may participate. The essential elements of the EIA process are illustrated in **Figure 3.1** and further discussed below.



**Figure 3.1. NEPA's EIA Review and Permitting Process**



## **Institutional Framework**

- 3.15. The varying responsibilities of the principal organisations, governmental and non-governmental, national and local, planning and environmental issues are summarised below.

### ***Central Government Agencies***

- 3.16. Central government agencies include:
- **The Planning Institute of Jamaica** initiates and coordinates the plans, programmes and policies for the economic, financial, social, cultural and physical development of Jamaica, provides technical support to Cabinet, and is the main interface with international funding agencies and donors; and,
  - **The Statistical Institute of Jamaica** collects, compiles, analyses, and publish statistical information in relation to commercial, industrial, social, economic and other activities, including the organization of national censuses.

### ***Ministry of Land and Environment***

- 3.17. The Ministry promotes sustainable development for Jamaica by effectively managing the environment and natural resources through strategic planning, policy formulation and implementation and the utilization of appropriate technology. Component agencies of the Ministry of Land and Environment relevant to the PAWSDP include:

- **The National Environment and Planning Agency (NEPA)** was formed on 1st April 2001 by the merger of the National Resources Conservation Authority, the Town Planning Department and the Land Development and Utilisation Commission, to *promote sustainable development by ensuring protection of the environment and orderly development*. NEPA's core functions as they relate to the PAWSDP include planning and development, environmental permits and licenses, change of agricultural land use, beach use and, sewage discharge. Until a National Environmental and Planning Act is promulgated NEPA operates under the mandate of the NRCA Act and other core environmental legislation. The organisation of NEPA is shown in **Figure 3.2**;
- **The National Meteorological Service** is concerned with the observation and forecasting of weather conditions over and around the island and provides weather forecasting services for general dissemination. It maintains a continuous Hurricane Watch during the hurricane season and is responsible for the issuance of severe weather warnings. The service also operates an island-wide network of rainfall and climate stations and processes the data recovered for a wide variety of needs.
- **The Mines and Geology Division** is the geological research and development arm of Government and is charged with developing a comprehensive understanding of the geology of Jamaica and directing the orderly development of mineral resources, in accordance with mining and environmental legislation. It has a modern analytical laboratory and a library, and is the sole distributor of blasting licenses.

