

## 2.0 Terms of Reference

Based on the NEPA EIA Guidelines, and NEPA Generic Terms of Reference for Human Habitation, the Terms of Reference for conducting the EIA have been approved by NEPA, after their review and input. These TOR's are given below:

- 1) Provide a complete description of the existing site proposed for development. Detailing the elements of the development, highlighting areas to be reserved for construction and the areas that are to be preserved in their existing state.
- 2) Identify the major environmental issues of concern through the presentation of baseline data, which should include social and cultural considerations. Assess public perception of the proposed development.
- 3) Outline the Legislation and Regulations relevant to the project.
- 4) Predict the likely impacts of the development on the described environment, including direct, indirect and cumulative impacts, and indicate their relative importance to the design of the development's facilities.
- 5) Identify mitigation measures to be taken to minimise adverse impacts and quantify associated costs.
- 6) Design a Monitoring Plan, which should ensure that the mitigation plan is adhered to.
- 7) Describe the alternatives to the project that could be considered at that site or any other site.
- 8) Assess the vulnerability of the site to hazards, supported by technical information

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

### **Task # -. Description of the Project**

The project components will be fully presented, a comprehensive description of the project will be given, noting areas to be reserved for construction, areas to be preserved

in their existing state as well as activities and features which will introduce risks or generate impact (negative and positive) on the environment. Maps, site plans, aerial photographs and other graphic aids and images, will be utilized as appropriate, to provide information on location, general layout and size, as well as pre-construction, construction, and post construction plans. A scale of 1:5000 will be used in creating the location map and a scale of 1:50,000 will be used for the generic site layout map. All phases of the project will be defined, and the relevant time schedules with phased maps, diagrams and appropriate visual aids, included. Information will be provided on vegetation clearance and sewage treatment facilities.

**Task #2 - Description of the Environment**

Baseline data will be generated for the study area on the:

- a) physical environment
- b) biological environment
- c) socio-economic environment

The methodologies employed to obtain the baseline data and other data will be clearly detailed and supported with appropriate references.

***(A) Physical***

- i. A description of the existing soils, geology and hydrology. Special emphasis will be placed on storm water run-off, drainage patterns, effect on groundwater and availability of potable water. Any slope stability issues that could arise will be explored and natural hazard exposure will be identified.
- ii. Water quality of the existing gully, spring and sewage pond will be determined. Quality Indicators will include but not necessarily be limited to nitrates, phosphates, faecal coliform, and suspended solids.
- iii. Climatic conditions and air quality in the area of influence including particulate levels, wind speed and direction, precipitation, relative humidity and ambient temperatures. Climate information will include historical data and any significant trends observed during extreme meteorological events over previous years.
- iv. Noise levels of undeveloped site and the ambient noise in the area of influence.
- v. Obvious sources of pollution existing and extent of contamination.

- vi. Availability of solid waste management facilities
- vii. Traffic Patterns

**(B) Biological**

A detailed description of the flora and fauna (terrestrial and aquatic) of the area, with special emphasis on rare, endemic, protected or endangered species will be provided. Migratory species and micro-organisms will be included as appropriate to an accurate baseline assessment. Generally, species dependence, niche specificity, community structure and diversity will be considered and if invasive species are located on the site, they will be noted. Information will be presented in lists where appropriate. Information will also be provided on the condition of sensitive habitats, trees worthy of protection (endemic, commercial, or mature; providing invaluable support in its sphere) and species with the potential to become nuisances, vectors or dangerous. Location maps with GPS coordinates will be presented where necessary.

**(C) Socio-economic & Cultural**

The following issues will be treated:

- Present and projected population; present and proposed land use;
- planned development activities, issues relating to squatting and relocation, community structure, employment, distribution of income, goods and services;
- recreation;
- public health and safety; cultural peculiarities, aspirations and attitudes.
- Information on the existing sub-division at Rhyne Park will also be presented.
- The historical importance of the area will also be examined.

While this analysis is being conducted, public perception of the proposed development will be included. This assessment may vary with community structure and may take multiple forms such as *ad hoc* interviews, application of interview instruments and meetings with community leaders. Methodology for obtaining public perception, and survey details will be included. Information on social amenities and utilities will also be included. Concerns and recommendations of neighbouring communities, groups and

agencies (e.g. PC, NSWMA, PDC, NWA, NWC, etc.) will be included. Information will be provided on traffic counts, congestion and transportation availability and impact. Existing or proposed developments to support the housing subdivision will be provided.

**Task #3 - Legislative and Regulatory Considerations**

The study will outline the pertinent regulations and standards governing environmental quality, safety and health, protection of sensitive areas, protection of endangered species, siting and land use control at the national and local levels. Included will be the NRCA Act, the Housing Act, the Town and Country Planning Act, other relevant statutes and laws such as Building Codes and Standards, Development Orders and Plans and the appropriate international convention/protocol/treaty where applicable.

**Task #4 - Identification and Analysis of Potential Impacts**

Identification of the major environmental and public health issues will be done, and will cover the following aspects:

- drainage patterns – pre and post development including modification of topography
- flooding potential – pre and post development
- landscape due to excavation and construction
- loss of vegetation
- modification or loss of habitats and species
- pollution of surface, ground water and marine waters
- air and noise pollution
- capacity and design parameters of proposed sewage treatment facility.
- socio-economic and cultural impacts
- risk assessment
- solid waste management
- hazard vulnerability

Inputs will be identified as being significant positive or negative, direct or indirect, reversible or irreversible and long term or immediate. Characterization of the extent and

quality of the available data, explaining significant information deficiencies and any uncertainties associated with the predictions of impacts will be presented.

**Task #5- Mitigation**

Mitigation measures to minimise any adverse impacts predicted from the proposed development will be presented. Where possible a costing of the mitigation measures will be undertaken.

**Task #6 - Environmental Monitoring and Management**

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

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

The Monitoring Report should also include:

- Raw data collected supported by tables and graphs where appropriate
- Discussion of results with respect to the development in progress, highlighting any parameter(s) which exceeds the expected standard(s).
- Recommendations
- Appendices of data and photographs if necessary

**Task #7 - Project Alternatives**

Examine alternatives to the project including the no-action alternative. This examination of project alternatives should incorporate the use history of the overall area in which the site is located and previous uses of the site itself.

All Findings will be presented in the **EIA report** and will reflect the headings in the body of the TORs, as well as references. Eight hard copies and an electronic copy of the report will be submitted. The report will include appendices with supporting information such as letters, maps, site plans, the study team, photographs, and other relevant information.

***Task #8 – Public Presentation***

NEPA has requested a Public Presentation of the EIA. This will be done based on the NEPA Guidelines for Conducting Public Presentations and will be staged in consultation with NEPA.

### **3.0 Policy, Legal and Administrative Framework**

This section presents the legislation and regulations pertinent to the proposed Rhyne Park Village.

#### **3.1 National Legislation – Natural Environment**

##### **3.1.1 Natural Resources Conservation Act (1991)**

The Natural Resources Conservation Act was passed in the Jamaican Parliament in 1991 and provided the basis for the establishment of the Natural Resources Conservation Authority (NRCA) with primary responsibility for ensuring sustainable development in Jamaica through the protection and management of Jamaica's natural resources and control of pollution. Sections 9 and 10 of the NRCA Act stipulate that an Environmental Impact Assessment (EIA) is required for new projects and existing projects undergoing expansion.

The body is also responsible for investigating the effect on the environment of any activity that may cause pollution or which involves waste management. Sections of the Act that relate specifically to pollution control state that:

- (i) No person shall discharge on or cause or permit the entry into waters, on the ground or into the ground, of any sewage or trade effluent or any poisonous noxious or polluting matter.
- (ii) No person is allowed to construct or reconstruct or alter any works designed for the discharge of any effluent.

