

**ENVIRONMENTAL IMPACT ASSESSMENT
FOR A DEVELOPMENT - PART OF RICHMOND,
LLANDOVERY, ST. ANN**

FIRST DRAFT



Presented to the:
NATIONAL ENVIRONMENT AND PLANNING AGENCY
10 Caledonia Avenue
Kingston 5



EPN CONSULTANTS LIMITED
Environmental Planners & Navigators

June 2005

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10 Caledonia Avenue
Kingston 5**

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June 2005

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EXECUTIVE SUMMARY

This development was conceived as a multidimensional project that would integrate a variety of land uses which would meet two basic objectives of the conversion of the Richmond property from traditional farming in sugar cane and cattle rearing to non-traditional agricultural production (such as floriculture) utilizing non-traditional techniques (hydroponics) and providing housing solutions. The development would proceed within the context of the awareness of the need to promote strong sustainable development principles as it contemplates the environmental management aspects of the project. The success of such a development would enhance the objective of sustainable development within the region and nationally.

The proposed development is expected to achieve:

- The construction of housing solutions geared to the middle to high income population.
- Improvement in the housing stock.
- Contribute to urbanization and regional development.
- Become a showcase for non-traditional agricultural production.

This Draft Environmental Impact Assessment (DEIA) will, therefore, consider the effects of the development on the physical environment, the ecology, the socio-economic and cultural environments and significant aspects related to health and safety and risk management. During the planning process, technical and economic considerations have not been embraced at the expense of environmental concerns as issues of concern are addressed within this (DEIA) report. To enhance the receiving environment, where adverse impacts are identified appropriate mitigation measures are recommended to reduce or remove. These impacts are identified based on their direction, duration, location and significance. In order to ensure that negative impacts are mitigated a proposal for the monitoring and management of these significant aspects is included the report.

More specifically, issues of concern to be confronted within the development relate to the initial socio-economic effects of the disruption to the lives of the residents as measures to implement the development through preparational, constructional and operational phases of the development.

At the end of this DEIA process it is expected therefore, that the issues associated with the proposed development would have been thoroughly explored and the potential environmental consequences addressed with suitable mitigation measures implemented where they are deemed to be adverse. Below impacts on the Physical, Terrestrial and Socio-economic environments are discussed.

Environmental Impacts

No significant negative impacts were revealed. Those that were identified in the biophysical settings, as well as in the socio-economic/socio-cultural spheres could be mitigated by methods incorporated in the project design or by collaborating with the relevant state agency.

a. The Physical Environment

The potential for groundwater and marine contamination would relate primarily to the disposal of sewage effluent. However, the risk of groundwater contamination is low, as a central sewage treatment facility with a reed bed would be built to achieve treatment to a tertiary level. The use of pesticides from agricultural production would be managed to reduce any potential risk from its usage.

Any potential flood hazard on the site and along the North Coast Highway will be mitigated with current infrastructure works on the Highway, as well as, those proposed for the Richmond Property; there are at least three natural waterways that can facilitate the management of runoff from the property.

b. Terrestrial Environment

The direct impact of the proposed conversion of the Richmond Property to residential housing and commercial lots and farm homestead would be in the region of a 70 percent loss in vegetative cover on the property. With this change in habitat structure and composition there would be further reduction of faunal diversity, however, they are of low conservation importance.

Wherever possible clear-cutting would be avoided and the larger trees of the property will be strategically marked for conservation. Saving those trees, including domestic tree crops, such

as, ackee trees, would also significantly advance the aesthetics of the area. The preservation of trees and creation of open spaces within the community would also act as a mitigation measure against the loss of the associated species. The proposed Landscape Plan would facilitate this programme.

c. Socio-economic Impact Assessment

Most of the socio-economic and socio-cultural impacts at the site would be positive. One of the major advantages of this development is the opportunity for the purchase of new housing solutions in an aesthetically pleasing environment.

There will be opportunities for earning a livelihood by members of the adjacent populations during all stages of the development.

The construction of the North Coast Highway will provide shorter commuting hours between the tourist resort towns of Ocho Rios and Montego Bay. On the other hand, the development of such a large residential development will lead to the increased demand for travel along the Priory/St. Ann's Bay/Ocho Rios main road. Any negative effects caused by traffic circulation and access/egress related to the site would be suitably addressed under the guidance of the National Works Agency (NWA).

The main negative socio-economic impact that may result from the proposed development plan is to provide a range of social infrastructure facilities. These include educational facilities at the All-Age, High School and Tertiary level. Those that exist are in excess of their enrolment capacity. The Development Plan proposes the construction of new facilities and the upgrading and expansion of others.

STUDY RATIONALE

This DEIA is a requirement of the National Environment and Planning Agency under the Natural Resources Conservation (Permits and Licenses) Regulations, 1996. Based on the information provided in the Project Information and the Permit Application Forms, NEPA was able to decide on the need for an Environmental Impact Assessment of the proposed project. The decision communicated to the project proponent is that the undertaking of an Environmental Impact Assessment would adequately provide the information required to analyze the significant socio-economic and environmental effects of the Proposed Action and to determine whether a permit would be granted for the proposed residential subdivision.

The purpose of this DEIA is to inform the decision makers in all agencies required to approve authorizing actions and the public in general regarding the anticipated significant environmental effects of the Proposed Development and possible ways to mitigate these significant effects. However, the information in this study does not control an agency's discretion on a project. Nevertheless, the local agency must adopt feasible mitigation measures or alternatives within its jurisdiction if they are to avoid negative environmental effects identified for the Proposed Action.

This DEIA contains the Table of Contents, Executive Summary, Chapters 1 through 6 which include photographs of the site and an Appendices which include the Subdivision Plan, Test result of the Richmond #2 well, and letters from relevant government agencies directly related to this permitting process. This Draft EIA is available for public review at the office of the National Environment and Planning Agency, 10 Caledonia Avenue, Kingston 5.

1.0 INTRODUCTION

1.1 Background

The Richmond Property near Priory in St. Ann is located on the North Coast of central Jamaica within the Rio Bueno-White River Watershed Management Unit and the narrow plain along the North Coast of the Island. Besides this coastal plain the physical environment is characterized by natural white sand beaches or areas such as east of Dunn's River where a coastal plain is absent instead, in its place is a steep incline. The topography of the upper slopes at the proposed development site is generally undulating, rising to approximately 350 metres (above mean sea level).

The main road to the North, the district of Lewis to the South East, the Llandoverly Property to the West, the adjacent O. Mafessanti Limited property to the East and the foothills to the South define the boundaries of the proposed development site. The property is located at equidistance between the towns of St. Ann's Bay to the East and Runaway Bay to the West, a distance of approximately 6.5 kilometres (Map 1.1). The site also falls in close proximity to Priory that lies to the West of St. Ann's Bay. The Town Planning Department (now the National Environment and Planning Agency) defined the St. Ann's Bay/Ocho Rios area as a Regional Centre. St. Ann's Bay is the administrative capital of the parish while Ocho Rios, approximately 16.10 km (10 miles) away to the East, is the primary tourist resort location along the North Coast.

Richmond is located within the agricultural corridor between St. Ann's Bay and Runaway Bay. A 1678 map showed the Richmond-Llandoverly properties as an indigo works since then, both properties have been in sugar cane production and cattle rearing. The Richmond sugar factory located which ruins are evident on the property served the sugar estates in the area since the seventh century until its closure in the twentieth century. The historian Long described the Richmond Estate in 1774 as belonging to Mr. Pinnock and was "graced by a very elegant mansion consisting of two stories". Richmond has had many owners over the centuries but has remained primarily in agricultural production. Sugar cane growing was practiced on the lower

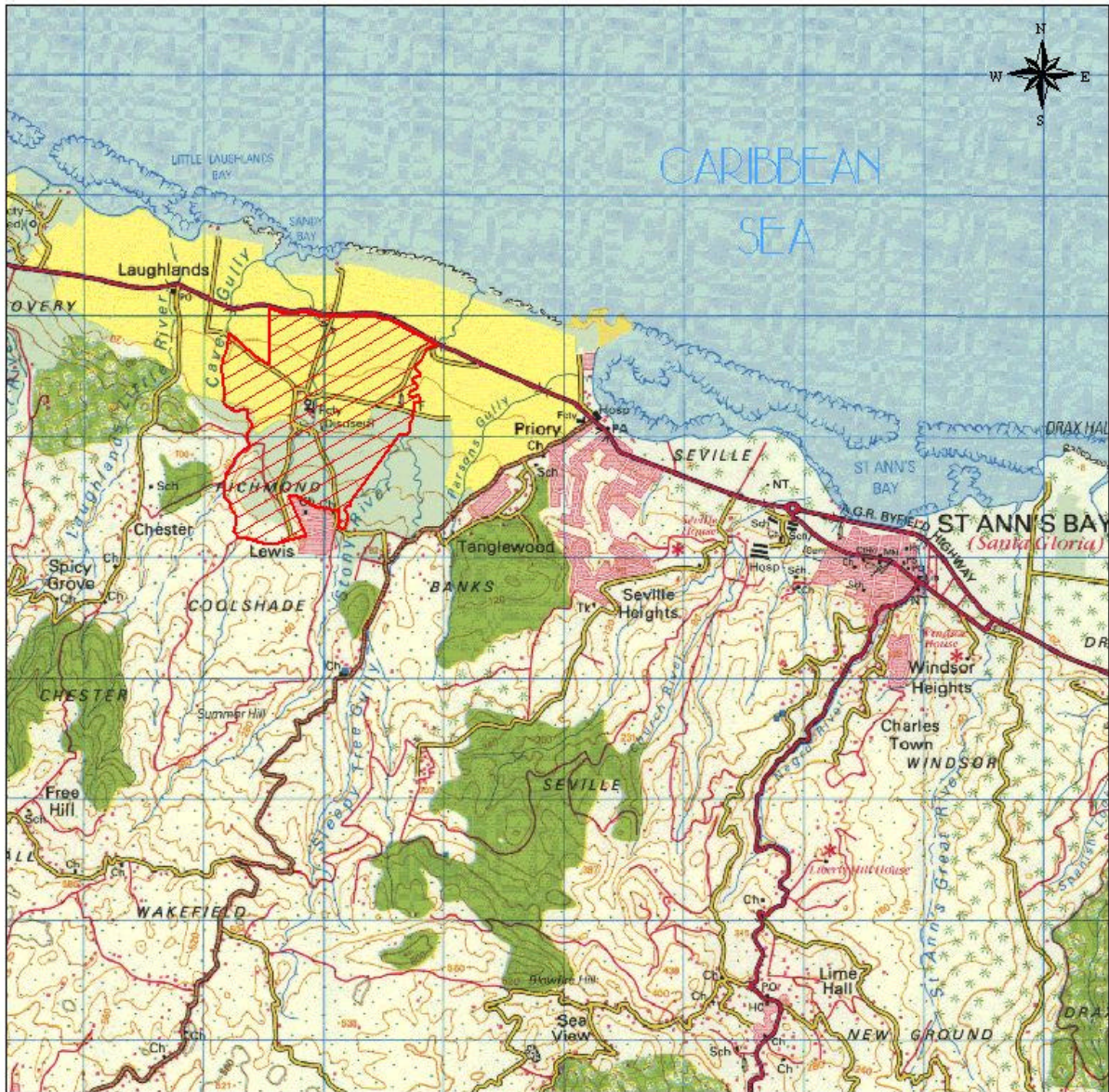
slopes, landward of the main road while cattle rearing occurred on the southern slopes. In recent years the papaya was grown commercially on land leased on the lowlands along to the property's western boundary. In general, however, most of the land has been in ruinate for a number of years yielding marginal or no economic rent.

The area to be subdivision is 430.4 hectares (1060.1 acres). The proposal is for a development of mixed land uses, which would comprise residential, agricultural, light industrial and commercial uses. Other land uses comprise institutional and recreation/open space; a central system of stabilization ponds would treat sewage and domestic wastewater.

1.2 Intended Uses of Draft Environmental Impact Assessment (DEIA)

This Draft Environmental Impact Assessment (DEIA) report is intended to provide the baseline information, outline the potential impacts of the project and suggest mitigation measures. These mitigation measures along with the proposed Monitoring and Management Plan when implemented will serve to limit the extent of negative impacts on the existing environment. This information will form the basis by which the National Environmental and Planning Agency (NEPA) under the Natural Resources Act (Permits and Licences Regulations) 1996 will further evaluate the project. At the end of the process, it is expected that a permit will be granted by NEPA for the development.

MAP SHOWING THE LOCATION OF THE PROPOSED RICHMOND SITE



<p style="text-align: center;">LEGEND</p> <div style="display: flex; align-items: center; margin-top: 10px;"> <div style="border: 1px solid red; width: 20px; height: 10px; margin-right: 5px;"></div> <p>Proposed Site Location</p> </div>	<p>Prepared by N. Thomas on behalf of EPN Consultants Ltd. Suite # 7 83 1/2 Red Hills Road Kingston 20</p> <p>Source: Jamaica 1:50,000 Base Map</p> <p>Corresponding Map: Jamaica 1:12,500 Map Series (sheet 72B and sheet north of 72B)</p> <div style="text-align: center; margin-top: 10px;"> <p>0.5 0 0.5 1 Kilometres</p> </div>	
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Map 1.1 - Site Location of proposed Richmond Llandoverly development, St. Ann

2.0 THE PROPOSED ACTION AND ALTERNATIVE

2.1 The Proposed Subdivision

Based on the Development Plan proposed for the property, the major land use allocations include land lease type settlements on 202.3 hectares (500 acres), mixed affordable housing of approximately 2,000 residential lots on 83.7 hectares (207 acres), farm homestead areas for hydroponics farming of 34.7 hectares (85.8 acres) and a Commercial Centre on about 17.6 hectares (43.6 acres) (see Table 2.1). The development is expected to be completed in at least four (4) phases.

2.1.1 Agricultural Production

Good agricultural land to the West that is primarily 79/94 (Bundo clay/Carron Hall clay) and strategically located to critical services such as irrigation for agricultural use has been recommended for agricultural use (Tai Hossman, 2005). The agricultural enterprises recommended are orchids, vegetables (lettuce grown under hydroponics), callaloo, hot pepper), root crops, for example, sweet potato, ornamental fishes, papaya, forestry and miscellaneous fruit trees for perimeter planting. A network of farm roads and irrigation channels would serve to maximise efficiencies.