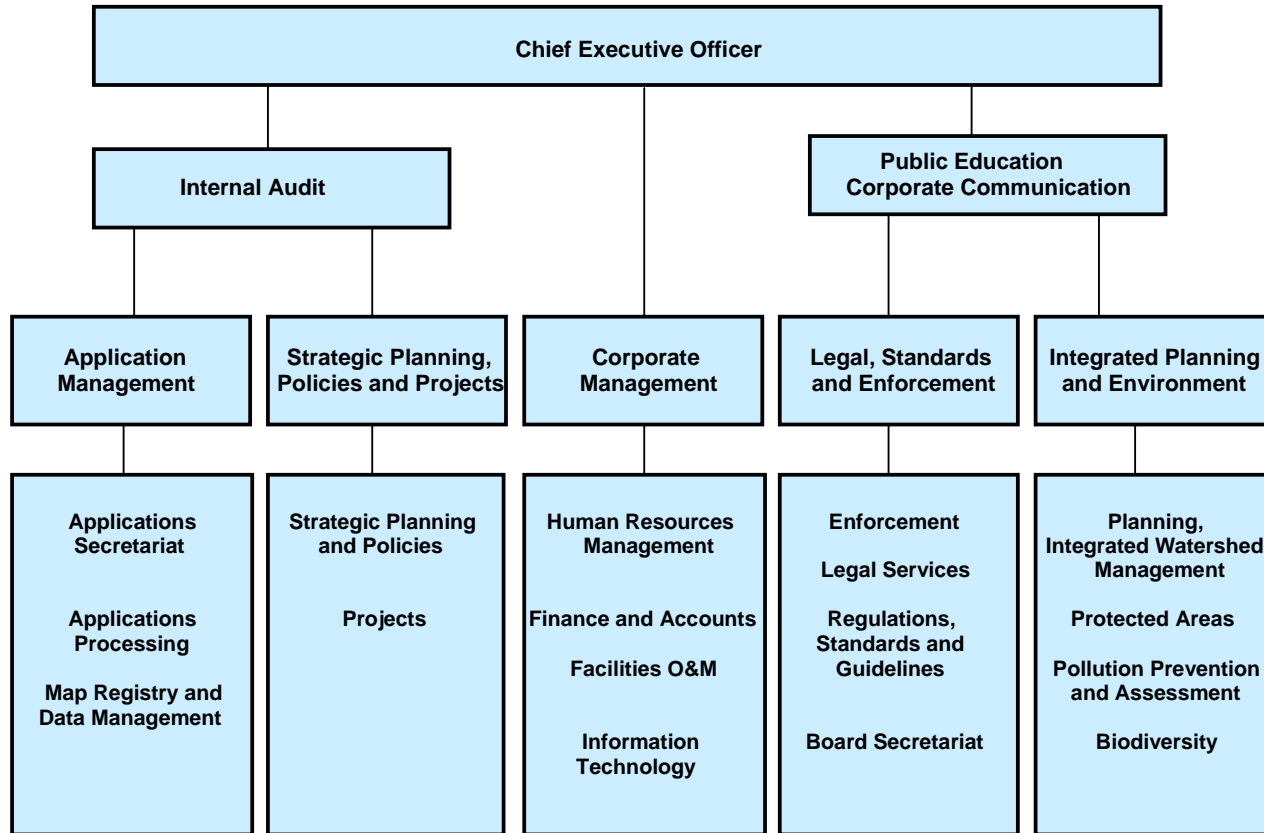


Figure 3.2. NEPA Organisation Chart

- **The National Land Agency** was established by the merger of the Office of Titles, the Survey Department and the Land Valuation and Lands Department to bring together core land information functions and provide for the integration of land titling, survey, valuation and management to create a modern national land information system to support sustainable development and the efficient management and administration of land.
- **The Council on Ocean and Coastal Zone Management** provides a formal mechanism integrated coastal zone management. Participants include representatives from local government, private sector, shipping, fishing, marine interests, marine park management entities, and selected international/regional agencies involved in marine and ocean management.

### ***Ministry of Water and Housing***

- 3.18. The Ministry seeks to achieve affordable housing solutions for all and provide clean potable water for all its citizens. Component agencies of the Ministry of Water and Housing include:
- **The National Water Commission (NWC)** was established in 1980 to be the statutory organisation responsible for providing potable water and wastewater facilities within the context of the Government's goal to provide universal access to potable water by 2005 and the installation of sewerage systems in all major towns by 2020. While the first of these goals may have slipped, the Agency currently produces over 90% of all potable supplies and provided 25% of the population with sewerage. NWC is the PAWSDP proponent; and,
  - **The Water Resources Authority** has statutory responsibility for the management, protection, and controlled allocation and of Jamaica's surface and ground water resources. Its duties include hydrologic data collection, compilation, and analysis; water resources investigation, assessment, and planning; water resources allocation; and environmental monitoring and impact assessment. The Authority processes applications for the permitting of well drilling and testing and for the licensing of surface and ground water abstraction. It will therefore be the prime agency involved in approving the PAWSDP proposals for increased abstraction from the Grant's Level wellfield.

### ***Ministry of Transport and Works***

- 3.19. The Ministry of Transport and Works was created in January 1998 and includes functions and programmes drawn from the former Ministries of Local Government and Works, Public Utilities and Transport. The Corporate Plan reveals the initiatives that will be taken to encourage national growth and development within the context of the National Industrial Policy. As the name suggests, the Ministry is responsible for the island's land, sea and air transport as well as the majority of road network, including bridges, drains, embankment etc. Through its various agencies, including the National Works Agency, the Ministry fulfills its mandate of providing a safe and efficient transportation system as well as the building and maintenance of quality roads for its populace and others who have to travel on them.