The Act also empowers the authority to require of any owner or operator of a pollution control facility information on the performance of the facility, the quantity and condition of effluent discharged and the area affected by the discharge of such effluent.

The Authority has the right to consult with any agency or department of Government having functions in relation to water or water resources to carry out operations to:

- (a) Prevent pollutants from reaching water bodies.

- (b) Remove and dispose of any polluting matter or remedy or mitigate any polluted water body in order to restore it.

### **3.1.2 Environmental Review and Permitting Process (1997)**

The Environmental Permit and License System (P&L), introduced in 1997, is a mechanism to ensure that all developments in Jamaica meet required standards in order to minimize negative environmental impacts. The P&L System is administered by NEPA, through the Applications Section (formerly the Permit and License Secretariat). Permits are required by persons undertaking new development which fall within a prescribed category. Under the NRCA Act of 1991, the NRCA is authorized to issue, suspend and revoke permits and licences if facilities are not in compliance with the environmental standards and conditions of approval stipulated. An applicant for a Permit or License must complete an application form as well as a Project Information Form (PIF) for submission to the NRCA.

### **3.1.3 Wildlife Protection Act (1945)**

The Wildlife Protection Act of 1945 prohibits removal, sale or possession of protected animals, use of dynamite, poisons or other noxious material to kill or injure fish, prohibits discharge of trade effluent or industrial waste into harbours, lagoons, estuaries and streams, and Authorizes the establishment of Game Sanctuaries and Reserves. Protected under the Wildlife Protection Act are six species of sea turtle, one land mammal, one butterfly, three reptiles and several species of birds including rare and endangered species and game birds.

### **3.1.4 The Endangered Species (Protection, Conservation and Regulation of Trade) Act (1999)**

This Act deals with restriction on trade in endangered species, regulation of trade in species specified in the schedule, suspension and revocation of permits or certificates, offences and penalties, and enforcement. Many species of reptile, amphibian and birds that are endemic to Jamaica but not previously listed under national protective legislation, or under international legislation, are listed in the Appendices of this Act.

**3.1.5 The Natural Resources (Prescribed Areas)(Prohibition of Categories of Enterprise, Construction and Development) Order (1996)**

The island of Jamaica and the Territorial Sea of Jamaica have been declared a Prescribed Area. No person can undertake any enterprise, construction or development of a prescribed description or category except under and in accordance with a permit. The Natural Resources Conservation (Permits and Licenses) Regulations (1996) give effect to the provisions of the Prescribed Areas Order.

**3.1.6 Water Resources Act (1995)**

The Water Resources Act of 1995 established the Water Resources Authority (WRA). This Authority is authorized to regulate, allocate, conserve and manage the water resources of the island. The Authority is also responsible for water quality control and is required under Section 4 of the Act to provide upon request to any department or agency of Government, technical assistance for any projects, programmes or activities relating to development, conservation and the use of water resources.

It is the responsibility of the WRA as outlined in Section 16 to prepare, for the approval of the Minister, a draft National Water Resources Master Plan for Jamaica. Areas to be covered in this Draft Master Plan of 1990 included objectives for the development, conservation and use of water resources in Jamaica with consideration being given to the protection and encouragement of economic activity, and the protection of the environment and the enhancement of environmental values.

Section 25 advises that the proposed user will still have to obtain planning permission, if this is a requirement, under the Town and Country Planning Act. In addition, Section 21 of the Act stipulates that if the water to be used will result in the discharge of effluents, an application for a license to discharge effluents will have to be made to the Natural Resources Conservation Authority or any other relevant body as indicated by the Minister.

With regard to underground water, Section 37 states that it is unlawful to allow this water to go to waste. However, if the underground water "interferes or threatens to interfere with the execution or operation of any underground works", it will not be unlawful to allow the water to go to waste in order to carry out the required works provided that there is no other reasonable method of disposing of the water. The Authority also has the power to determine the safe yield of aquifers (Section 38).

The soils test report produced by Hill-Betty Ltd. states that in all eleven (11) boreholes tested water was present at a depth of 0.8 m (2.5 ft.) indicating a high water table. Implications for the potential contamination of ground water are clear.

### **3.1.7 Country Fires Act (1942)**

Section 4 of the Country Fires Act of 1942 prohibits the setting of fire to trash without prior notice being given to the nearest police station and the occupiers of all adjoining lands. In addition, a space of at least fifteen feet in width must be cleared around all trash to be burnt and all inflammable material removed from the area. Section 6 of the Act empowers the Minister to prohibit, as may be necessary, the setting of fire to trash without a permit.

Offences against this Act include:

- Setting fire to trash between the hours of 6.00 p.m. and 6.00 a.m. (Section 5a);
- Leaving open-air fires unattended before they have been completely extinguished (Section 5b);
- Setting fires without a permit and contrary to the provisions outlined in Section 6 (Section 8);
- Negligent use or management of a fire which could result in damage to property (Section 13a);
- Smoking a pipe, cigar or cigarette on the grounds of a plantation which could result in damage to property (Section 13b).

Vegetation clearance will be required and burning may be used to facilitate this. The Developer should note the legal requirements for burning of vegetation.

### **3.1.8 Quarries Control Act (1983)**

The Quarries Control Act of 1983 established the Quarries Advisory Committee, which advises the Minister on general policy relating to quarries as well as on applications for licenses. The Act provides for the establishment of quarry zones, and controls licensing and operations of all quarries. The Minister may on the recommendation of the Quarries Advisory Committee declare as a specified area any area, in which quarry zones are to be established and establish quarry zones within any such specified area.

Section 5 of the Act states that a licence is required for establishing or operating a quarry though this requirement may be waived by the Minister if the mineral to be extracted is less than 100 cubic metres. Application procedures are outlined in Section 8. The prescribed form is to be filed with the Minister along with the prescribed fee and relevant particulars. The applicant is also required to place a notice in a prominent place at the proposed site for a period of at least 21 days starting from the date on which it was filed.

Any quarries used to provide material for the project should be licensed.

### **3.1.9 The Pesticides (Amendment) Act (1996)**

The Pesticides (Amendment) Act of 1996 amended sections of the principal act, which came into effect in 1975 and established the Pesticides Control Authority. This Act gives the Authority the responsibility of controlling the importation, manufacture, packaging, sale, use and disposal of pesticides. Section 11 states that the Authority is required to keep a register or record of all relevant information such as registered pesticides, restricted pesticides, pest control operators and persons licensed to import or manufacture pesticides. Under Section 16 of the Act, the Authority may also, with the approval of the Minister, make regulations which relate to areas such as:

- Aerial application of pesticides;
- Supervision required for the use of pesticides, the prescribed protective clothing to be worn and other precautionary measures;
- The permissible levels of pesticides to be used;
- The periods during which particular pesticides may or may not be used on certain agricultural crops;
- The disposal of pesticides and packages.

### **3.1.10 Clean Air Act (1964)**

This act refers to premises on which there are industrial works, the operation of which is in the opinion of an inspector likely to result in the discharge of smoke or fumes or gases or dust in the air. An inspector may enter any affected premise to examine, make enquiries, make tests and take samples of any substance, smoke, fumes, gas or dust as he considers necessary or proper for the performance of his duties.

### **3.1.11 Noise Standards**

Jamaica has no national legislation for noise, but World Bank guidelines have been adopted by the National Environment and Planning Agency (NEPA) and are used for benchmarking purposes along with the draft National Noise Standard that is being prepared. The guidelines for daytime perimeter noise is 75 decibels and 70 decibels for nighttime noise.