One of the primary farming activities would be floriculture for the local and export markets. Floriculture products have expanded tremendously in the last decade and orchids make up the highest percentage of the tropical cut flower trade internationally. The production methods used to cultivate various types of orchids in Jamaica are well established. The proposed site at Richmond is ideally suited for the large-scale commercial cultivation of this crop and has been recommended as a viable enterprise.

Crop production will be based both on traditional method of farming with soil and hydroponics. The growing of plants without soil is called hydroponics, and was developed from the findings of experiments carried out to determine what substances make plants grow and the composition of plants, this farming method dates back as early as the 1600s.

Table 2.1: Land Budget for Proposed Development at Richmond, St. Ann

LAND USE	ACRES	HECTARES	PERCENTAGE
Single Family Residential Lots	174.8	70.7	31.05
Multi-Family Residential Lots	32.3	13.0	5.74
Commercial Lots	43.6	17.6	7.74
Light Industrial	5.9	2.4	1.05
Civic Community	14.4	5.8	2.56
Educational	22.3	9.0	4.0
Farm Homestead	85.8	34.7	15.24
Sewage Treatment Facility	5.0	3.9	0.9
Green Area & Drainage & Community Playing Field	71.0	29.0	13.18
Roads & Walkways	21.0	8.0	3.64
Sub-Total	560.1	228.1	100
Land Lease Agricultural Settlement	500.0	202.3	
Total Area	1060.1	430.4	

2.1.2 Physical Infrastructure

Roads, Transportation and Traffic

The structure of the road network is very simple it features a main Class A coastal road, which is presently being upgraded to the North Coast Highway. Seven and a half (7½) acres/3.04 hectares from the Richmond Property have been given up to facilitate the highway construction. As part of the programme, gullies crossing the road are being upgraded; however, further dialogue with the project engineers should result in their improvement to allow for post development runoff levels.

Shared/route taxis or “robot taxis” provide local transportation service. It is likely that at full development these taxis will extend their service to Richmond. Other transportation services would be available from providers of Rural Stage Carriages or Contracts Operators (buses).

The transportation of construction materials, solid waste and the labour force would also increase traffic flow along the North Coast Highway, the Llandoverly portion of roadway is presently under construction and it is anticipated that it will be completed before development activities commence on the Richmond property. The additional traffic movement could have a moderate effect on traffic flow especially during peak hours.

Potable Water

Potable water would be provided by a well on the adjacent Llandoverly property. An application for a licence for this purpose has been made to the Water Resources Authority; daily yield will be placed at 3,550 cubic metres. A well test by Hood Daniel from August 27-29, 2003 confirmed that water can be adequately supplied from that source (Appendix III)

Water would be supplied through a network of mains that would vary in sizes from a maximum of 250mm Ø to a minimum of 100 mm Ø. The requisite pressure rating will be determined by actual analysis and design.

The National water Commission would ultimately be responsible for the water supply to the community.

Electricity/Telephone

The Jamaica Public Service Company Limited (JPSCo.) would provide electricity to households from its sub-station at Roaring River, St. Ann through a 12 kV distribution line.

Cable and Wireless (Jamaica) Limited supplies land line and cellular services to residents in the area. Mobile service is also available through Digicel and Oceanic Digital Jamaica Limited. The extension of land line service to the proposed development is within the capability of Cable and Wireless; however, companies offering telephone service should be notified during the planning stages of the development to ensure that the additional demand would be included in the companies' plans for service expansion. In the case of land lines the main infrastructure needs are cables while for mobile service it would be base stations within a five-mile radius.

Drainage

The natural drainage systems on the property are well developed and can, therefore, adequately meet the demands of efficient site drainage. This drainage system comprises four major gullies and rivers that run parallel south to north to the coast. The most easterly is the Parson's Gully followed by the Stony River, Cave Gully and the Laughlands Little River, which is the most westerly. There are other minor systems including about three others that traverse the property in an east-west direction.

Within the existing drainage system the major issues relate to the stability of slopes and the adequacy of existing and proposed culverts across the main road to accommodate the intensified rate of run-off resulting from the increased paved surfaces such as roadways and roofs.

Waste Disposal

The proposed wastewater disposal method would be by a system of Waste Stabilisation Ponds. Their proposed location at the Northeast of the property allows wastewater flows to be gravity fed to them, thus reducing the need for the use of lift stations.

Advantages

The ponds:

- allow the achievement of bacterial removal and hence, the requirements for constructing a wetland are only for nutrients removal.
- do not use mechanical equipment; hence, the operational costs are lower.

Disadvantages

- This treatment technology requires the use of a constructed wetland for effluent disposal.
- Need for large volumes of cut and backfill due to the large area
- The use of geomembranes (high density polyethylene) must be used to avoid groundwater contamination.

A survey among the adjacent communities such as Lewis indicates that the primary means of sewage disposal in the community is by individual septic tanks/absorption pits and pit latrines. The construction of a central sewerage system as proposed will negate any likely negative environmental impact on groundwater resources. The wastewater treatment system would produce effluent that is acceptable based on guidelines established by the Environmental Health Unit (EHU) of the Ministry of Health and NEPA (Appendix IV).

Testing the biochemical oxygen demand (BOD), suspended solids, faecal coliform, nitrate and phosphate monitors compliance with the required effluent discharge standards as the wastewater treatment plant when it becomes operational and should contain less than the following concentrations:

- BOD --- 15 mg/l,

- PO₄ --- 3 mg/l
- TSS --- 15 mg/l,
- NO₃ --- 8 mg/l
- Faecal Coliform – 100 per 100 ml

Solid Waste Disposal

The scale of the development demands formal arrangement for solid waste disposal. The final estimated volume of solid waste to be generated with the areas zoned for residential development at full development is approximately 8,000 kilograms (kg), (National Solid Waste Management Authority (NSWMA) standard) i.e.

1 kilogram per person per household/4.11 kilograms per household.

There are no available NSWMA standards for commercial and farm waste. However, research has shown United States of America estimates of approximately 1.8 kg of mixed waste per employee per day for retail businesses such as small to large consumer-oriented store and 6.4 kg per employee per day for food services such as restaurants, supermarkets and food processors (KAB, Inc., 2001)

Solid waste from Richmond would be disposed of either at the Haddon Dump in the parish and is the responsibility of the NEPM Waste Management Limited. Approval for accessing the service has been obtained from the National Solid Waste Management Authority (Appendix V).

It is expected that private trucks will be hired to remove construction and other debris from the site during the construction phase of the development.

2.1.3 Spoils

Materials required for filling areas, such as, low points in the road profile, would be sourced from quarries licensed by Mines and Geology of the Ministry of Land and Environment or from materials excavated from the site if found suitable. Surplus material would be incorporated into the landscape architecture for the project.

2.1.4 Construction Materials

Basic construction materials such as sand, cement, marl and blocks would be obtained within the parish. This would have the effect of reducing transportation costs and the use of energy (petrol). Cement, sand, marl and blocks would be obtained from authorized sources, which would not affect the local environment negatively. As far as possible, other required materials will be sourced locally. Imported goods will be used where it is essential or unavoidable. An estimated 4,000 building blocks are used of in the construction of a standard two-bedroom housing unit (Burrowes and Wallace).

2.1.5 Landscaping

Landscaping provides the means, apart from making the site attractive and improving its visual aesthetic character, would partially restore the natural elements of the site. In this sense, landscaping activities would have a beneficial impact.

There is a variety of fruit trees such as Mango (*Magnifera indica*), Ackee (*Blighia sapida*), Avocado Pear (*Persea americana*) and Breadfruit (*Artocarpus altilis*) that occur naturally at the site and these would be incorporated into the landscape design along with other ornamental species that would be legitimately obtained.

The Landscape Plan visualizes the landscaping of common areas/open spaces and along verges and roadways.

2.2 Socio-economic Integration/Comments on Draft Plan and DEIA

The developers of the proposed site envisage a fully integrated community hence the range of land use allocations detailed in Table 2.1. Potentially, the anticipated dramatic incremental population movement would result in significant social, economic and cultural impacts. Socially and economically, the quality of life of the existing population would improve as the liveability of the area improves. The existing population would be allowed access to all facilities and services, as well as, employment opportunities.

It appears that the housing development will not reflect in any way an enclave where residents will be socially and economically different from the general population of the receiving community. For example, lots closest to Lewis would be made affordable for members of that community. However, the integration of the communities will require the effort of developers and community leaders to achieve harmony among the groups through media, such as, the establishment of a Citizens' Association, which would provide an excellent vehicle to accomplish this objective.

2.3 Alternative 1: "No Action"

In the event that the development does not proceed, the proposed site is expected to maintain or develop the characteristics described below.

2.3.1 The Physical Environment

The Richmond/Llandovery area falls within an area of narrow coastal plain along the North Coast of the Island. Generally, the physical environment consists of a coastal plain along which there may be natural white sand beaches or areas, such as, east of Dunn's River where a coastal Plain is absent. The upper slopes at the proposed development site are generally undulating and rise to approximately 350 metres (above mean sea level) to the adjacent Lewis community and beyond.

One of the most outstanding physical aspects of the property is its hydrology, characterized by three principal south-north drainage channels, the most easterly and westerly of which form the eastern and western boundaries. They provide no serious challenges to the site in its underdeveloped state but instead provide good drainage for the property.

2.3.2 Land Use

Traditionally, land use on the Richmond and adjacent properties has been agricultural. Sugar cane growing has been practiced mainly on the lower slopes on the landward side of the main road while cattle rearing have occurred on the southern slopes and to the east. In recent years papaya has been grown commercially on land leased on the lowlands towards the western boundary. Much of the sugar cane land, however, is in ruinate. The Southern section of the

property is mainly open pastureland beyond which is the community of Lewis. No significant changes would be anticipated over the short to long term.

There is an established small settlement, a ribbon development, along the property's arterial roadway that essentially served the function of accommodation for the former property employees. Their continued tenancy would become uncertain over the short to medium term.

2.3.3 Socio-cultural Environment

Some residents are engaged in mostly marginal livelihood activities on the property while others have secured employment in nearby locations. The dominance of the Richmond property encompasses many years and its transformation from a place of vibrant economic activity to one of limited potential has impacted negatively on growth and development within its regional setting. This situation would most likely to be maintained as the former owners no longer viewed sugarcane production as viable.

This decline in sugarcane production nationally, over the years has manifested itself in lower production levels leading to the closure of many sugar factories. This includes the Richmond factory that was closed in 1970. Despite the continuation of cattle farming on the eastern flanks of the property it is essentially underutilized and this was envisioned for the foreseeable future.

The site is strategically located on the residential periphery of the town of Priory/St. Ann's Bay whose location would have to continue to provide all the basic social services, such as, health and education without the benefit of major improvement in physical infrastructure such as roads, and potable water supply.

2.4 Alternate 2: Regenerate the Agricultural Potential of the Site

2.4.1 Land Capability and Soil Type

The Rural Physical Planning Unit (RPPU) of the Ministry of Agriculture (MOA) is of the opinion that the potential of the property for agricultural development remains given the presence of productive soil types:

SOIL TYPES	NAME
#25	Fontabelle Clay
#74	Lucky Hill Clay Loam
#77	Bonnygate Stony Loam
#79	Bundo Clay
#91	Killancholly Clay
#94	Carron Hall Clay

Crops identified as suitable for the listed soil types are vegetable, sugarcane, citrus, food trees, food crops, coconut and improved pasture. The developer is aware of the land capability concerns of the MOA and has incorporated agricultural land use as a significant part of plans for the development. The proposal is

intended to maximise the property's agricultural potential while it seeks to address the growing demand for housing solutions within the parish.

2.4.2 Economic Potential of Ornamental Horticulture

The developer proposes a mix of agriculture including floriculture. Specifically, the growing of orchids is highlighted as one of the most feasible. Commercial production of ornamental horticulture (production of exotic tropical cut flowers) for export commenced in the mid 1970's as the need arose to implement agricultural diversification programs and to take advantage of emerging niche markets. The industry developed rapidly in the 1980's with export earnings increasing from \$0.48 m in 1982 to \$US5.75 in 1987. The momentum was not sustained resulting in a dramatic decline; reaching a low \$US0.27 m in 2001. Factors contributing to the decline are hurricanes, in particular hurricane Gilbert in 1988, pest and disease problems, competition from overseas suppliers and high establishment costs.

Farmers engaged in ornamental horticulture are located primarily in the parishes of St. James, St. James, St. Catherine and Kingston and St. Andrew (67 per cent of total production in 2001), they number approximately ninety-(90) individuals. The most important cut flower crops were orchids, anthurium's, ginger lilies and heliconias while the main cut foliage harvested were crotons, aglaonema and dracaena. Orchids account for 6.3 per cent of production grown on over 455 hectares. In 2001, orchids accounted for 12 per cent of total earnings (Tai Hossman, 2005). The area zoned for farm homestead at 34.7 hectares is relatively small but orchids are cultivated in high densities and, therefore, do not necessarily require large land areas.

3.0 SITE ASSESSMENT

3.1 The Physical Environment

3.1.1 Climate and Air Quality

The climate at the proposed development site at Richmond Llandoverly is very similar to the climate at Ocho Rios, which occurs approximately 14 kilometres west of it. For this reason, Ocho Rios climate data (30-year means) have been used to characterise the climate of the area. In general, the climate can be described as a tropical maritime climate, as it occurs close to 18 degrees of latitude from the equator.

Temperature

Average temperatures divide the year into cool months (with temperatures between 29.5 and 27.9 degrees Celsius) between November and May, and hotter months between June and October when temperatures range between 30.4 and 31.3 degrees Celsius. The coolest month of the year is February, and August is the hottest.