***Ministry of Health***

- 3.20. The Ministry of Health will promote and safeguard the physical, mental and social well-being and enhanced quality of life of the Jamaican people by empowering individuals and communities and ensuring access to adequate health care through the provision of cost-effective promotional, preventive, curative and rehabilitative services delivered by adequately trained and motivated personnel.

***Portland Parish Council***

- 3.21. The Parish Council is the local government institution responsible for planning in Portland. All development plans for Portland must be approved by the Parish Council.

***Other Organisations***

- 3.22. Other organizations with interests allied to those of the PAWSD include:
- **The United States Agency for International Development (USAID)** is primarily involved in assisting GoJ improve the quality of key resources in environmentally and economically significant areas through support in the development of a number of environmental policies including the Sewage Connection Policy, the National Policy on Ocean and Coastal Zone Management and the National Environmental Management Systems Policy. Port Antonio has been a particular focus of the USAID programme, with environmental audits and 'Green Globe' certification for small hotels and manufacturers, and the strengthening of civil society groups and local agencies to better plan and implement environmental protection policies and strategies. Technical assistance on the introduction of the Blue Flag Beach Safety and Environmental Certification Scheme has also been provided. Of specific interest to the PAWSDP, USAID is providing technical assistance to strengthen the institutional capacity of public and private sector wastewater operators, the Jamaica Wastewater Operators Association and Wastewater Advisory Monitoring Committees.
  - **The Jamaican Hotel and Tourism Agency** implements Environmental Audits for Sustainable Tourism (EAST) under which 'green properties' obtain ISO 14000 registration under the Green Globe Programme of the World Travel and Tourism Council. An EAST programme operates in Port Antonio.
  - **The Portland Environment Protection Association (PEPA)**, founded in June 1988, is an association of community organizations, service clubs and civic organizations, bound together by our common interest to protect the natural environment of the Parish of Portland specifically and of Jamaica in general. There are currently there are over 60 organisational members and more than 100 individual members of PEPA.

## **Project Environmental Assessment Framework**

3.23. As required by the KBR Contract, the present EIA study has been undertaken in general accordance World Bank requirements<sup>1</sup> and more specifically with the NEPA requirements discussed above. As required under NEPA procedures, Draft Terms of Reference were submitted for approval on 6th December 2005 and formally approved on 6th February 2006. Preparation of the Stage 2 EIA commenced on 25th January and was submitted to NWC for review on 8th 2006. Information Participation and Consultation activities have included:

- Meetings of the NWC/Port Antonio Wastewater Advisory Committee;
- Visits to concerned groups and individuals to introduce the project;
- Visits and interviews with Project Affected Persons;
- An EIA Scoping Session;
- Public Notices issued to the Press;
- Public Exhibition and Meeting to disseminated the results of the EIA; and,
- The opportunity for the public to submit their views in writing.

3.24. All IPC activities are reported in Section 13. In accordance with NEPA's requirements, a period of not less than three weeks from the date of submission of an EIA has to be allowed for the document to be available for public inspection and comment in council offices, schools, police stations or other public places. At the end of this period the Project Proponent will hold a public meeting at which the project and the EIA are presented and attendees given the opportunity to air their comments.

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<sup>1</sup> *The World Bank Operational Manual. Operational Policies PO 4.01.* World Bank, January 1999

## 13. REVIEW OF INFORMATION PARTICIPATION AND CONSULTATION PROGRAMME

- 13.1. This, the final section of the EIA, reviews the programme and outcomes of the various consultations that have been undertaken to inform stakeholders about the PAWSDP and provide the opportunity for them to give their comments.