### **3.1.12 Water Quality NRCA Act (1990)**

The NRCA has primary responsibility for control of pollution in Jamaica's environment, including pollution of water. National Standards exist for industrial and sewage discharge into rivers and streams. WHO Standards for drinking water are used and these are regulated by the National Water Commission. There are no national standards for ambient water quality of riverine systems. The tables below give the relevant NRCA Interim Irrigation Standards and Sewage Effluent Standards.

The site contains several streams and is adjacent to a gully. During the construction and operation phases the integrity of the water quality in these systems should not be compromised. The sewage treatment plant proposed meets the standards for effluent discharge.

**Table 3.1.12a: Interim Irrigation Standards**

<b>Natural Resources Conservation Authority (NRCA)</b>	
<b>Interim Irrigation Standards</b>	
<b>Parameter</b>	<b>Standard Limit</b>
Oil & Grease	10 mg/L
Total Suspended Solids (TSS)	15 mg/L
Residual Chlorine	0.5 mg/L
Biochemical Oxygen Demand (BOD)	15 mg/L
Chemical Oxygen Demand (COD)	<100 mg/L
Faecal Coliform	12 MPN/100mL

**Table 3.1.12b: NRCA Sewage Effluent Standards**

<b>Immediate Technology Based Effluent Standards</b>	
<b>Parameter</b>	<b>Effluent Limited</b>
BOD <sub>5</sub>	20 mg/l
TSS	30 mg/l
Nitrates (as Nitrogen)	30 mg/
Phosphates	10 mg/l
COD	100 mg/l
pH	6-9
Faecal Coliform	1000 MPN/100ml
Residual Chlorine	1.5 mg/l
<b>Proposed Sewage Effluent Standards</b>	
BOD <sub>5</sub>	20 mg/l
TSS	20 mg/l
Total Nitrogen	10 mg/l
Phosphates	4 mg/l
COD	100 mg/l
pH	6-9
Faecal Coliform	1000 MPN/100ml
Residual Chlorine	1.5 mg/l

**3.1.13 Trade Effluent Regulations (1996)(Draft)**

Jamaica has draft regulations governing the quality of the effluent discharged from facilities to public sewers and surface water systems. These draft regulations should be gazetted sometime in 2006. The draft guidelines require the facility to meet certain basic water quality standards for trade effluent including sewage. The requisite permits and licenses are required to install and operate sewage treatment facilities.

Gore Developments Ltd. Has applied for a permit to construct a sewage treatment facility and a licence to discharge sewage effluent. The proposed sewage treatment facility will be designed to meet NEPA standards for effluent discharge.

### **3.2 National Legislation – Social Environment**

#### **3.2.1 Town and Country Planning Act (1958)**

Section 5 of the Town and Country Planning Act authorizes the Town and Country Planning Authority to prepare, after consultation with any local authority, the provisional development orders required for any land in the urban or rural areas, so as to control the development of land in the prescribed area. In this manner, the Authority will be able to coordinate the development of roads and public services and conserve and develop the resources in the area.

Any person may, under Section 6 of the Act, object to any development order on the grounds that it is:

- impractical and unnecessary;
- against the interests of the economic welfare of the locality.

However, if the Minister is satisfied that the implementation of the provisional development order is likely to be in the public interest, he may, under Section 7 (2) of the Act, confirm it with or without modification by publishing a notice in the Gazette. Section 8 of the Act also gives the Minister the authority to amend a confirmed development order.

Section 10 of the Act states that a development order must include:

- clearly defined details of the area to be developed;
- regulations regarding the development of the land in the area specified;
- formal granting of permission for the development of land in the area.

If the provisions of section 9A of the Natural Resources Conservation Authority (NRCA) Act apply to the development, the application can only be approved by the Planning

Authority after the NRCA has granted a permit for the development. (Section 11 (1A)). The Authority may impose a "tree preservation order" under Section 25 of the Act if it considers it important to make provision for the preservation of trees and woodlands in the area of the development. This order may:

- prohibit the cutting down, topping, lopping or willful destruction of trees;
- secure the replanting of any section of the woodland area in which trees were felled during the forestry operations permitted under the order.

The tree preservation order is not applicable to the cutting down of trees which were already dead, dying or had become dangerous and the order can take effect only after it has been confirmed by the Minister.

The Minister can, under Section 26 of the Act, make regulations to restrict and regulate the display of advertisements in any area to be developed if he considers this to be in the interest of public safety. Section 28 of the Act empowers the local authority to require the owner or occupier of land in the development area to take the steps necessary to ensure its proper maintenance.

### **3.2.2 Land Development and Utilization Act (1966)**

Under Section 3 of the of the Land Development and Utilization Act (1966), the Land Development and Utilization Commission is authorized to designate as agricultural land, any land which because of its "situation, character and other relevant circumstances" should be brought into use for agriculture. However, this order is not applicable to land, which has been approved under the Town and Country Planning Act for development purposes other than that of agriculture. Among the duties of the Commission outlined in Section 14 of the Act is its responsibility to ensure that agricultural land is "as far as possible, properly developed and utilized".

The property has been zoned for housing, was already developed with some infrastructure such as roads, pipes and fire hydrants, and has an existing housing subdivision adjacent to it.

### **3.2.3 Public Health Act (1976)**

The Public Health (Air, Soil and Water Pollution) Regulations 1976, aim at controlling, reducing, removing or preventing air, soil and water pollution in all possible forms.

Under the regulations given:

- i. No individual or corporation is allowed to emit, deposit, issue or discharge into the environment from any source.
- ii. Whoever is responsible for the accidental presence in the environment of a contaminant must advise the Environmental Control Division of the Ministry of Health and Environmental Control, without delay.
- iii. Any person or organization that conducts activities which release air contaminants such as dust and other particulates is required to institute measures to reduce or eliminate the presence of such contaminants.
- iv. No industrial waste should be discharged into any water body which will result in the deterioration of the quality of the water.

### **3.2.4 The National Solid Waste Management Authority Act (2001)**

The National Solid Waste Management Authority Act (2001) is “an act to provide for the regulation and management of solid waste; to establish a body to be called the National Solid Waste Management Authority and for matters connected therewith or incidental thereto”. The Solid Waste Management Authority (SWMA) is to take all steps as necessary for the effective management of solid waste in Jamaica in order to safeguard public health, ensure that waste is collected, sorted, transported, recycled, reused or disposed of, in an environmentally sound manner and to promote safety standards in relation to such waste. The SWMA also has responsibility for the promotion of public awareness of the importance of efficient solid waste management, to advise the Minister on matters of general policy and to perform other functions pertaining to solid waste management.

Solid waste management will be essential in both the construction and operation phases and will require the removal and proper disposal of vegetative matter, untreated sewage effluent, soil, construction rubble, unused subdivision infrastructure and sludge from the existing sewage pond.

### **3.2.5 Jamaica National Heritage Trust Act (1985)**

The Jamaica National Heritage Trust Act of 1985 established the Jamaica National Heritage Trust (JNHT). The Trust's functions outlined in Section 4 include the following responsibilities:

- To promote the preservation of national monuments and anything designated as protected national heritage for the benefit of the Island;
- To carry out such development as it considers necessary for the preservation of any national monument or anything designated as protected national heritage;
- To record any precious objects or works of art to be preserved and to identify and record any species of botanical or animal life to be protected.

Section 17 further states that it is an offence for any individual to:

- willfully deface, damage or destroy any national monument or protected national heritage or to deface, damage, destroy, conceal or remove any mark affixed to a national monument or protected national heritage;
- alter any national monument or mark without the written permission of the Trust;
- remove or cause to be removed any national monument or protected national heritage to a place outside of Jamaica.