Table 3.1: 1951-80 Mean Climatological Data for Ocho Rios (St. Ann) at sea level

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum Temperature (°C)	28.5	27.9	29.1	29.5	29.6	30.8	31	31.3	30.9	30.4	29.5	28.9
Minimum Temperature (°C)	19.6	19.2	20.4	21.8	22.6	22.9	23.5	23.8	23.2	22.8	22.3	20.7
Rainfall (mm)	132	86	40	87	99	67	58	65	111	118	199	189
Number of rain days	10	8	7	9	11	7	6	6	9	12	11	9
Relative Humidity – 7 am (%)	85	84	84	83	85	82	84	84	85	86	84	85
Relative Humidity – 1 pm (%)	81	77	76	78	78	75	75	76	78	78	80	81
Sunshine (Hrs.)	7.3	7.5	7.8	7.6	7.4	7.8	8.6	8.2	7.8	7.5	7.5	7.3

(Source: Meteorological Service of Jamaica -MSJ)

Winds

Observations of wind patterns indicate that the coastal area is subject to night time land and daytime sea breezes. The northeast trades influence the area throughout the year, bringing prevailing winds and rain from the northeast. These winds reach greatest strength and persistence during the cooler months from December to March. MS, J provided wind direction and wind speed data for hourly winds at the Donald Sangster International Airport (April 1962-

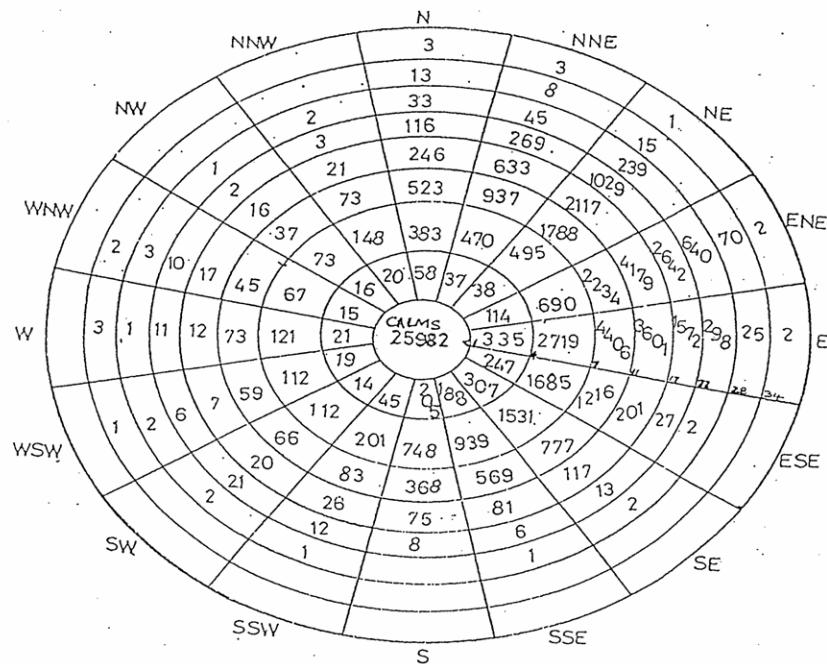
March 1967 and January 1968 to December 1970) which indicated that dominant winds come primarily from the easterly direction but also from the North East and the East North East (see Figure 3.1). Approximately 55 per cent of all readings were less than 3 metres per second, and 98 per cent of all readings were less than 11 metres per second.

Other meteorological phenomena result in seasonal or periodically different wind conditions including:

1. "Northerners" from the north during the winter period (November through to February-March).
2. Low pressure cells which can result in occasional strong gusts (up to 80 km/hr), which can affect agriculture.
3. Tropical cyclones which form in the south-eastern Atlantic

Figure 3.1: Wind Frequency, Sangster International Airport

Distribution of Surface Wind
(Hourly)
Montego Bay Airport
April 1962 – March 1967
Jan. 1968 – Dec. 1970



Total No. Observations 69945
Total No. of Hours of wind (> 4 knots) 42284
Mean No. of Observations 183

Precipitation

Table 3.2: 30 Year Mean Monthly Rainfall (mm) – Richmond Estate, Llandoverly, St. Ann and Priory

	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
St. Ann	145	90	78	117	164	115	50	97	130	177	214	219	1596
Richmond Estate	96	76	98	168	89	59	62	96	135	262	233	132	1506
Llandoverly	149	102	71	89	147	80	51	53	77	144	246	240	1449
Priory	156	81	95	95	180	99	78	64	78	129	228	260	1543

Source: Meteorological Service, Jamaica

The months of October followed by November, May and January are the wettest while the driest days are experienced during July August and September.

Generally speaking, rainfall is much heavier on the North Coast of Jamaica, as it receives the relief rainfall provided by the mountains running from west to east. The rainfall pattern on the North Coast of Jamaica follows the binomial distribution pattern typical of the island where rainfall peaks occur in the months of May and October to January.

According to Table 3.2 most rainfall fell at the Richmond Estate during the months of October, followed by November, January and May while the least occurrences were during the months of July and August. The mean annual total of 1,506 mm of rainfall at Richmond Estate was less than that of the adjacent town of Priory (1,543 mm) but greater than the total at Llandoverly (1,449 mm). At all three locations mean annual precipitation were less than that of the Parish of St. Ann (1,596). At all three locations October, November and December were among the wettest.

Humidity

Relative Humidity varies between 83 per cent and 85 per in the morning, and between 75 per and 81 per cent at 1:00 pm. Afternoon relative humidity only exceeds 80% in the wetter months of November to January.

Daylight Hours

Typical of this latitude, daylight hours vary between winter and summer only by about 1 hour and 20 minutes. The longest days occur in July, and the shortest days occur in January.

3.1.2 Geology

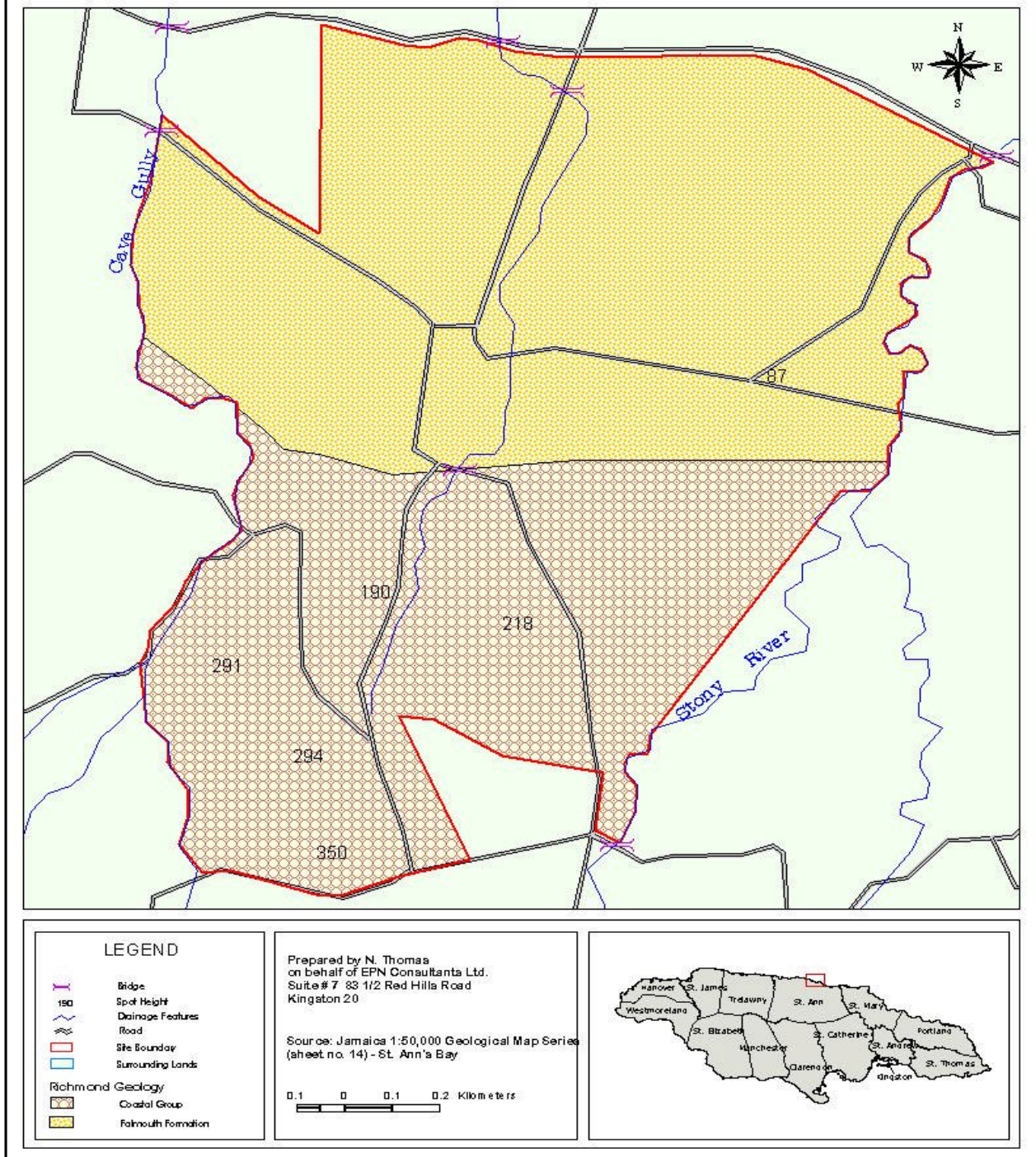
There are two major lithologies outcropping at the site (Map 3.1). These include the Falmouth Formation and the Coastal Group.

1. The Falmouth Formation at this location is mapped by the Geological Survey Division as consisting of a Gravel Facies. This rock is mainly composed of rounded boulders and cobbles from older limestones in the interior (the Montpelier Formation), which have been re-deposited as gravel fans in this area. The Falmouth Formation is generally located on the site at elevations below the 40-m contour, and is characterized by gently sloping to flat topography. This area was mapped (Robinson, UWI) and it was confirmed that there is an extensive presence of gravelly fans in this area suggesting that these might be debris flow deposits.
2. The Coastal Group are generally described as impure marly limestones with shallow water fossils such as corals and gastropods. These rocks are collectively classified as an aquiclude, although there is evidence that in some areas rocks classified as Coastal Group allow extensive subsurface drainage. The entire southern portion of the site (areas south of the factory) consists of the marls of the Coastal Group. The marls of the Coastal Group are subject to erosion, particularly along the riverbanks, and slumping can occur in over-steepened hillsides or banks.

The White Limestone in the area is represented by the Montpelier Formation, which comprises the hills above the site, and occurs beneath the Coastal Group at the site. The Montpelier Formation (Miocene age) is a hard well-bedded limestone with chert bands/nodules, and fossils. It is classified as an aquiclude because its dense crystalline texture makes it impervious, and would impeded drainage at depth. The southern boundary of the site at Lewis also marks the major contact between the Coastal Group and the Montpelier Formation. The terrain associated with this formation tends to be steeper than the Coastal Group.

Several faults traverse the region and drain water from the limestone aquifer that rise as springs within the limestone aquiclude. Fault lines, however, generally lie to the south of the property. No major faults have been mapped in the area of the site.

GEOLOGY OF RICHMOND, LLANDOVERY ST. ANN AND SURROUNDING AREAS



(Sources: 1:50,000 Metric Sheet 4, Geological Survey Metric Sheet 4, Edward Robinson, 12:500 Sheet 17a)

Map 3.1: Geological Map showing the proposed Richmond development and surrounding areas.

3.1.3 Soils

A detailed land use and soil capability survey was conducted (Tai Hossman, 2005) and the six main soils types identified on the property are given in the following table .

Table 3.3: Soils at Richmond Estate

Soil Name (soil number)	Slope (degrees)	Description	Location
Fontabelle Clay (25)	0-2	Moderate drainage medium to high alkalinity. Well-drained soil developed on recent alluvium.	Lower elevations of the property. Dominant soil class on the property.
Fontabelle Clay Stony Phase (27)	0-2	As above – contains stones and boulders	North-eastern corner of the property – near sewage treatment plant.
Bonny Gate Stony Loam (77)	All Mainly >20	Thin soil with bedrock at 1-12" below surface. Rapid internal drainage.	Southern portion of the property with steeper slopes and limestone bedrock.
Bundo Clay (79)	0-5	Highly acidic. Impeded drainage at 6"-9". Slow drainage through soil.	Western side of the property – zoned for agriculture. Minor
Killancholly Clay (91)	10-30	Alkaline. Rapid drainage. Tends to be shallow.	Western side of the property – zoned for agriculture. Minor
Carron Hall Clay (94)	5-30	May be shallow to bedrock. Slow internal drainage.	Western side of the property – zoned for agriculture. Minor

Source: Ministry of Agriculture

The Fontabelle Clay underlies most of the site, particularly the flat terrain on the north eastern and central parts of the property. The most important feature of this soil is the fact that it has a very high infiltration capacity. This means that in most cases rainfall will percolate rapidly, rather than run off.

Soil types 27, 77, 79 and 91 have limitations for commercial field-based agriculture. The area

Table 3.4: Distribution of soil types on property

Soil Type	% of land area
25 Fontabelle clay	41.5
27 Fontabelle clay stony phase	1.3
77 Bonny Gate stone loam	26.3
79 Bundo clay	10.7
91 Kilancholly clay	9.2
94 Carron Hall Clay	11.0
Total	100.0

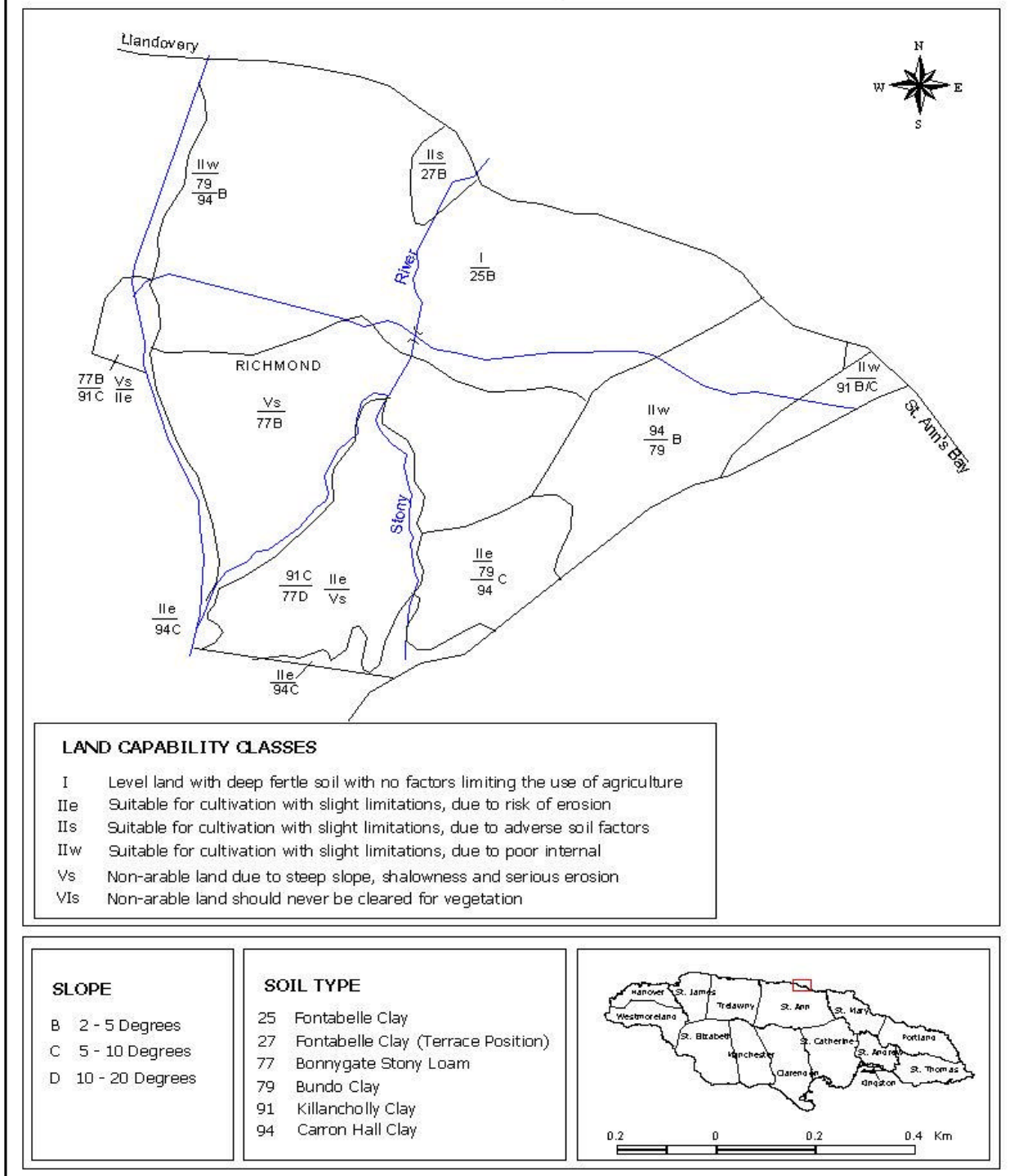
zoned for agricultural development is primarily 79/94, which is good agricultural land. The analysis of this suggests that there are higher proportions of 94 than 79 (Tai Hossman, 2005), differing from the information provided on the soil map for the

area.