### **Advisory and Monitoring Committee**

- 13.2. The process of public involvement in community infrastructure development is well practiced and GoJ is committed to project implementation becoming a partnership between agencies such as the NWC and affected communities.
- 13.3. Previous new sewerage networks and treatment plants at Negril, Montego Bay and Ocha Rios were successfully completed following the involvement of Advisory and Monitoring Committees (AMCs) The composition of these committees comprises the project proponent, other government agencies, local administrators, elected representatives, local and national NGOs, the police, the local chamber of commerce and other stakeholders.
- 13.4. Based on this positive experience a Stakeholders Workshop was facilitated by USAID/NEPA's Coastal Water Quality Improvement Project (CWIP) and held on Tuesday 5th February 2002, where it was agreed an AMC for Port Antonio be established to offer the same level of public participation as had benefited similar projects elsewhere.
- 13.5. The Port Antonio AMC met several times prior to the award of the detailed engineering design and construction management to KBR. The first informal meeting was held on Wednesday 15th May 2002 in the NWC offices at Smatt Road in Port Antonio. The agenda included a review of the CWIP Workshop, presentation of the water and wastewater plans for Port Antonio, and public consultation on the Sewage Effluent Regulations and recent water quality monitoring results.
- 13.6. A second informal meeting was held at Port Antonio Marina on Wednesday 19th June 2002, when 17 attendees discussed the Sewage Effluent Regulations.
- 13.7. Wednesday 16th April 2003 witnessed a milestone in the project with the public launch of the *Port Antonio Wastewater Advisory and Monitoring Committee*. Those present at included a the Minister of Water and Housing, the MP for East Portland, the Chief Executive of NEPA, an NWC Vice President, the Mayor of Port Antonio and the Director of USAID Jamaica.

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- 13.8. The next meeting was held on Wednesday 11th February 2004 when 34 persons attended. A further meeting was planned for Wednesday 5th May 2004.
- 13.9. The first meeting at which KBR, the PAWSDP designer and construction manager was present was held on Thursday 14th April 2005 when NWC's Project Manager gave an update of the PAWSDP proposals.
- 13.10. The meeting of Thursday 14th September was the first to be held in the new Ken Wright Pier at Port Antonio Marina. The KBR Project Manager reported on the current status of the project, the scope of the proposed construction, explained the various studies that had been initiated, and presented a provisional programme to the 30 attendees.
- 13.11. The meeting on Thursday 26th January witnessed another milestone in the project. After KBR had presented a further update of project activity, the company's Environmental Consultant explained the need for an Environmental Impact Assessment and the EIA process. Discussion was then open to the floor and the Scoping Session elicited a wide range of questions and concerns in respect of the potential impacts of the project on both the biophysical and socio-economic environment.
- 13.12. The primary concerns expressed at the Scoping Session in respect of the Stage 1 works can be summarised as follows:
- Once constructed, properties would not be quickly connected to the sewage network;
  - Operation and maintenance would not be undertaken effectively;
  - There would not be meaningful and effective public participation;
  - Disruption due to traffic, noise and dust during construction would be intolerable;
  - The current start date for construction coincided with the beginning of the tourist season.
- 13.13. All comments and concerns expressed were recorded and KBR undertook to take them forward into the present EIA study. The available records from all AMC meetings are presented in Appendix E.

## **Public Presentation**

- 13.14. In accordance with NEPA's EIA procedures, a period of three weeks from the date of submission of an EIA has to be allowed for the document to be available for public inspection and comment in council offices, schools, police stations or other public places. At the end of this period the Project Proponent is required to hold a public meeting at which the project and the EIA are presented and attendees given the opportunity to air their comments.
- 13.15. NWC will follow this requirement and closely coordinate with NEPA on the arrangements. Full details of the public presentation, the comments forthcoming and any necessary amendment of the EIA will subsequently be presented as an Addendum.