The Rose Hall area is a known heritage area and includes listed sites such as the Rose Hall Great House and aqueducts. Additionally, evidence suggests that the site may have been significant as a Taino site. However, considering that the site was cleared previously for the development of subdivision infrastructure it is not expected that many untouched artifacts would be remaining.

**3.2.6 Land Acquisition Act (1947)**

Section 3 of the Land Acquisition Act (1947) empowers any officer authorized by the Minister to enter and survey land in any locality that may be needed for any public purpose. This may also involve:

- Digging or boring into the sub-soil;
- Cutting down and clearing away any standing crop, fence, bush or woodland;
- Carrying out other acts necessary to ascertain that the land is suitable for the required purpose.

The Minister is authorized under Section 5 of the Act to make a public declaration under his signature if land is required for a public purpose provided that the compensation to be awarded for the land is to be paid out of the:

- Consolidated Fund or loan funds of the Government;
- Funds of any Parish Council, the Kingston and St. Andrew Corporation or the National Water Commission.

Once the Commissioner enters into possession of any land under the provisions of this Act, the land is vested in the Commissioner of Lands and is held in trust for the Government of Jamaica in keeping with the details outlined in Section 16. The Commissioner shall provide the Registrar of Titles with a copy of every notice published as well as a plan of the land. The Commissioner will also make an application to the Registrar of Titles in order to bring the title of the land under the operation of the Registration of Titles Act.

**3.2.7 Registration of Titles Act (1989)**

The Registration of Titles Act of 1989 is the legal basis for land registration in Jamaica, which is carried out using a modified Torrens System (Centre for Property Studies, 1998). Under this system, land registration is not compulsory, although once a property is entered in the registry system the title is continued through any transfer of ownership.

### **3.2.8 The Housing Act (1968)**

The Jamaica Housing Act of 1968 is the legal basis for housing in Jamaica. The Act outlines the primary roles of the Minister of Housing; the procedures for acquisition of land required for schemes, the preparation and approval of schemes; and the preparation, approval, and completion of schemes prepared by housing associations.

The Housing Act established the Minister responsible for Housing as a Corporation Sole, which allows him to have perpetual succession and to acquire, hold and dispose of land and other property of whatever kind.

The Minister is advised under section 9 of the Act; that before approving a scheme, information be furnished to the Local Authority within whose area the scheme is to be operative. The particulars to be furnished shall include specifications and estimates, and particulars relating to roads, water supply, sewerage and lighting, if appropriate to the scheme.

The Minister before approving a scheme should also consider any objections or representations made to him in pursuance of this section and shall afford the Local Authority making such objections or representations an opportunity to be heard.

### **3.3 International Legislative And Regulatory Considerations**

#### **3.3.1 Cartagena Convention (Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region) (1983)**

Adopted in March 1983 in Cartagena, Colombia, the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, also known as the Cartagena Convention, is the only legally binding environmental treaty for the Wider Caribbean. The Convention came into force in October 1996 as a legal instrument for the implementation of the Caribbean Action Plan and represents a commitment by the participating governments to protect, develop and manage their common waters individually and jointly.

Ratified by twenty countries, the Cartagena Convention is a framework agreement which sets out the political and legal foundations for actions to be developed. The operational Protocols, which direct these actions, are designed to address special issues and to initiate concrete actions. The Convention is currently supported by three Protocols. These are:

- *The Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region* (The Oil Spills Protocol), which was adopted and entered into force at the same time as the Cartagena Convention;
- *The Protocol Concerning Specially Protected Areas and Wildlife in the Wider Caribbean Region* (The SPAW Protocol), which was adopted in two stages, the text in January, 1990 and its Annexes in June, 1991. The Protocol entered into force in 2000;
- *The Protocol Concerning Pollution from Land-based Sources and Activities in the Wider Caribbean Region* (LBS Protocol), which was adopted in October, 1999.

### **3.3.2 Biodiversity Convention**

The objectives of the Convention on Biological Diversity are "the conservation of biological diversity, sustainable use of its components and the fair equitable sharing of the benefits arising out of the utilization of genetic resources". This is the first global, comprehensive agreement which has as its focus all aspects of biological diversity: genetic resources, species and ecosystems. The Convention acknowledges that the "conservation of biological diversity is a common concern of humankind and an integral part of the development process". In order to achieve its goals, the signatories are required to:

- Develop plans for protecting habitat and species.
- Provide funds and technology to help developing countries provide protection.
- Ensure commercial access to biological resources for development.
- Share revenues fairly among source countries and developers.
- Establish safe regulations and liability for risks associated with biotechnology development.

Jamaica's Green Paper Number 3/01, entitled *Towards a National Strategy and Action Plan on Biological Diversity in Jamaica*, speaks to Jamaica's continuing commitment to its obligations as a signatory to the Convention.

## **4.0 Methodology and Approach**

### **4.1 General Approach**

A multi-disciplinary team of experienced scientists and environmental professionals was assembled to carry out the required resource assessment, generation of baseline data, determination of potential impacts and recommendation of mitigation measures. The members of the project team are given in Appendix II. An iterative approach among the environmental team members and other project professionals was adopted.

The team utilized the Charette-style approach to data gathering, analysis, and presentation whereby team members conducted the reconnaissance investigations together to determine the critical elements for analysis and the issues to be highlighted for the design and planning process. Team meetings were held to discuss the progress of investigations and analyses and facilitate integration of data toward an understanding of the systems at work in both the natural and built environment.

The EIA team worked very closely with the other project team members including the project manager, civil engineer, architect and land surveyor.

Baseline data for the study area was generated using a combination of:

- Field studies
- Aerial survey
- Analysis of maps, plans, aerial photos
- Review of reports and background documents
- Structured Interviews
- Laboratory analyses

## **4.2 Physical Environment**

The existing physical environment was assessed in terms of climate, topography, land cover/use, geology/hydrogeology, soils, hydrology (including ground and surface water quality) assessment of adequacy of water supply for the proposed demand and natural hazards including slope instability, flooding, earthquakes, hurricanes and soil erosion.

### **4.2.1 Climate**

Climate data was sourced from the National Meteorological Service of Jamaica. Note - rainfall data in 4.2.4 as part of hydrology assessment methodology.

### **4.2.2 Topography**

The topographical description was based on the available topographic survey of the site. The slope diagram was generated by creating a triangulated image and using ARCVIEW GIS to create a slope map.

### **4.2.3 Geology/ Hydrogeology**

Geology was assessed by using the published geological map for the area, a review of available literature and confirmed by field verification.

### **4.2.3 Soils**

Soils were assessed based on the Rural Physical Planning Division categorization and mapping for the area, and confirmed by field assessment.

### **4.2.4 Hydrology and Drainage**

Hydrology was described based on available data for the Martha Brae hydrologic basin obtained from the Water Resources Authority (WRA). Surface run-off was determined using the Hydrological Modeling System (HEC-GeoHMS), and an extension of ArcViewGis was used to delineate the drainage network based on a digital surface model. The software analysed flow direction and flow accumulation.

Additionally, an interactive and intractive process was employed among the EIA team members, particularly the hydrological professionals and the engineer.