Land Capability

The site is primarily Land Capacity Class 1-level with deep fertile soil having no limiting factors for agriculture. The soils in the area slated for agricultural development are capable of supporting a wide range of agricultural uses. This is shown in the Table 3.5 below.

LAND CAPABILITY MAP, PART OF RICHMOND, LLANDOVERY, ST. ANN



Map 3.2: Map showing land capability at the part of Richmond, Llandoverly, St. Ann

Table 3.5: Land capability of predominant soil types on area for agricultural development

Soil Type	Food crops	Vegetables	Orchard crops	Traditional crops	Timber & fruit trees
79	X	x	x	X	X
94	X	x	xx	xx	X

xx- highly suitable
x- Suitable

3.1.4 Topography

Terrain

Map 3.3 below shows the main topographic features at the site. Elevations on the site range between 8 metres on the southern entrance along the main road, to approximately 350 metres above sea mean level in foothills that occur above Lewis. Much of the site comprises very gently sloping (northward) sloping lands. This topography is probably largely influenced by decades of cultivation, as well as the underlying geology. Steeper slopes are found on the south-western side of the property, and these occur mainly where rivers have incised into the marly limestones of the Coastal Group.



Plate 3.1 – Vegetation and topography at Richmond

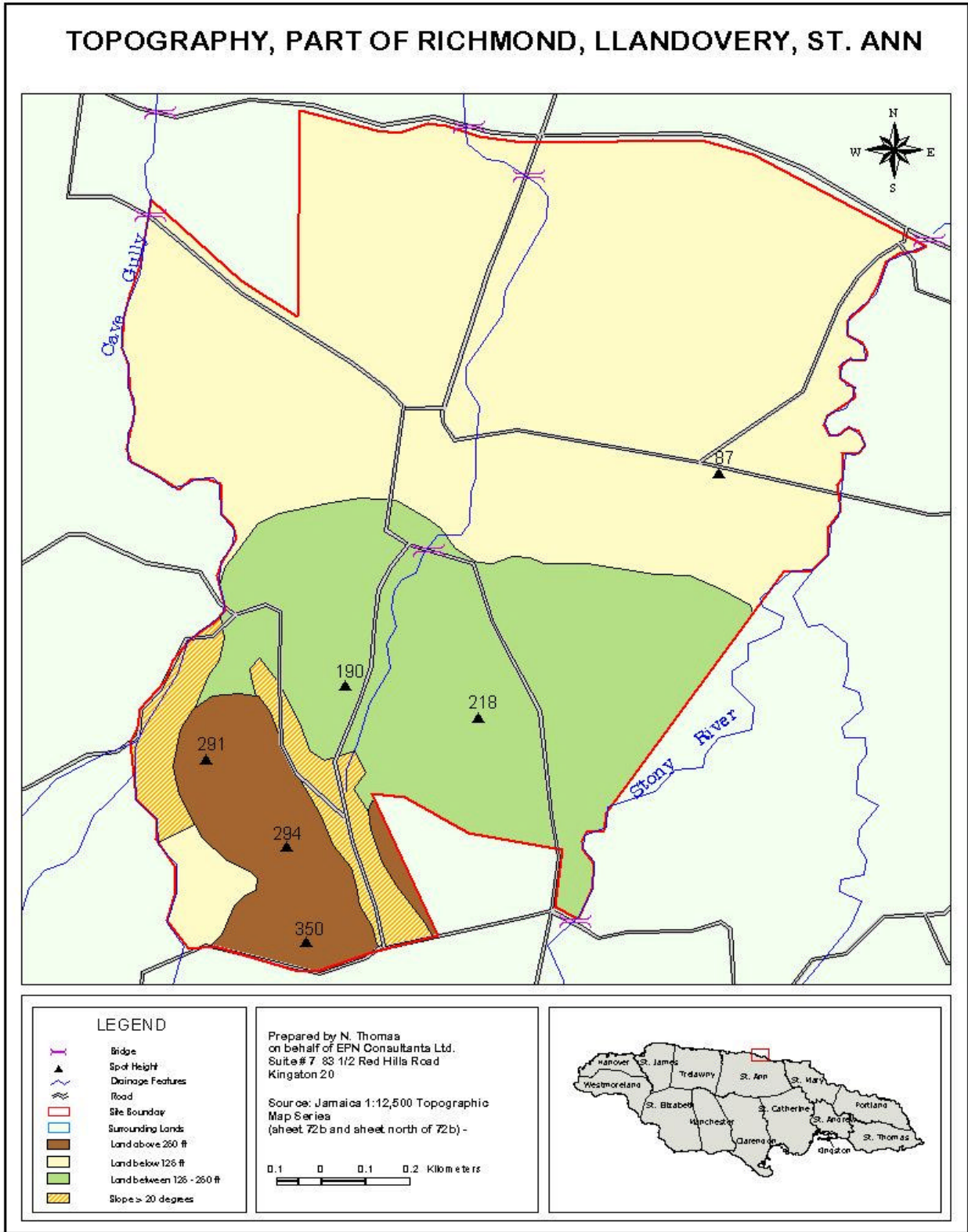
The typical flat topography can be observed on the frontispiece (view of site from Free Hill). Plate 3.1 shows the low foothills in the background looking southeast from the main access road. Aside from these foothills (that mark a change in underlying geology) and the seasonal streams on the property, there are no other significant landforms.

Site Drainage

There are three seasonal streams associated with the site. All three rivers flow in a generally southern direction toward the coast.

1. Cave River is an ephemeral stream that runs along the western boundary of the property. This stream probably carries the highest storm flows.

TOPOGRAPHY, PART OF RICHMOND, LLANDOVERY, ST. ANN



Map 3.3: Map showing topography at site of proposed development, Richmond, Llandoverly, St. Ann

2. An unnamed river runs through the centre of the property (as shown in Map 3.3); in this report, it is referred to as the Richmond Estate gully. This stream drains most of the Richmond Estate, and will be the principal pathway for storm water run-offs from the site.
3. The Stony River similarly demarcates the eastern property boundary. The Sleepy Tree Gully is a major tributary of the Stony River, which joins the main Stony River immediately above the Richmond Estate property boundary. This river is demarcated on the map as permanent stream. Observations indicate that the upper part (near the confluence with the Sleepy Tree Gully) may have a flow in the dry season, but the river appears dry at its intersection with the highway.

The hydrology of the area is further discussed below. It is likely that the riverbeds of all three rivers act as sinks for the water as the rivers flow over the gravel deposits of the Falmouth Formation, resulting in relatively dry lower watercourses.



Plate 3.2: Cave River (South Western Boundary)

Plate 3.2 below is a photo of the Cave River as it enters the property near its south-western border. This river is not wider than 20 m along its course. Plate 3.3 is a photograph of the designed corrugated culvert where the Cave River crosses the North Coast Highway. Compared to the box-culverts and beds of the other two streams it would appear that this system transmits the heaviest storm flows. Provisions have been made by the developers of the North Coast Highway for the crossings of all three streams.



Plate 3.3: Cave River Dry Bed (northern side of the Main Road and North Coast Highway)



Plate 3.4: Richmond Estate Gully (Northern Exit)



Plate 3.5: Richmond Estate Gully (Northern Exit)



Plate 3.6: North Coast Highway Culvert for the Richmond Estate Gully



Plate 3.7: Stony River (Northern Exit)



Plate 3.8: Stony River (Culvert on North Coast Highway)

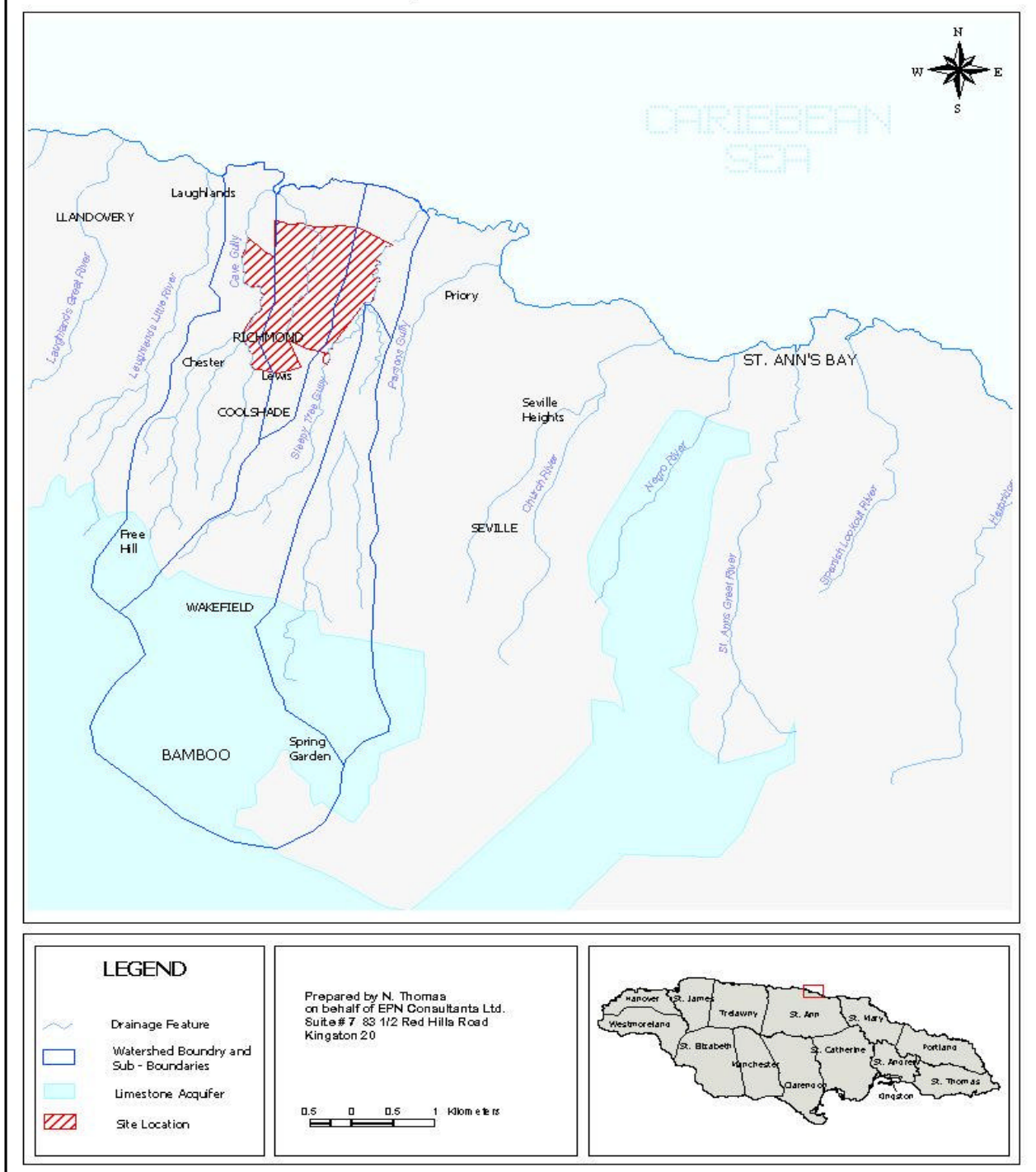
3.1.5 Hydrology

Surface Water

Map 3.4 shows a generalized hydrology of the region. The area is characterised by south (seaward) draining rivers. On the western side, these rivers tend to be ephemeral or seasonal, and include the Cistern River, Laughlands Great River, Laughlands Little River and Cave River (which forms the western boundary of the site). On the eastern side, the rivers include an unnamed drain which traverses the property, and the Stony River, Sleepy Tree Gully, and Parson Gully. West of this is a river system which drains into St. Ann's Bay, including the Church River, Negro River and the St. Ann's Bay Great River. The Laughlands Great River is the only stream in the area with perennial flow. The average daily flow is 48,932 cubic metres per day. The lowest flow recorded was 12,233 cubic metres per day (WRA, 2001).

The watershed and sub-basin boundaries of this system are given in Map 3.4. The Richmond property is contained in the lower catchment for the Cave River, Stony River and Sleepy Tree River. It falls into Water Management Unit 6 (Water Resources Authority designation, and is

GENERALIZED HYDROLOGY OF THE RICHMOND, LLANDOVERY REGION



Map 3.4: Map showing the generalized hydrology of the part of Richmond, Llandoverly, St. Ann

estimated to be of the order of 25 km². Both the Stony River and the Cave Gully systems are likely to transport storm water emanating from elevations far above the site.