The peak flow determination for the catchments is based on the SCS (Soil Conservation Services, Unites States Department of Agriculture, Washington, DC) Rainfall-Runoff

Relation  $Q_d = \frac{(P - 0.2S)^2}{p + 0.8S}$  where  $Q_d$  is the accumulated runoff in millimeters, P is the

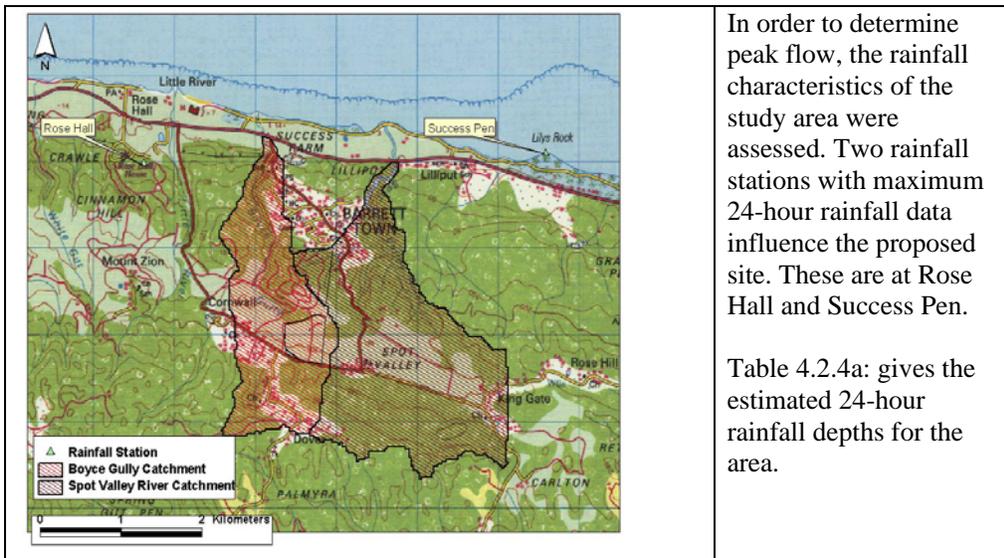
accumulated rainfall depth in millimeters and S the available soil moisture storage deficit

in millimeters given by  $S = \frac{25400}{CN} - 254$

The curve number (CN) is an index of runoff and is a function of the soil group, land use and antecedent soil moisture conditions. The basin outflow Q is the result of a transformation of  $Q_d$  using the dimensionless unit hydrograph option of the HEC-1 model. The SCS-unit hydrograph parameter is the Lag, which has the unit in hours and is

computed as:  $Lag = \frac{L^{0.8}(S + 1)^{0.7}}{19000Y^{0.5}}$

In this empirical formula, L is the hydraulic length in feet, S the storage deficit in inches and Y the percent slope of the basin.



**Figure 4.2.4: Locations of Rainfall Stations**

**Table 4.2.4a: Maximum 24-Hour Rainfall Depths for Different Return Periods - Rhyne Park Area**

LOCATION	Period of Record	Return Period				
		T5	T10	T25	T50	T100
Rose Hall	1950-86	136	166	204	232	260
Success Pen	1950-86	111	134	163	184	205

The Rose Hall station located approximately 1.8 km west of the Boyce Gully catchment has been selected to be representative of this catchment and Success Pen station to be representative for the Spot Valley River catchment. The 24-hour rainfall depths for the above return periods were recalculated to represent shorter durations in the following manner:

The 1-hour duration rainfall depth was determined by multiplying the 24-hour rainfall depth with the average ratios shown in Table 24.2.4b.

1. The 5 minutes to 30 minutes duration rainfall depths were calculated by multiplying the 1-hour rainfall depth by the ratios in the second column Table 2.
2. For 2 – 12 hour rainfall depths an interpolation constant (second column Table 2) was applied. The rainfall depth for n-hours are described by the equation:

$$R_n = C_n \times R_{m2} + (1 - C_n) \times R_{m1}$$

where  $R_n$  is the desired rainfall depth

$C_n$  is the interpolation constant

$R_{m1}$  and  $R_{m2}$  are the 1-hour and 24-hour rainfall depths respectively

**Table 4.2.4b: Average Ratios for the conversion of the 24 Hour rainfall depth into an 1-Hour Rain**

1-24 hour ratios	
5 yr – 1 hr/5y – 24 hr	0.41
10 yr – 1 hr/10yr – 24 hr	0.4
25 y – 1 hr/25 yr –24 hr	0.38
50 y – 1 hr/50 y – 24 hr	0.37
100 yr – 1 h/100 yr – 24 hr	0.35

#### 4.2.5 Natural Hazard Risk

Assessment of natural hazard risk was accomplished through a review of relevant literature pertaining to soils, slopes and drainage, site assessment, and anecdotal reports on historical events from residents in the surrounding communities.

#### 4.2.6 Air Quality

The objective of the air quality monitoring exercise was to determine the normal concentration of respirable particulates in the project area prior to construction works.

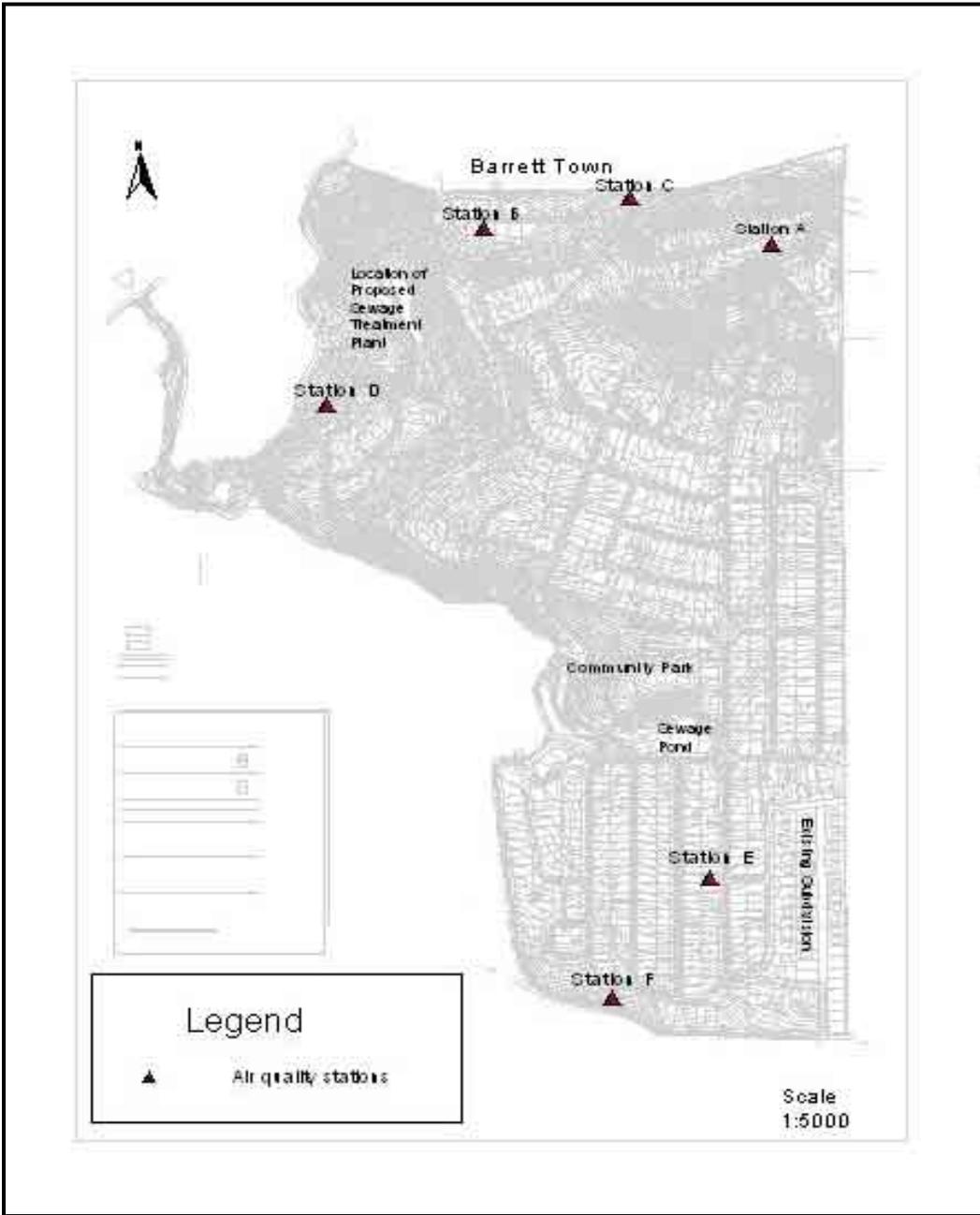
Air contains particulates in the form of dust. A portion of that dust with particle size less than 10 microns can be retained in the lungs. During construction and excavation activities the concentration of fugitive dust increases significantly.

Air quality measurements were taken at six sites in the project area. The sites are listed in Table 4.2.6 and shown in Figure 4.2.6.

**Table 4.2.6: Location of Air Quality Sampling Stations**

Site #	Location
A	North Eastern Corner of Project site adjacent to Barrett Town
B	North Western Corner of Project site adjacent to Barrett Town
C	Centre of Northern Property boundary adjacent to Barrett Town
D	Centre of Western Property boundary
E	South eastern property boundary within the existing housing development

Figure 4.2.6: Air Quality Sampling Stations



The air quality assessment involved the measurement of ambient levels of respirable particulates, PM10 (<10µm). Particulates were measured using Sensidyne (BDX 530) personal vacuum pumps (suction 2-3 l/min), attached to pre-weighed Millipore filters. The pumps were placed at the approximate respiratory height of pedestrians over a twenty-four hour period at the six sites. The pumps were then returned to the ESL laboratory where the filters were stabilised and weighed to determine a Time Weighted Average (TWA) value for the particulates.

#### 4.2.7 Water Quality

The major objective of the present water quality sampling programme was to assess current land use practices prior to the construction of the Rhyne Park Village and to determine the nature and extent of existing land use impacts. The objective was largely met through a detailed site investigation and the conduct of three weekly water quality surveys, during January and February 2006. It should be noted that sampling was conducted during the dry season only.

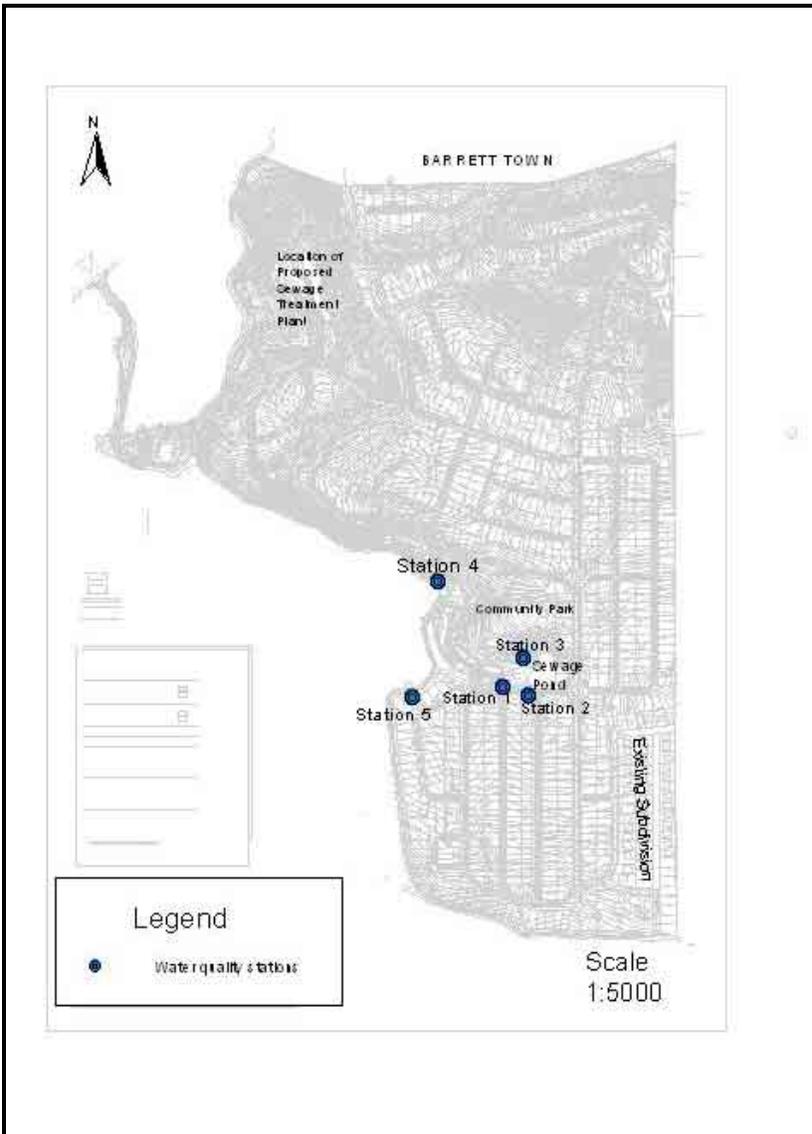
Five sampling stations were selected based on their location relative to the discharge points of surface and possibly subsurface drainage systems, as well as their current or potential impairment. The sampling stations are listed in Table 4.2.7 and shown on Figure 4.2.7.

**Table 4.2.7: Water Quality Stations for Rhyne Park Village**

Site #	Location
1	Freshwater spring
2	Existing sewage pond
3	Beginning of Boyce gully, south of sewage pond
4	Downstream near road bridge
5	NWC pumping station

Samples were collected at a depth of 0.5m. All samples were collected in pre-cleaned 2 litre polyethylene sample bottles. Bacterial samples are collected at the water surface in sterilized 100 ml glass and plastic bottles.

**Figure 4.2.7: Water Quality Stations**



The following parameters were analysed on all of the water samples:

- ◇ pH
- ◇ Conductivity
- ◇ Temperature
- ◇ Dissolved Oxygen
- ◇ Total Suspended Solids
- ◇ Nitrate
- ◇ Phosphate
- ◇ BOD<sub>5</sub>
- ◇ Total and Faecal Coliform
- ◇ Fats, oil and grease
- ◇ Manganese
- ◇ Copper
- ◇ Lead
- ◇ Iron

Salinity, temperature, and dissolved oxygen were measured *in situ* at all sampling stations using a YSI Model 57 Salinity/Conductivity/Temperature (SCT) meter and YSI Model 33 oxygen meter respectively. Measurements were taken at the surface (0.5m depth) of the water column.

Environmental Solutions Limited Laboratory performed or supervised the analysis of all parameters. Laboratory analyses used certified methodology, primarily from the text 'Standard Methods for Examining Water and Wastewater'.

The quality control programme at the ESL laboratory involves the collection of duplicate samples for every four samples collected in the field. Laboratory duplicate samples are also analysed.

### **4.3 Biological Environment**

#### **4.3.1 Flora**

The status of the flora of the study area was determined by a review of literature relevant to the area and supported by field investigations throughout the property. The surveys focused on dominant plants and habitats, which were observed by extensive walked transects on 26<sup>th</sup> January (0730-1630) and 8<sup>th</sup> February (1000-1700). Unidentified Plant specimens were collected and taken to the University of the West Indies herbarium for identification.

#### **4.3.2 Fauna**

The status of the fauna of the study area was also determined by a review of literature relevant to the area and field investigations throughout the property. The detailed surveys focused on birds, which were sampled by extensive walked transects on 26<sup>th</sup> January (0730-1630) and 8<sup>th</sup> February (1000-1700). Birds were identified by sight or by call. *Ad hoc* observations of butterflies and other wildlife were also recorded.

#### **4.3.3 Parks and Protected Areas**

Parks and Protected Areas in close proximity to the site were identified.