The Cave Gully system arises near the contact between the White Limestone aquifer and the Montpelier Formation (which is an aquiclude) approximately 3 km to the south-west of the site. The Stony River arises near Wakefield, and is similarly associated with the contact between the White Limestone aquifer and the impervious Montpelier limestone.

The sub-basin most likely to impact on the site is the un-named drainage channel, which arises on the southern limit of the property. The sub-basin for this system includes an area to the south of the village of Lewis, and it is expected that storm water from this area will flow through the site.

An aqueduct that traverses the property west to east off the Llandovery Property has been a feature of water supply system over the years. This supply was disrupted during the passage of Hurricane Ivan and is to be repaired as this would be main source of water for the irrigation needs of the property.

Groundwater

Significant groundwater resources are associated mainly with the White Limestone aquifer that occurs in the hills above the site. In general, it is expected that groundwater will flow in a north-north-easterly direction, not unlike the major surface flows that are shown in Map 3.4. As described above, contact between the White Limestone aquifer and the Montpelier Limestone (aquiclude) results in a number of springs, including Chester, Rosehall, Lewis, Liberty, Wakefield and Mt. Zion springs. The National Water Commission (NWC) and the St. Ann Parish Council (SAPC) tap the springs as a source of domestic water.

The Richmond-Llandovery estates also tap water from the Liberty Spring (also called Coolshade Spring) to meet the domestic demands of the property. The Water Resources Authority (WRA) has classified all the springs as being either fifth to seventh class. This means that flow vary from 1 gallon per minute (gpm) for a seventh class to 100 gpm for a fifth class. The Montpelier limestone, which comprises the foothills above the site, behaves like an aquiclude, restricting

the flows of groundwater significantly. Wells sunk in this unit can be expected to have very low yields. Surface water flows play a more important role on this unit, incising channels into the bedrock, and transporting coarser bed loads (limestone boulders). The Coastal Group (limestone marls) occur on the elevated areas on the southern part of the site as shown on Map 3.1. These marls are generally classified as a “Coastal Aquiclude”, also impeding sub-surface flows. Despite this classification, the hydrogeological properties of these limestones are variable, depending on the lithology present: for example marly units tend to be less permeable than harder fractured limestones. Surface ponding and sheet flooding can be expected to occur on this unit during very intense rainfall events. Storm water generally flows towards one of the three main drainage channels that traverse the property.

The Falmouth Formation (gravel facies) occurs below the Coastal aquiclude below the 40 metres (130 feet) contour, and acts as a major sink for surface flows traversing the aquicludes. However, at depth the aquicludes underlie the gravel fans at the site, so once this deposit reaches field capacity (saturation), ponding and surface flows can be expected at the lower elevations as well.

Water Supply

The Richmond #2 well is a producing well at the adjacent Llandovery property (to the west of the Cave River). This well is shown in Plate 3.9, and is owned and operated by Richmond Llandovery Limited. This well is located at grid reference 223090E 199074N at an elevation of 150.9 metres above sea level. Rest level upon completion was 43 metres below ground level (WRA Well Records Database). According to the WRA lithology log for this well, the well is producing from the White Limestone aquifer, which underlies the Coastal Group and the Montpelier Formation at ~52 metres below ground level at this location. The Coastal Group is 44 metres thick, and is underlain by a limestone described as “honeycombed” (Montpelier?), which is only about 7.6



Plate 3.9: Producing Well at Llandovery Estate: Richmond #2

metres thick.

The Richmond Development Company Ltd. has reached an agreement with the owners and operators of the well for the provision of water to the development site from this well (Appendix VI).

A total of approximately 1,295,750 cubic metres per year is expected to be provided to meet the demand from the Richmond Development site, demand will vary according to type of land use for residential use in this urban setting it would be approximately 270 litres per capita per day.

Water Quality

Table 3.6: Water Quality Data

Monitored Parameter	Sample Data	Comparative Standards		
	28/08/03	NEPA Ambient Freshwater Criteria	Health Canada Drinking Water ^a	USEPA Drinking Water ^b
pH		7 – 8.4	6.5 - 8.5 (AO)	6.5-8.5
Sulphates mg/l	10	3 – 10	≤500 (AO)	250
Total Suspended Solids mg/l	-	NA	NA (< 1 NTU –MAC)	
Total Dissolved Solids mg/l	-	120 – 300	≤300 (AO)	500
Nitrates mg/l	6.16	0.10 – 7.5	45 (MAC)	10
Chloride mg/l	26.36	5 – 20	≤250 (AO)	250
Pesticides		NA		
Diazinon mg/l			0.02 (MAC)	
Malathion mg/l			0.19 (MAC)	
Faecal Coliform MPN/100 ML	<3	NA	0	0

^a Health Canada. 1996. Guidelines for Canadian Drinking Water Quality. Sixth Edition. 91p. Prepared by the Federal-Provincial Subcommittee on Drinking Water of the Federal-Provincial Committee on Environmental and Occupational Health. Maximum acceptable concentrations (MACs): are established for certain substances that are known or suspected to cause adverse effects on health. Each MAC has been derived to safeguard health assuming lifelong consumption of drinking water containing the substance at that concentration.

Interim MAC (IMAC): For those substances for which there are insufficient toxicological data to derive a MAC with reasonable certainty, interim values are recommended, taking into account the available health-related data, but employing a larger safety factor to compensate for the additional uncertainties involved

Aesthetic Objective (AO): apply to certain substances or characteristics of drinking water that can affect its acceptance by consumers or interfere with practices for supplying good-quality water.

^b. USEPA 2005, List of Drinking Water Contaminants & MCLs (Maximum Contaminant Levels). <http://www.epa.gov/safewater/mcl.html>. An USEPA 2004 Edition of the Drinking Water Standards and Health Advisories. 20p.

The water quality in the Richmond #2 well is generally adequate for agricultural purposes. It can be used for public water supply (potable) with chlorination as the water quality is of

relatively good quality (Table .3.6 and Appendix III). As groundwater can be susceptible to high bacterial loads when settlements are located higher up in the catchment water quality should be monitored more closely during heavy rainfall events. .

The well is the source of potable water supply for the owners of the property adjacent to the proposed development site. Houses on the site presently get their water supply piped from a spring that occurs near Lewis (*personal communication, Mr. Jones, Estate Manager, Richmond Estate*).

It must be noted that whilst the NEPA standards apply to ambient freshwaters (including groundwater); they are not specifically designed to regulate drinking water. Therefore the USEPA and Health Canada standards are included.

3.2 Risk Assessment of Natural Hazards

3.2.1 Flood Hazard

The underlying geology on the southern portion of the site (Coastal Group) is generally prone to ponding of water in depressed or flat areas. At the Richmond site, this area tends to be characterised by slight to steep slopes, which are expected to enhance run-offs of storm water to the lower more permeable areas. The following photographs were taken on Thursday, May 12, 2005. The weather station at Runaway Bay reported 6.2 mm fell on May 11 and 28.2 mm fell on May 12.

- The Stony River was in spate, and the storm water was very turbid, but did not overflow the 3-cell box culvert as it crosses the North Coast Highway.
- Sheet flows and rills flowed off the Richmond Estate. The Falmouth Formation (gravel facies), which forms an apron on the lowest areas of the site immediately south of the North Coast Highway, had apparently reached field capacity (saturated) as extensive sheet flooding was observed (Plate 3.10). Storm water collected in an area running parallel to the North Coast Highway, draining east or westwards to the nearest culvert.
- The worst flooding occurred along the main road intersection between the Richmond Estate main access road and the Chukka Cove access road. This flooding (Plate 3.10) was associated with extensive sheet flooding off the site and overflows from the 2-cell

culvert and channel (both upstream and downstream of the culvert). When the underlying rocks are at field capacity (saturated) sheet flows from the site (from both the Stony River sub-basin and the Richmond Estate Gully sub-basin occurs. A high proportion of these sheet flow runs northwards onto the main highway and due to the slope of the road to the west, this run-off is transmitted towards the smaller culvert



Plate 3.10: Flooding of North Coast Highway at Richmond Estate-Chukka Cove



Plate 3.11: Sheet Flooding on Main Site Access Road (Chukka Cove Intersection)

- (Just beyond the intersection with the main site access road. Hence, the peak flows entering that culvert are greater than would be calculated for its sub-basin acreage. There was extensive flooding along the gully banks on the northern side of the road (western border of Chukka Cove). The flooding of the North Coast Highway at this point resulted in:
 - (a) Hydroplaning hazard to vehicles.
 - (b) Traffic congestion along the highway.
 - (c) Erosion of riverbanks and undercutting of the road.
 - (d) Increased coastal turbidity
 - (e) Degradation of the road surface.

The storm water from the Cave River was more than adequately contained by the culvert and drainage channel north of the Richmond Estate (Plate 3.12).

The peak flows at the point of intersection with the North Coast Highway was calculated for each of the sub-basin areas above that point, using the Rational Method (see Appendix VIII). The peak flow for the Stony River system is expected to be the largest with a 100-year return



Plate 3.12: Cave River (downstream side of Highway)

flow of ~67 cubic metres/second (Table 3.7). However, as noted above, after field capacity is reached at the site, much of the overland flow does not enter either the Richmond or Stony River streams but exits the site by flowing northwards as sheet flows. This storm discharge travels down gradient to the smallest capacity culvert, which is inadequate.

Table 3.7: Projection of peak flows at North Coast Highway culverts

	Return Period:	5 Year	10 Year	25 Year	50 Year	100 Year
River Channel	Culvert Design	Peak Flow at North Coast Highway culvert in cumecs (m³s⁻¹)				
Cave Gully	Corrugated Pipe	28.2	31.3	35.6	38.5	42.3
Richmond Gully	2-cell box	8.2	9.1	10.3	11.1	12.2
Stony River	3-cell box	44.9	49.8	56.6	61.2	67.2

3.2.2 Hurricane Hazard

The hurricane season occurs between June and November, and during this time tropical cyclones originating in the south-eastern Atlantic may bring rainfall to Jamaica. Table 3.8 shows the major systems that have affected Jamaica since 1988.

Many of these affected the southern parishes of Jamaica more than the parish of St Ann. Statistically, hurricanes are most likely to hit later in the season, (between September and November). Hurricanes may result in flooding in coastal areas, higher than average rainfall and flash flooding as well as destructive winds. Indirect effects of hurricanes can include mudslides and landslides on steeper slopes comprising marls of the Coastal Group.

Table 3.8: Major weather systems (named) affecting Jamaica (1988-2004)

Name	Date
Hurricane Ivan	September 10 th 2004
Tropical Storm Charley	August 11 th 2004.
Hurricane Claudette	July 9 th 2003
Hurricane Lili	September 30 th 2002
Hurricane Isidore	September 18 th 2002
Hurricane Michelle	October 29 th 2001
Hurricane Iris	October 7 th 2001
Tropical Storm Helene	September 19 th 2000
Hurricane Gordon	November 8 th 1994
Hurricane Gilbert	September 12 th 1988

3.2.3 Earthquake Hazard

Jamaica is prone to earthquakes by virtue of its tectonic location (in proximity to a major plate boundary). Historically, Jamaica has been subject to several extremely devastating earthquakes including Port Royal 1692 and Kingston 1907. However, the Richmond site is far removed from the zones normally associated with high risk in Jamaica. According to the zonation developed by Pereira (1987), the site falls into to a zone that has experienced less than 3 category VI (or greater) earthquakes between 1874 and 1978.

3.2.4 Soil Erosion or Land Slippage Hazard

The flat areas of the site (gravel fans) are not prone to land slippage, although there might be some erosion along gully banks. The marly limestones of the Coastal Group may be prone to slumping along hillsides, when saturated. Rock falls are associated with the Montpelier Formation, and major land slips have been reported from the Fonthill Formation (White Limestone Group) occurring in Free Hill above the development site

3.3 Terrestrial Ecology

3.3.1 Methodology

Sample Sites

Fourteen (14) sampling sites were selected for a two day survey. None of these sites was within 250 metres of the next nearest site.

These sample sites were chosen based on a random stratified selection method using the following criteria:

- 1) Over 60% of the sites were chosen in areas that had more heavily developed vegetation including logwood, riparian vegetation, secondary growth forest, and rural residential habitat.
- 2) The presumed importance of the site/habitat subtype for wild species of flora and fauna due to observed structural characteristics of the habitat.
- 3) To sample all the observed habitat subtypes within the boundaries of the study area.

As part of the survey of the property, the potential impacts of land use changes related to the development of the area and the necessary mitigation measures were also examined and recorded.

3.3.2 Vegetation Survey Methods

The sub-habitats present within the study area were characterised based on an overall survey of the general study area in addition to the species and abundance data collected from the 14 sample stations. Based on the preliminary survey, four habitat subtypes were identified within the proposed development area, namely; Degraded Forest, Rural Residential Areas, Riparian Vegetation, and Savannah/Abandoned Sugar Cane Fields. The method of assessment of these areas varied due to the significant variation between them in species composition, tree density and accessibility. The method used in each area is outlined below:

Rural Residential Areas

At the three sample stations within rural residential areas, the vegetation was assessed but no quantitative measurements were taken due to difficulties related to access of human occupied

property. The vegetation of each site was assessed based on the dominant plant species giving an indication of the average canopy height.

Coastal/Lowland Vegetation

Based on the survey, it was noted that the vegetation of the coastal lowlands on the northern, coastal side of the property was composed of either abandoned sugar cane or other grass species. This section of the property was reportedly planted in sugar cane until 1999. Sugar cane was however abandoned after the 2000 reaping. The property was then used for cattle until 2002 after which this was also abandoned (personal communication with Mr. Jones, property foreman/watchman). The resulting vegetation is now a mixture of sugar cane growing from the abandoned ratoons, pasture grasses and weeds, and in many areas a mixture of these. Examples of the more common pasture weeds observed were Vervine (*Stachytarpheta jamaicensis*), Dandelion (*Cassia occidentalis*), and Donkey Milk/Weed (*Stylosanthes hamata*). Where this vegetation type has not been managed either mechanically or by grazing, it often exceeds one meter in height. Along the northerly margins of these grass dominated areas were stands or scattered coconut trees. Along the southern inland margins of this habitat, the grass dominated lands either graded into rural residential land use or into the degraded tree dominated habitats of logwood scrub or secondary forest.



**Plate 3.13: Vegetation along a water way
at Richmond**

Degraded Forest Areas

There were four sample sites in this vegetational type. Vegetational assessment was conducted by sampling plants along 10 metre transects. Along each transect the vegetation within a 1.5 metre band was sampled by recording:

1. Tree species (for the purpose of this study, a tree was defined as any plant (succulent or woody) that had a diameter greater than 6 cm measured at a height of 1.4 metres above ground level.
2. Canopy height - where there was relatively

continuous canopy cover.

Tree species were identified according to Adams (1972). The relative abundance of the species observed was ranked using the DAFOR (dominant, abundant, frequent, occasional, and rare) scale of relative abundance.



Plate 3.14: Degraded forest showing a cleared patch that had been burned surrounded by tall shrubby vegetation

Savannah and Sugar Cane Areas

In the open, treeless areas of the property, the vegetation was described based on the dominant species.

Upland/Interior Vegetation

In general, the upland interior areas of the proposed development area were a mixture of rural residential areas, degraded forest and logwood scrub. These habitats were generally characterized by low tree density among the larger trees, small basal area and short trees below 6 metres, compared to descriptions of more natural forest from this area (Asprey & Robins1953). The structure and composition of these

sample sites therefore reflects the area's long history of human management and use. It was therefore not surprising that species such as Red Birch trees (*Bursera simaruba*), Guango (*Samanea saman*), and Logwood (*Haematoxylum campechianum*) which tend to dominate many secondary forests in limestone areas were all prominent species of these habitats with human introduced species such as Mango trees being observed to multiple habitat subtypes (see Appendix IX for species list).

Residential habitat within the property was of two types. This land use both occurred linearly along the roadways and was then bordered to their rear by another land use type such as logwood forest, secondary forest or grasslands, or they occurred as part of more extensive settlement areas such as was present in sections of Rose Hill and Lewis communities. Rural residential land use in the Richmond Property is a mixture of housing and their associated yards, small plots of mixed cultivation and woodland plots in various stages of succession. The

dominant cultivated trees associated with these residential habitats were Citrus, Pimento and Ackee.



Plate 3.15: Photo showing larger forest trees and also a foundation at Richmond

Riparian Vegetation

Running from the southern uplands through the coastal grass dominated habitats were gullies and seasonal streams. These waterways were lined by riparian vegetation. This vegetation was considerably varied both in its species composition, height and area of coverage outwards from the waterways that they followed. In the upland areas the composition and structure of the riparian vegetation was primarily that of the closed broadleaf forest. However, in the northern, more severely human altered areas (such as abandoned sugar cane

fields etc.) of the property, the riparian habitat was dominated by species such as Guango (*Samanea saman*), Dogwood (*Piscidia piscipula*) and Guava (*Psidium guajava*).

3.3.3 Bird Species Composition by Habitat Type

There was a marked difference in bird species composition across the sub-habitat types surveyed. This was a direct result of the marked differences in the composition and structure of the plant community described above. Sample points 1-5 (see Appendix VIII) that were centred in what were formerly sugar cane fields and in savannah/pasture lands contained the fewest species. Additionally all the endemic and forest dependent species were absent from these areas. This was not surprising due to the structural simplicity and few plant species present in these areas. Of all the sample area, it was therefore obvious that these areas were the least important for either native plants or animals. The Riparian sites, (sample points 6-7), Rural Residential (sample points 8-10) and Degraded Forest sites (sample points 11-14) contained a more diverse fauna. The forested sites contained almost all the observed endemic and forest dependent species.

3.3.4 Species Distribution

The fauna of the Richmond property was species poor. This was graphically shown in the results of the bird survey. Birds provide a good indicator of the overall faunal diversity of an area due to their abundance, conspicuousness and ease of identification (Bibby 1992). They are also excellent indicators of environmental quality due to their reliance and sensitivity, and hence close association with specific environmental variables depending on their habitat requirements. The survey of Richmond revealed that, despite the relatively large area of the proposed development area, the property contained relatively few species of birds (23 species). Additionally the property was particularly poor in both Jamaican endemic species and those native species that require mature/well developed forest for their survival (see Table 3.9 below). In general the Jamaican endemic species and subspecies are those of greatest conservation importance in that their entire ranges are restricted to the island, and may be limited in their national distributions due to their specific habitat needs. Overall therefore, the development area appears to have already lost those species of greatest conservation concern due to habitat loss and degradation.

Table 3.9. Jamaican Endemic Species and Forest Dependent Species Observed during the Survey Period.

JAMAICAN ENDEMIC SPECIES	FOREST DEPENDENT SPECIES
1. Red-billed Streamertail	1. Caribbean Dove (endemic subspecies)
2. White-Chinned Thrush	2. Stolid Flycatcher (endemic subspecies)
3. Jamaican Vireo	3. Jamaican Vireo
	4. Black-whiskered Vireo
	5. Greater-Antillean Bullfinch (endemic subspecies)

3.4 Socio-Economic Impact Assessment

The primary focus of this SEIA is the Richmond Property and the contiguous areas that include the Lewis and Priory area extending to St. Ann's Bay. The property is located midway between the towns of Ocho Rios to the east and Runaway Bay to the West distance of approximately 6.5 kilometres. The town falls within the North Coast Belt. Ocho Rios is the centre of tourism/resort development in that region of the island.

The following are the main the issues relating to the development.

- The pending implications for social services and amenities, physical infrastructure and employment.
- The effects of local cultural practices related to the use of the site for marginal agricultural activities over the years.
- The effects of the development on existing and adjacent populations.
- Its effects on the hierarchy of the towns in the parish in general and along the North coast in particular.

Ultimately, the success of the development could be measured in terms of the how liveable it becomes and included in the measurement of liveability are how it:

- Fosters good school, housing, jobs, public transportation and safety
- Brings quality to the physical, social, economic and cultural environment
- Takes advantage of its uniqueness in terms of population, climate, geography, history, culture and industry in its design
- Helps conserve energy and natural resources
- Stimulates the mental, physical and spiritual potential of individuals
- Developments a participatory attitude, in the planning of projects

The following are the important indicators as plans for the proposed development progresses:

Solid waste disposal	arrangements for solid waste disposal are considered adequate
Transportation	no problem with transportation but roads need improvement
Telephone	this service is considered adequate
Liveability	quiet and peaceful community
Post Office	one small Postal Agency serves community
Potable Water	water supply unreliable at Lewis
Recreation	recreational facility inadequate
Day Care	no day care centre serves the immediate communities
School	only the Priory All-Age School serves the community
Health Service	no health centre serves the immediate communities

The socio-economic, physical planning and spatial implications are extensive given the scale of the proposed development. It is therefore important that an integrated approach to the development be planned for all stakeholders in order to facilitate sustainable development. In describing and analysing plans for the proposed development impacts will be noted for mitigation measures stated. This would ensure that sustainable comprehensive social and economic community development is achieved.

3.4.1 Demographics

According to preliminary census data for 2001 the combined population of the three major urban centres of Ocho Rios/St. Ann's Bay in the East to Runaway Bay, in the West along the coast referred to as the North Coast was 32,036, almost 20 per cent of the population of the parish of St. Ann (see Table 3.10).

From 1991-2001 the annual rate of growth for:

- Jamaica was 0.91 per cent
- the Parish of St. Ann was 1.10 per cent
- the mean for Ocho Rios/St. Ann's Bay and Runaway Bay combined was 1.38 per cent
- Ocho Rios at 4.36 per cent was highest nationally
- St. Ann's Bay was -0.50

The Town Planning Department has classified the towns of Ocho Rios/St. Ann's Bay as one Regional Urban Centre and based on its tabulation, the population within that region (which includes hinterland communities) stood at 35,101 in 1991. The Regional Centre extends from

White River in the East to Priory in the West and to Dawson Town, Beecher Town, Breezy Hill and Colegate at its most Southern border.

The population along the coastal strip that not only includes that of major centres of Ocho Rios, St. Ann's Bay and Runaway Bay but also Drax Hall, Steer Town, Llandoverly, Richmond/Laughlands and Salem was approximately 27,600 in 1991. Within the SEIA area the population in 2001 was approximately 16,140. There were fewer males than females, a sex ratio of 104.6 or 4.6 per cent females than males. The sex ratio for the parish was 100.42.

Population Density

In 1991, overall population densities within the St. Ann's Bay/ Ocho Rios Region were 5-10

persons per hectare. Highest densities were primarily to the north in areas, such as, built-up areas of St. Ann's Bay and Seville Heights whose densities were in excess of 50 persons per hectare.

Table 3.10: Hierarchy of Major Towns and Population Change in St. Ann, 1991 – 2001

LOCATION	1991	2001	ANNUAL GROWTH RATE %
Parish, St. Ann	147,000	161,915	0.97
St. Ann's Bay	11,051	10,506	-0.50
Ocho Rios	10,254	15,714	4.36
Brown's Town	8,232	8,162	-0.09
Runaway Bay	5,655	5,816	0.28

Population Projection

Source: STATIN

Based on its 1991 population, the regional population up the year 2020 was projected by Town Planning Department at 42,226, growing at a projected growth rate of 0.4 per annum (see Table 3.11). Given the mean annual growth rate mentioned above and development plans for the region it is assumed that the projected population could be slightly higher.

Given the proposed scale of the development of the Richmond Property, the projected population at full development would be approximately 8,000. If the adjacent O. Mafessanti & Sons Limited development takes off, an additional 3,000 persons could populate the area, the combined total would be over 68 per cent of the estimated 2001 population.

Table 3.11: Population Projection for the Ocho Rios/St. Ann's Bay Region

1991	1995	2000	2005	2010	2015	2020
35,101	36,065	36,401	39,088	40,103	41,164	42,226

Source: Town Planning Department

3.4.2 Housing

The 1991 Population Census revealed a total of 45, 378 households in St. Ann. There were 2,621 dwellings and a population of approximately 11,051 persons in St. Ann's Bay. The average number of persons per dwelling was 4.2 persons. In 2001, however, the population had decreased to 10,506 persons while the number of dwelling units had increased to 2,921. This resulted in the average number of persons per dwelling decreasing to 3.6 (STATIN 2001).

In 2001, the average dwelling size was in the range 1-3 bedrooms within the Region. The outer walls of the houses built in St. Ann are constructed of four main types of materials; (i) concrete and block (75 per cent), (ii) wood (8.9 per cent), (iii) nog (5.9 per cent) and (iv) wood and concrete (4.5 per cent). The roofing materials are predominantly; metal sheeting, (82 per cent).

3.4.3 Existing Land Use

Agriculture on the Property over the years has been primarily sugar cane production and cattle rearing. The sugar cane land is now in ruinate. In recent years 19.44 hectares (48 acres) to the west was leased for papaya production but this has been discontinued. Cattle rearing continued towards the eastern boundary.

Residential development of the property is presently confined to about eight (8) small units that are dedicated to housing property employees and are located along the arterial road. They feature a variety of domestic fruit trees, including breadfruit and cherry.

Lying immediately to the north, across the main road is Chukka Cove, a multifunctional equestrian resort facility that offers horseback riding, features polo matches, lessons and trail rides through neighbouring plantations such as Richmond. The Llandoverly property to the west continues in agriculture, which includes the growing of a variety of vegetable crops. To the east the development of a 776-lot subdivision is now in progress.

Other land uses in the vicinity is the Circle B Farm, 56.79 hectares (140 acres) and Cranbrook both lying to the Northwest of the property which are engaged in ecotourism attractions.

3.4.4 Employment and Income

The dominant economic activities in St. Ann are agriculture, mining and tourism. Tourism has in more recent years superseded the dominance previously enjoyed by agriculture and mining. Changing fortunes within these sectors have been influenced by both global and national trends. Except for a period of growth in the apparel sub sector, the role of the manufacturing sector both locally and nationally has been in decline for over the past couple of decades. Owing to the unavailability of sufficient data for the region, the national and Parish data will be applied where necessary.

The average unemployment rate was 11.70% in the parish of St. Ann in October 2001 as, shown in Table 3.12. In 2004, the national unemployed rate was placed at 11.70 per cent (PIOJ, 2005). The female employed labour force grew due to increased opportunities in the Wholesale and retail trades, Hotel and Restaurant Services while there was a decline in the number of employed males.

The dependency ratio for St. Ann (the economically active - adult age-group (15-64) over infants and adolescents (ages 0-15) and the elderly (age 65+)) was 70.40 in 2001 compared to the national average of 66.67.

Within the Richmond area on the average, the rate of unemployment appears to be below the parish average as except for the 26 per cent of sample population who are retirees, the rest were employed in a variety of jobs, as hairdresser, waiter, bartender, taxi driver, and shopkeepers. This was confirmed when residents were asked about the most urgent community needs, only 11 per cent cited unemployment as a concern although based on experience there may be some level of underemployment among those surveyed. Although most persons were reluctant to disclose their income the range obtained was from \$5,000.00 to \$32,000.00 monthly.

Table 3.12: Total Labour Force Employed and Unemployed

Location	Total	Employed	Unemployed	Percentage Unemployed
St. Ann (October 2001)	66,800	59,800	7,000	11.70
Richmond Survey (May 2005)	22	16	-	0

Source: Statistical Institute of Jamaica

3.4.5 Economic Activities

Mining

a. Bauxite

In recent years productivity in the bauxite industry has increased after a decline in the 1980's and the industry remains a vibrant sector in the Parish. In fact, the bauxite and alumina industry, along with tourism are the two major non-agricultural employment and income generating economic activities. Nationally, in 2004, real Gross Domestic Product (GDP) in the Mining and Quarrying sub sector increased by 3.1 per cent.

b. Non-Bauxite Minerals

There is favourable prospect for the development of this sub-sector as within the limestone deposits just North of Ocho Rios there has been the discovery of high quality whiting. The demand for this product is high and growing as it is now being increasingly used in the motor vehicle and confectionery industries. Other locations of whiting in the parish are at Lumsden, Brown's Town, Colegate and the Fern Gully Conservation Area (TPD 1994).

Lydford Mines Limited is now undertaking the production of whiting and their projection for the area occupied is 300 million tons of whiting valued at US\$ 4,000,000. The product is exported out of the port at Ocho Rios to the United States of America. There is growth of this sector will increase opportunities for employment within the region.

There is also the potential for the exploitation of commercial marble in the area.

Agriculture

Agriculture has been the main economic activity at the Proposed Site and on adjoining the adjoining properties to the East and West – sugarcane growing and cattle rearing have been the traditional forms. Other crops such as bananas coconut, pimento and cocoa like sugar cane have been in a state of decline. While global trends have been inclined to influence national sector objectives there have also been the negative effects of natural disasters, such as, hurricanes and diseases, for example, lethal yellowing disease and that has ravaged the coconut industry. The decline in agricultural production has left many large properties in the parish idle or under utilized. Properties are now undergoing land use changes, for example, the land east of the proposed development site has been proposed for a development of over 776 residential lots, as mentioned above, and a section of the Llandoverly property has been earmarked for resort development.