### **4.4 Socio-economic Environment**

A combination of rapid field appraisal techniques, windscreen observations, informal interviews, literature surveys and desk research were employed to collect data on the socio-economic considerations within the project area, and the surrounding communities. The data collected was based on the following aspects:

- Demographics and livelihoods
- Land use and zoning
- Physical infrastructure
- Traffic pattern, transportation and access roads
- Public perception
- Archaeological and cultural heritage

**4.4.1 Demographics and Livelihoods**

Statistical data was obtained from the Population Census 2001, Jamaica (Statistical Institute of Jamaica, 2003); secondary data was also obtained from the Greater Montego Bay Area (GMBA) Plan, 2014 (Greater Montego Redevelopment Company, 1997) and the Strategic Environmental Assessment for the Rose Hall Master Plan (Environmental Solutions, 2004). Information collected from interviews and discussion with residents was also utilized and incorporated in the findings.

**4.4.2 Land use and Zoning**

The assessment of land use and zoning drew heavily on the Rose Hall Master Plan (to Figure 1.2b), which includes the land use for the entire Rose Hall area. Evaluation of the proposed land use of the site was through discussions with the project managers and from viewing the development plan layout of the housing development.

**4.4.3 Physical Infrastructure**

Survey of existing infrastructure was done through field investigations and from interviews with residents of the existing subdivision. The availability of physical infrastructure during both the construction and operational phase were considered. Interviews with the project relevant personnel were carried out and helped to inform the mitigation recommendations.

**4.4.4 Traffic Pattern, Transportation and Access Roads**

A traffic study done Nicholson (2006) at the request of Gore Developments, was the main document used to assess traffic pattern, transportation and access roads, applicable to the project. This Traffic Impact Assessment report has been submitted to the National Works Agency for approval.

#### **4.4.5 Archaeological and Cultural Heritage**

Information on archaeology and cultural heritage was obtained mainly through desk research, literature surveys, consultations with individuals and communication with the Jamaica National Heritage Trust. There are no JNHT listed sites on the property.

#### **4.4.6 Public Perception of the Project**

Public perception of the proposed project was obtained through interviews with residents of the existing subdivision, the neighbouring communities of Barrett Town and Spot Valley and the General Manager of Rose Hall Development Ltd. (Stanley Nansen, Pers. Com.). A total of 14 persons were interviewed during a three day period from January 25 – 26, 2006 and on January 29, 2006. Interview instruments were designed and applied. Examples of these interview instruments are given in Appendix XII.

## 5.0 The Existing Environment

### 5.1 Physical Environment

#### 5.2.1 Climate

The climate in this area is subtropical as for the entire island of Jamaica with northeast trades influencing the area throughout the year. Average daily temperatures along the coast are 26.2° C with a maximum average of 30.3° C and a minimum average of 22.0° C. The relative humidity in coastal areas averages 84% at 7 a.m. as temperatures at this time are in the mid 20's (°C). At 1 p.m. the average relative humidity on the coasts is 71%. (Source: <http://www.metservice.gov.jm/relative.asp>).

Rainfall data (Table 5.2.1) from the Meteorological Office over the period 1951-1980 indicate mean annual rainfall depth for Cinnamon Hill (located ~1 km WNW of the site) of 974 mm, which is relatively dry. The mean monthly rainfall distribution shows the typical bimodal pattern, with rainfall below 100 mm for most of the year mean monthly, and rainfall peaks May-June and October–November (with the maximum mean monthly rainfall depth of 150 mm occurring in October). February and March represent the driest months.

**Table 5.2.1 1951-1980 Mean Monthly Rainfall (mm) for Cinnamon Hill**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
66	46	36	56	107	97	36	71	91	150	137	81	<b>974</b>

(Source: National Meteorological Service of Jamaica-NMSJ)

Rainfall data from Rose Hall and Success Pen were also used in the hydrological assessment, as indicated in Section 3.2.4.

During the hurricane season (June 1<sup>st</sup> to November 30<sup>th</sup>) extreme weather conditions result in high rainfall and strong winds. These systems originate in the southeastern

Atlantic Ocean and move generally northwestward through the Caribbean. During the winter period (December to March) winds from the north (called “Northers”) produce slow moving cold fronts that bring significant long duration low intensity rainfall.

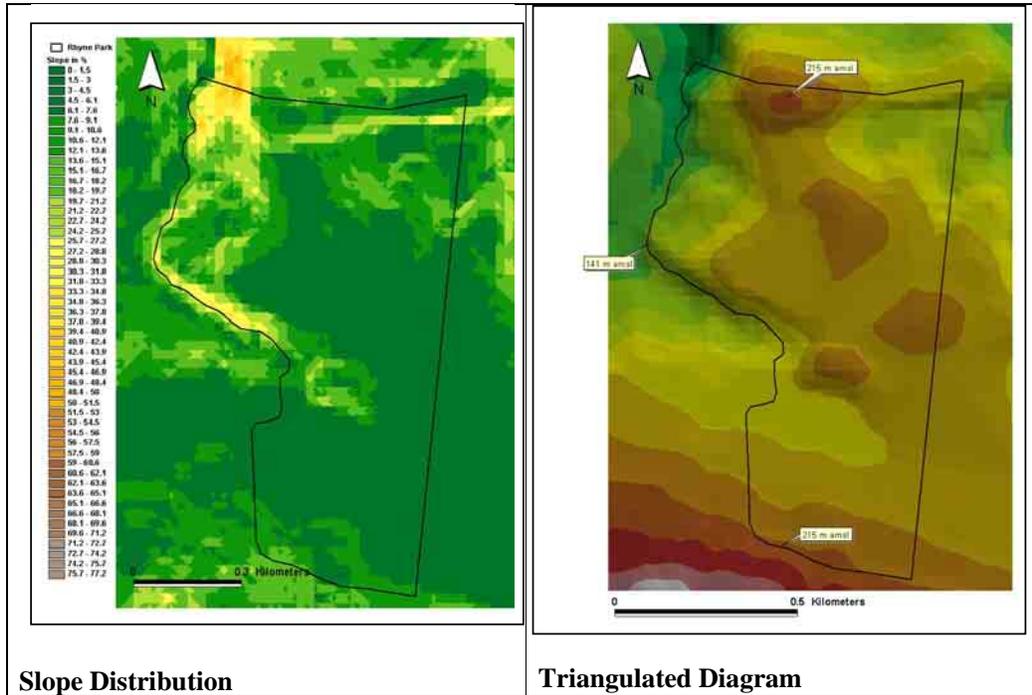
### **5.2.2 Topography**

The topographic elevation ranges between 141 m above mean sea level (amsl) in the western section and 215 m amsl at its southern border to the road. The main geomorphological units found at the site include:

1. Steeply sloping limestone ridge (greater than 25%) and flat-topped escarpments (north-western and northern sides of the property – Plate 5.2.2). The steeper slopes on the western side of the property are part of the Boyce Gully valley. The northern slopes are part of an east-west trending ridge system, which may be structurally controlled.
2. Flat-topped limestone hills (rolling topography) found on much of the central parts of the property
3. More gently (5%) sloping terrain with surface drainage found on the southern part of the site (including the lands on which the older sub-division was built).

The terrain analysis is shown in Figure 5.2.2. The distribution of slopes on the property is shown in Figure 5.2.2a and, the triangulated diagram in Figure 5.2.2b.