Manufacturing

Manufacturing has never contributed significantly to the economic base of the Parish. The Factories Inspectorate of the Ministry of Labour completed the last survey of manufacturing establishments in the Parish in 2001, at that time, a total of 183 manufacturing businesses were located in the parish. Along the North Coast some were located in St. Ann's Bay (21) Ocho Rios (20) and Runaway Bay (4); this was 24.60 per cent of the total.

Industrial development within these communities is limited and do not offer a great variety, as there is an over dependence on the tourism sector, with industry related activities forming the economic base of the region's economy.

Tourism

There are two hotels in close proximity, one in St. Ann's Bay (Seacrest) and Mammee Bay (Sandals) each, a third is under construction at Mammee Bay; also there are guesthouses (4) villas (19). In 2004, the Ocho Rios region had the second largest number of hotel rooms (6,712) after Montego Bay (7,944).

Real Gross Domestic Product (GDP) from tourism grew by 4.9 per cent in 2004. This was a

decline over 2003 when growth was 5.6 per cent; this reduction was a direct effect of Hurricanes Charley and Ivan during 2004.

3.4.6 Social Services and Amenities Infrastructure

Within the framework for a totally integrated residential development the promotion of a harmonious integration of all sectors such as the physical, social, cultural, economical, environmental and governance systems are integral to the objective of achieving comprehensive sustainable development and must be embodied in the process from its outset. In this context, the various social services are discussed below.

Police

A Police Station is a basic social facility in all major urban centres. At St. Ann's Bay the Police Station extends its service to Llandovery and the southern hinterland communities. Information obtained from an Officer at the Police Station indicated relatively high incidents of domestic disputes in the adjacent Lewis community but very few incidents of crime at Priory and the high-income community of Tanglewood.

At the start of the year there were one hundred and thirty (130) officers at the St. Ann's Bay Police Station, eighty-one (81) of who were attached to the Central Intelligence Bureau (CIB), twelve (12) were stationed in the general office and thirty (30) were special constables. The station is adequately equipped; for example, there are 24-hour patrol cars and two (2) special patrol unit cars.

Post Office

The Post Office at St. Ann's Bay would serve the development along with the Priory Postal Agency. At St. Ann's Bay there is house-to-house delivery of mail within the town centre. In addition to the basic services of mail delivery/receipt and the selling of stamps, the Post Office also has a branch of Paymaster, a bill payment service and Moneygram, a remittance service.

The main post office at St. Ann's Bay distributes mail to the postal agency at Priory. The services offered there are basic, that is, mail delivery and the sale of stamps. There is no house-to-house, delivery of mail so residents must make visits to the postal agency in order to

access its services. The facility is incapable of accommodating long lines, as the space is inadequate. The Post Mistress has communicated that, if a suitable location is found the facility should be upgraded to a full service Post Office as it has already outgrown the needs of the existing population.

Public Schools

Public schools within a 16 kilometres radius of the proposed development are listed in Table 3.13 below. There are two public Infant School (ages 3-5) an All-Age school level (ages 6-15) and three Primary Schools (ages 6-12). The St. Ann's Bay Infant, the Priory Primary and Infant and the St. Ann's Bay Primary are within the closest proximity to the proposed development. In the 2003-2004 period the pupil/teacher ratio for all the adjacent Primary and All-Age schools were above the standard of 30:1 set by the Ministry of Education even where the school is on the shift system as in the case of the St. Ann's Bay Primary School. At the Priory Primary and Infant enrolment was 336 above capacity.

Enrollment in the Secondary High/Technical High Schools mostly exceeded capacities, for example, Ocho Rios High School is on the shift system but more than double its capacity. Two schools, York Castle High and Marcus Garvey Technical had their pupil/teacher ratio higher than the national standard of 25:1.

In 2001:

the age cohort 5-19 in St. Ann totalled 53,688 or 32.21 per cent of the population.

At a projected population of 8,000 the school age population would be approximately 2,579

i.e. Age cohort 5-9 totalled 923; Age cohort 10-19 totalled 1,656

The development plan includes areas zoned for basic, primary and high schools.

Table 3.13: Public Schools in Ocho Rios/St. Ann's Bay/Runaway Bay Area - 2003 - 2004

LEVEL	CAPACITY	ENROLMENT	NO. OF TEACHERS	PUPIL/TEACHER RATIO
Infant				
St. Ann's Bay	110	251	11	25:1
Primary				
Ocho Rios	1,135*	2,110	65	33:1
Priory Primary and Infant	430	766	24	35:1
St. Ann's Bay	855*	1,700	55	36:1
All Age				
Runaway Bay	385	692	25	31:1
Secondary High				
Browns Town	1350*	2,205	101	25:1
Ferncourt High	1350	1,239	58	23:1
Iona	450	407	23	19:1
Ocho Rios	1125*	2,448	108	23:1
St. Hilda's Diocesan	1125	951	47	23:1
York Castle	1125	1,201	50	27:1
Technical High				
Marcus Garvey	1,350*	2,494	103	27:1

Source: Ministry of Education

*Shift system

Health Services

a. Health Centre and Services

The North East Regional Health Authority (NERHA) within which St. Ann falls is responsible for public health surveillance and enforcement, and delivery of healthcare to the estimated 356,000 inhabitants of the parishes of St. Ann, St. Mary and Portland, a population that is growing at a steady rate of approximately 0.7% per year.

Within the region there is Types I to V health centres. A Type V Health Centre is located at the St. Ann's Bay hospital, it provides in-patient and out-patient services as follows:

- Child health
- Pre-natal health
- Child guidance counseling
- Sexual Transmitted Infection Service
- Public Health (food handling etc.)
- Curative

- Medical
- Dental
- Family planning
- Dressing

b. Hospital

Table 3.14: Hospitals in the North East Regional Health Authority, by Type, Bed Complement and Services

NORTH EAST	HOSPITAL	ADDRESS	TYPE	ROOMS
Portland	Port Antonio Hospital	Naylor's Hill	C Public	95
Mary	Annotto Bay Hospital	Annotto Bay	C Public	100
	Port Maria Hospital	Trinity	C Public	60
St. Ann	St. Ann's Bay Hospital	St. Ann's Bay	B Public	180

Hospital services are provided through general and specialist facilities. These are administered through the boards of the four Regional Health Authorities. Hospitals are classified A, B or C according to the level of service and the size of the population served.

The St. Ann's Bay hospital is a Type B; these types are situated in the larger urban centres. They provide in-patient and outpatient services in the four basic specialties- general surgery, internal medicine, obstetrics and gynaecology and paediatrics.

Overcrowding occurs both at the clinic and the outpatient area of the hospital. Patients at the clinic are normally attended to on the same day although they may experience long waits. Overcrowding at the outpatient area of the hospital is due to a general preference for the hospital's service over that of the Heath Centre.

In planning for a fully integrated development it is projected that the health service needs of the population would be met by at least a Type I1 Health Clinic.

MAP SHOWING SOCIAL INFRASTRUCTURE IN CLOSE PROXIMITY TO THE PROPOSED RICHMOND SITE

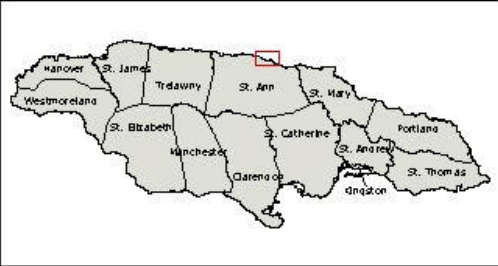


LEGEND	
	School
	Police Station
	Hospital
	Health Centre
	Fire Station
	Post Office
	Road
	Richmond Site Location

Prepared by N. Thomas
on behalf of EPN Consultants Ltd.
Suite # 7 83 1/2 Red Hills Road
Kingston 20

Source: Jamaica 1:50,000 Map Series
(Sheet no. 3 and 4)

1 0 1 2 Kilometers



Map 3.5: Social Services and Amenities Infrastructure within the Richmond Region.

Fire Service

The fire brigade station that serves the community is located in St. Ann's Bay. However the stations at Ocho Rios and Browns Town serve the region as well. There is a single fire engine at the St. Ann's Bay Station, therefore; ideally a standby unit would offer more security. There are two fire engines in Ocho Rios one of which can access high-rise buildings; Brown's Town like St. Ann's Bay has only one fire engine. The station in the Capital needs improved availability of equipment and other tools that are needed in fire fighting. Nevertheless, it can adequately respond in cases of emergency as all three fire stations support each other.

Recreation

- a. The development of recreational facilities fosters good community relationship. A large urban-type community centre and a Recreational Park are basic social infrastructure in Regional Urban Centres such as in St. Ann's Bay and Ocho Rios. However St. Ann's Bay has only a small community centre adjacent to the Type V Health Centre, where sports, such as, football are played and where clubs, such as, the Police Youth Club hold their meetings. The community facility at Priory is less formal as it is essentially an open-air playfield. Schools and church halls also provide accommodation for community activities. Given the inadequate development of the facilities in adjacent communities, such as, Priory, a public facility of this nature within the proposed development would, possibly serve the Priory and Lewis communities.
- b. The main public beaches are located in Runaway Bay, Priory, Dunn's River Falls and Ocho Rios. There are a few private beach facilities including that at the Chukka Cove facility.
- c. There is a wide range of attractions within the region, mostly as a response to demands of the tourism product. Those attractions such as Chukka Cove opposite the proposed site and Dunn's River and Dolphin Cove are well known.

3.4.7 Cultural and Historical Heritage

The Richmond Property

The Richmond property was originally a privately owned sugar plantation. There was an old sug/ar mill dating to the seventeenth century, however, the only remnant of that old factory is part of a water wheel and a tall square brick chimney in remarkably good condition. Quite a few

persons owned the Richmond Sugar estate in the 18th and 19th centuries. There was a very elegant mansion on the property (The Daily Gleaner, June 19, 1979). In 1951 the Richmond Estate was incorporated with Llandoverly in order to achieve the benefits of economies of scale. The building in ruins on the property is that of a more recent factory that dates back to the early twentieth century.



Plate 3.16: The ruin of the old Richmond, Llandoverly sugar factory

The Arawak

The cultural heritage of the area is rich, predating Christopher Columbus. Archaeological records show that the Arawak group, the Taino established settlements at Little River in the Drax Hall area and Seville around AD 500 – 650. Although Christopher Columbus was thought to have visited the area in 1494 he and his men only dropped anchor but never came ashore. Following his landfall at Santa Gloria (thought to be St. Ann's Bay) in 1504 the initial establishment of Spanish settlement on the island began.

New Seville

By 1509 New Seville (Sevilla Nueva) was established and became the capital of Jamaica in 1510 but more significantly it was the third Spanish capital established in the New World. However, by 1534, the national capital had moved to Spanish Town. Sevilla Nueva remained an import settlement, for example, its economic base of agriculture, including sugar cane production led

to the construction of the island's first sugar mill in that town prior to 1526. The town's port facility also played an important role in its economy up until its destruction during the conquest of the island by the British.

The Town of St. Ann's Bay

The British established the town of St. Ann's Bay and it developed as a fishing port during the nineteenth century and became a market centre for the surrounding estates. The port eventually became important for the handling of the export of banana, sugar and citrus and the import of rice, lumber and other staples. The decline in the port functions was partially due to the construction of the AGR Byfield Highway on reclaimed land in the Bay during the 1970's.

3.4.8 Visual Amenities

The design of the proposed subdivision would maximize the aesthetic value of the rolling topography and the outline of the coast. On the higher slopes on a clear day one can view many miles of coastline.

The members of the adjacent community of Lewis confirmed the satisfying experience of living in the area as when asked if they like the area 62 per cent of those surveyed indicated they do either because it's quiet, peaceful; because of the view or that they like the clean air.

3.4.9 Physical Infrastructure

Electricity

Jamaica Public Service (JPS) supplies electricity to Richmond, Llandoverly and environs through a 12kV transmission line from its sub station at Roaring River, St. Ann (approximately is three miles west of Ocho Rios. This service to the area is reliable as only 4 per cent of the survey sample indicated any concern about electricity supply.

In 2001, electricity was found to be the source of lighting in 85.4 per cent of all households in the Parish compared to the global average of 87.05 per cent.

Telephone

Cable and Wireless supplies land line and Cellular services to residents in the area. Cellular service is also available through Mossel (Jamaica) Limited and Oceanic Centennial Digital Jamaica Limited. The extension of landline service to the proposed development is within the capability of Cable and Wireless, however. It is usually advisable to inform the companies of any proposed development plans in order for them to organize to meet the pending demand.

Telephone use penetration by household for the Parish in 2001 was 15, 239 (33.6 per cent) for landlines and 6,874 (15.15 per cent) for mobile telephones; the national averages were 45.5 per cent and 13.9 per cent respectively.

Potable Water Supply

Potable water would be provided by a nearby well on the Llandovery property, it is expected that a Water Resources Authority licence would be granted for the supply of 3,550 cubic metres of water daily to the development. The source of potable water in the region is the springs North of Richmond as described in Section 3.1.6.

Households in the Parish obtained potable water from water piped in their dwellings 15,047 (33.16 per cent), piped into yard 3,692 (8.14 per cent), standpipe 3,410 (7.51 per cent), and catchment 2,029 (4.47 per cent, this was the highest percentage from this source and was superseded only by St. Catherine).

Roads and Transportation

The structure of the road network is very simple it features a main Class A coastal road, which is presently being upgraded to the North Coast Highway. Seven and a half (7½) acres/3.04 hectares from the Richmond Property have been given up to facilitate the highway construction.

Residents would find it more convenient to work outside of the area, as travel time between the two major tourist resort centres of Montego Bay and Ocho Rios would be significantly reduced. This section of the Highway is Phase II of the project, which constitutes the segment from Montego Bay to Ocho Rios.

As part of the programme, gullies crossing the road are being upgraded but only to the predevelopment requirements. The project managers have indicated their intention to investigate the possibility of making some adjustment in their plans to accommodate the proposed development.

Shared/route taxis are the main providers of transportation service locally. It is likely that these taxis will extend their service to Richmond once the demand exists.