Figure 5.2.2 a and b: Slope Distribution and Triangulated Diagram

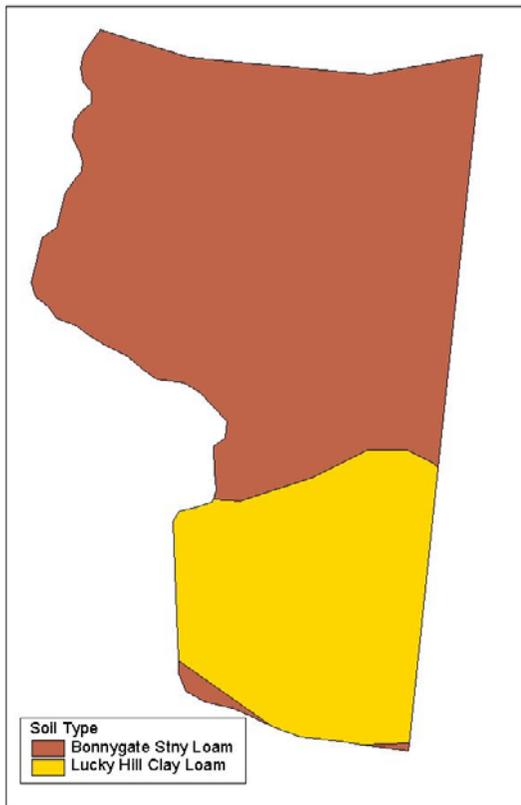




**Plate 5.2.2: Typical escarpment with flat top, rubble limestone exposed.**

### **5.2.3 Soils**

The soil report prepared by Hill-Betty (Engineers) Ltd. indicates low bearing pressure for the upper soil layer in the samples taken across the site. It is recommended that in order to achieve a blanket bearing pressure the first 1.5m of soil be removed and replaced with compacted granular material.



**Figure 5.2.3: Soil categorization**

The site is characterized by two distinct soil types (Figure 5.2.3) based on the Rural Physical Planning Division categorization. The northern part of the site (~70% of the site) is underlain by Bonny Gate stony loam (a residual soil developed over limestone bedrock). This unit has a very rapid internal drainage capacity, high permeability and a high erosion risk.

The remaining 30% is underlain by the Lucky Hill clay loam, which has a very slow internal drainage capacity/low permeability and slight erosion risk.

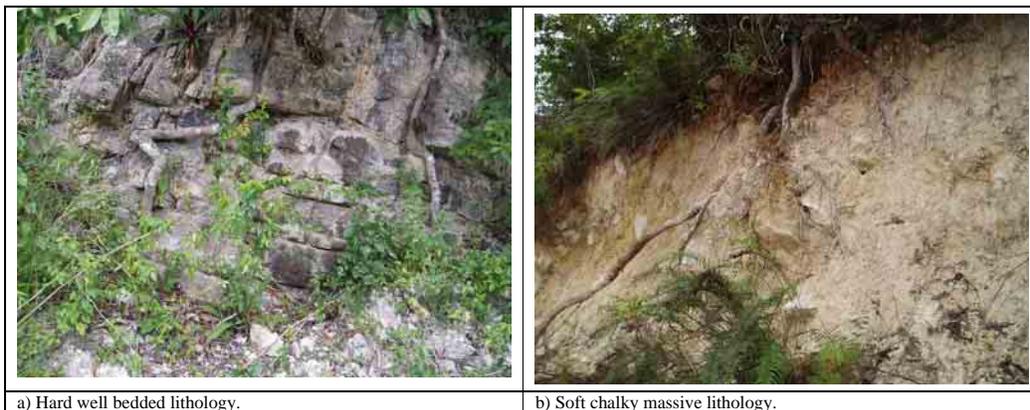
#### 5.2.4 Geology

Tertiary limestones belonging to the White Limestone Supergroup (WLS) underlie the site. These consist of very pure white limestones of varying lithologies. The recognition of the formations in the WLS is generally based on a combination of biostratigraphic and lithostratigraphic criteria. Robinson (1994) divided the WLS into two lithostratigraphic units, which represent laterally equivalent units, with the Montpelier Group representing periplatform deposits flanking the deep sea floor and Moneague Group (shallower carbonate deposits).

The Montpelier Formation is characterized by a foraminiferal assemblage, which includes *H. antilleo*, *L. Canellei*, *Operculinoides cojimarensis* and *Miogypsinoides complanus*). Lithostratigraphically, it is generally described as a hard well-bedded micrite with chert (siliceous) bands/nodules (Figure 1/a), and may be interbedded with bioclastic layers. Figure 1/b shows a second lithology observed on the site at various locations (photo taken on road leading towards proposed site of the sewage treatment plant). This is a soft chalky cream-white massive limestone with micritic corestones. The latter probably represents a sub-facies of the Montpelier limestone.

The typical lithology of the Montpelier limestone is classified as a limestone aquiclude. The development of the headwaters of the Boyce Gully and the Spot Valley River are indicative of the change in lithology to the Montpelier Formation, which does not allow for significant underground drainage.

**Plate 5.2.4: Lithologies at the Site**



The provisional geological sheet for the area indicates that the Bonny Gate Formation (a member of the Montpelier Group, also a well-bedded micritic White Limestone) outcrops on the southern border of the site. The absence of surface drainage on the south side may be indicative of the presence of this unit, which behaves as an aquifer.

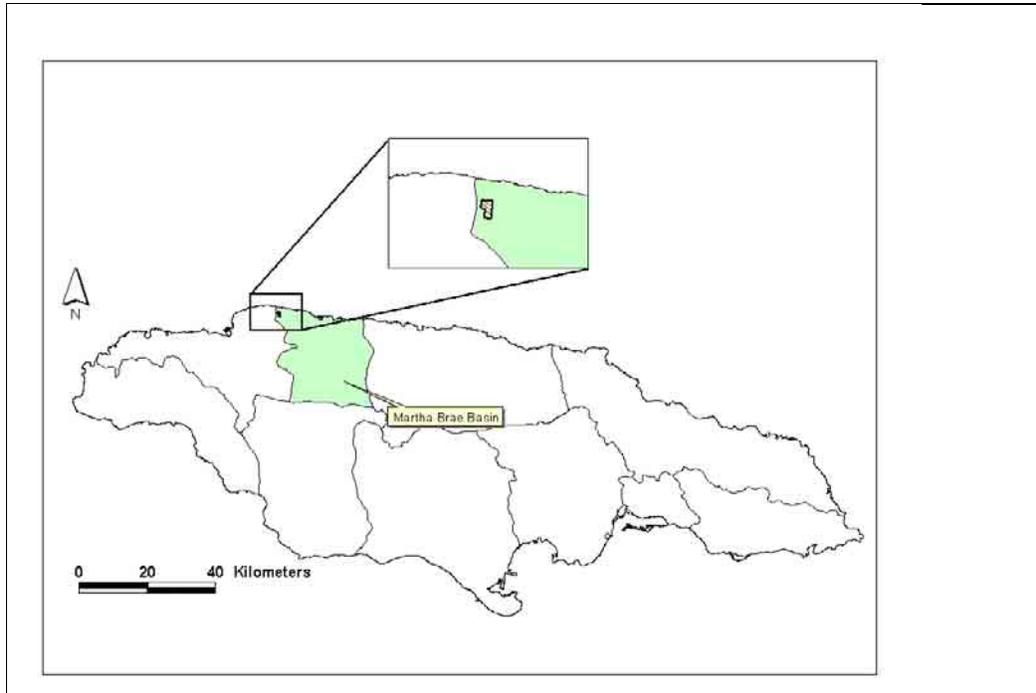
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## 5.2.5 Hydrology and Drainage

### 5.2.5.1 Hydrologic Classification

The development site is located at the extreme northwestern section of the Martha Brae hydrologic basin (Figure 5.2.5.1). The Martha Brae Basin is 699 km<sup>2</sup> and contains six distinct hydrostratigraphic units.

The size and percentage distribution of the units is given in Table 5.2.5.1.



**Figure 5.2.5.1: Hydrologic Basins of Jamaica (Source: WRA)**