Waste Disposal

a. Solid Waste Disposal

The NEPM Waste Management Limited has the responsibility for solid waste disposal in the Parish and collection at Lewis is on Mondays and Fridays weekly. The solid waste is disposed of at the Haddon Dump; however, there is also an alternate disposal site at Haddon in the parish. The scale of the development demands formal arrangement for solid waste disposal and approval for accessing the service has been obtained from the National Solid Waste Management Authority. The cost of this service will be \$3,547.80 per household or \$7,095,600.00 annually until the development is listed on the property tax role.

b. Sewage Disposal

Globally in 2001, water closets were the dominant means of sewage disposal 58.2 per cent compared to pit latrines (37.9 per cent). This was an improvement over the 1991 figures when with pit latrines were used by 50.81 percent of all households. In St. Ann, pit latrines were used by 18, 824 (41.5 per cent) of households.

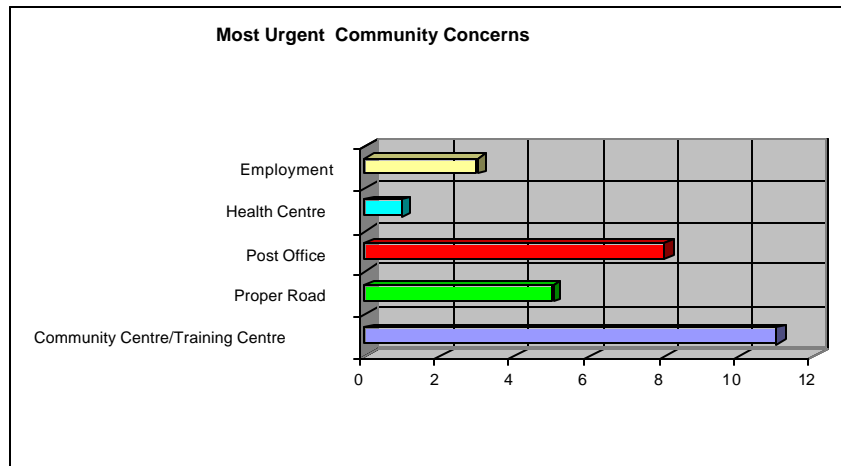
The main means of sewage disposal in the area is water closets using absorption pits and the use of pit latrines are rare. A primary concern in the region is the potential for contamination of ground water as the area has shown a high level of vulnerability given its hydrology and geology and the growth of settlements in the higher slopes.

The plan for development involves the construction of a central sewerage system (waste stabilization ponds) that would negate any likely negative environmental impact on groundwater resources.

3.4.10 Community Concerns

Community concerns among residents in the adjacent areas varied, however; in general they were pleased with the idea of a new residential community in their area. The development they feel would result in improved conditions, such as, better roads, access to amenities and employment opportunities. Some felt that there should be a chance to purchase houses in the development and asked to be included among the beneficiaries.

Figure 3.2: The most Urgent Community needs in the Richmond Area



Not unlike most communities island wide the need for community/training centres (38 per cent) is a primary concern. Other community needs were for a post office, improved roads, employment and a health centre.

The developer has plans for the integration of the existing Lewis community with the new development by providing affordable housing solutions in the areas adjacent to Lewis.

4.0 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.1 Assumptions and Assessment Guidelines

1. Physical Resources

a. Geology

The Proposed Action would normally have a significant effect on the environment if it would:

- Expose people or structures to major geologic hazards

b. Soils Resources

The Proposed Action would normally have a significant effect on the environment if it would:

- Cause substantial erosion.
- Cause the substantial production of agricultural crops

c. Surface waters

The Proposed Action would normally have a significant effect on the environment if it would:

- Substantially degrade water quality;
- Contaminate a public water supply;
- Cause substantial flooding or siltation; or
- Substantially alter surface flow conditions, patterns, or rates.

d. Ground Waters

The Proposed Action would normally have a significant effect on the environment if it would:

- Substantially degrade water quality;
- Contaminate a public water supply;
- Substantially degrade or deplete ground water resources; or

2. Air Resources

The Proposed Action would normally have a significant effect on the environment if it would:

- Violate any regulatory requirement of NEPA; or
- Violate any ambient air quality standard; or
- Expose sensitive receptors to substantial pollutant concentrations.

3. Biological Resources

The Proposed Action would normally have a significant effect on the environment if it would:

- Substantially affect a rare or endangered species of animal or plant or the habitat of the species;
- Interfere substantially with the movement of any resident or migratory wildlife species;
or
- Substantially diminish habitat for wildlife, or plants.

4.2 Preparation and Constructional Phases

4.2.1 Impacts on Hydrogeologic Resources

Ground Water

The potential for groundwater contamination at the site relates primarily to the disposal of sewage effluent. The risk of groundwater contamination is low due to the protection of the limestone aquifer offered by the overlying limestone aquiclude. **(Direct, long term, negative impact)**

Measures Incorporated by Project Design and Mitigation Measures

The risk of groundwater contamination is low as a central sewage treatment facility will be built.

Surface Water Hydrology

Based on a rapid assessment along the gullies and seasonal streams within the area it was determined that these waterways have been important in recent years for both the transportation of flood waters and debris flows. Debris flows, unlike regular flood waters have very high amounts of suspended materials. Hence, the later flows are denser and may transport larger materials (rocks and boulders) along with silt and mud. They are, therefore, potentially more destructive than regular floodwaters. Based on the extent of this study it is not possible to determine the magnitude and estimate the frequency and scale that these events are likely to recur.

No alteration of the riverbeds on the property is planned. The beds will act as natural sinks for storm water.

Where waterways cross the North Coast Highway culverts have been sized and upgraded to accommodate their flows. (**Direct, long term, negative impact**)

Measures Incorporated by Project Design and Mitigation Measures

- Measures would be aimed at stabilizing the slopes on the banks of rivers and gully; mostly by planting and maintaining erosion resistant shrubs.
- Blockage and dumping of waterways would be strictly prohibited both during the construction and post-construction phases
- Need to liaise with the Project Managers of the North Coast Highway to ensure that both drainage plans for runoff from the property coincide. Inadequate drainage structures may result in the flooding of lots to the North, flooding of roadways and the lands north of the main road.
- A berm is recommended to along the northern perimeter of the site to prevent sheet floods from exiting the Richmond Estate to the highway. As far as possible, the storm water drainage system should be routed to the Cave River culvert system as this has the greatest capacity to accept increased run-offs from the site.

4.2.2 Impacts on the Terrestrial Resources

Fauna

The proposed development that will include residential, commercial, light industry, institution, agricultural, recreation/open space and sewage treatment will further reduce faunal diversity in the area. However, given the already impoverished state of the community and its low conservation importance, no specific mitigation measures have been proposed.

Flora

There are several important components of the vegetation of the property, which should be carefully considered in the development.

There is riparian vegetation along the entire length of waterways. **(Direct, short/medium term negative impact).**

Measures Incorporated by Project Design and Mitigation Measures

- Removal and establishment of trees is a lengthy and potentially expensive undertaking. Retaining as many of the larger trees as is possible would also significantly advance the aesthetics of the area. Specifically those trees around what was formerly used as the sugar cane plantation property house, such as the Royal Palms (*Roystonea regia*) should be clearly marked for conservation
- Preservation of the allotted open spaces on the site, and the replanting of trees within the community would mitigate against loss.
- The maintaining of riparian vegetation along waterways would be important in maintaining the integrity of these systems.
- The maintaining and replanting of vegetation would be ongoing as the development proceeds. Vegetation would also serve to protect the vulnerable slopes.
- As far as possible, the drainage plans follow the natural regimes to prevent the die-off of the tree species by flooding or drought.

4.2.3 Impacts on the Socio-Cultural Environment

Socio-economic/cultural

- The new development would likely become an extension of the Priory community however; existing social and physical infrastructure could not adequately meet the needs of the new development in addition to those that would be added.
- The projected population growth for the region is significantly higher than the parish average. Therefore, the demand for housing solutions is expected to be maintained. Potential purchasers are likely to come from individuals employed in the Tourism, Mining and other service sectors.

- Individuals in the region tend to look to Ocho Rios for entertainment and shopping, banking etc.
- The revitalization of agriculture would improve the property's productivity.

(Direct, positive, long term impact)

Measures Incorporated by Project Design and Mitigation Measures

Social infrastructure needs to be met:

- Health Centre – preferably a Type 11 Health Centre.
- Schools – High, Primary and Infant Schools
- Day care – a high employed labour force is anticipated therefore a day care facility would be considered.
- A major commercial centre planned would also serve adjacent communities.

Employment

The proposed project provides the opportunity for employment of construction workers and tradesmen for the duration of construction period and eventually, the means of improving the socio-economic status of members of the community. New jobs (up to about 250) created during the construction phase could result from activities in the development of infrastructure, housing solutions, recreation sites and the sewage treatment facility and establishing of agricultural production. Priority will be given to residents within the immediate community for employment opportunities created during the implementation of the project. Another beneficial consequence of the project is the income generated to shop owners at the site through provision of materials and services to the project and others within the town, such as, taxi and mini bus drivers would also profit. **(Indirect, short to long-term positive impact)**

Public Utilities

Public utility companies such as the Jamaica Public Service Company (JPSCo.), National water Commission must be notified of the pending development so future public utilities needs can be factored into their future plans. **(Indirect, long term, impact)**

Waste Disposal

Solid waste

Construction activities will lead to the generation of solid waste in significant amounts. Material produced will primarily be in the form of construction debris. Negative impacts caused at the site by waste material disposal will depend on the location of that site. Appropriate holding area sites would be determined, but proper disposal of the waste material must be a primary concern of the development. **(Direct, short term, negative impact)**

Measures Incorporated by Project Design and Mitigation Measures

Specific attention would be given to minimizing and reducing the quantities of solid waste produced during site preparation and construction. A waste management plan would be prepared and followed. Organic waste, namely vegetation, would be composted on site and used for soil improvement (soil conditioning) during landscaping. Branches can be put through a wood chipper to prepare soil cover for garden beds, etc. Excess inorganic waste would be stockpiled (away from drainage features) for infilling of lot sites where necessary. To avoid the harmful effects of poor solid waste disposal adequate arrangement would be made with NEPM or with a private contractor to dispose of solid waste at the authorized dumpsite.

Strategically located and maintained temporary latrine facilities would be made available for construction workers.

Materials Transport

The transport of materials from source to site would entail use of heavy trucks, which have the potential to produce polluting gaseous emissions and dust, depending on the material being transported. The movement of heavy trucks could also lead to additional road ways. These impacts are of short-term duration, but are of particular importance, as the main road leading to the site is a major thoroughfare, which already experiences high volume vehicular traffic flows. **(Indirect, major, short-term impact).**

Measures Incorporated by Project Design and Mitigation Measures

Construction materials at times are transported in uncovered, overloaded trucks which contribute to dust pollution, increased noise and wear and tear of the roads. The contractors

should ensure that trucks carrying the materials are covered with tarpaulins to reduce air pollution. Vehicles should be properly maintained and serviced to reduce emissions. The development of a transport schedule; e.g. during the off-peak hours, would also help to alleviate the effects of traffic congestion and noise. **(Indirect, major, short-term impact)**.

Site Access

Due to the nature of the site, levelling and the use of heavy equipment would be necessary. The transportation of paving, fill and other construction material onto the site will have the negative impacts of increased incidence of noise, fugitive dust formation and accompanying disturbances to residents of the community. **(Direct, short-term, negative impact)**.

Measures Incorporated by Project Design and Mitigation Measures

An appropriate schedule of activities during the construction phase will help to alleviate the impacts of increased noise, dust, etc. likely to result from construction activities. The activity schedule would be communicated to residents of the community. Additionally, construction activities will take place during periods when disturbances to the residents are minimized. Measures to reduce the formation of fugitive dust, such as sprinkling, will be instituted.

Construction Works

This refers to the actual construction, for example, of buildings, access roads. Considerable amounts of solid waste will be generated, and the natural drainage of the site patterns would be changed by the increase in impervious surfaces. Uncontrolled discharges entering waterways could introduce pollutants and particulate material. **(Indirect, negative, short term impact)**.

Measures Incorporated by Project Design and Mitigation Measures

Good site waste management procedures would be implemented. Adequate drainage is designed and engineered to prevent excessive runoff of sediments into the gully marine environment. Sediment traps will be installed. Stockpiles would be contained by using sandbags and other retaining measures. The stockpiles will also be sprinkled regularly to prevent the formation and escape of fugitive dust.

4.2.4 Other Potential Impacts

Social Services

The relevant government agencies for the delivery of the fire, health and postal services should be notified early and their progress followed, as they will be responsible for the upgrading where necessary and operation of the proposed services.

Public Health and Safety

- Traffic and public transportation management capability would need to be enhanced.
- Monitoring and management of the waterways to prevent flooding in the community.
- Maintain standard wastewater treatment practices to avoid pollution of the coastline.
- Solid Waste: Arrangement must be in place to ensure that solid waste and construction debris is properly disposed of. About six (6) skips would adequately serve the site. Other waste such as tree cuttings would be preserved and composted or suitably secured.
- Air Pollution

Table 4.1: Potential Pollution Sources

List of Potential Pollution Sources and Type for the Proposed Action					
Pollution Unit	Pollution Unit Description	Emission "Source" Type			
		Point	Fugitive	Mobile	Other
Construction Phase					
1.001	Excavating/Drilling (Back hoe)	X	X	X	
1.002	Sand or Marl, Cement used		X		
1.003	Haul trucks			X	
1.004	Bull dozers		X	X	
1.005	Wind Erosion (Waste)		X		
1.006	Wind Erosion (Stockpile)		X		
1.007	Front end loaders			X	

- The use of adequate equipment and vehicles to reduce a dust pollution and noise. Noise would be kept to a level which does not exceed 70 dB at 50m from the property boundary at any given time.
- Frequent wetting of the site during construction will also help to alleviate the problem of fugitive dust.
- Cut and fill material and stockpiles construction materials such as of sand and marl would be secured in order to reduce effects of dust pollution and to avoid them been washed away during rainfall events

- No major site grading is planned, given the topography, besides it has been historically altered during cultivation. **(Short term, indirect, negative impacts)**

4.3 Operational Phase Impacts

4.3.1 Impacts on the Physical Environment

Surface Water Hydrology

There would be increased levels of overland flow. The greatest impact will be above the contact line between the gravel fans deposits and the less permeable coastal marls. Increases in built surfaces on the site are likely to be of the order of 172 acres.

Table 3.14: Estimated Increase in Overland Flows by Land use

Land Use	Total Planned Area (Acres)	Estimated Impermeable Surface (Acres)	Estimated Coverage by Impermeable Surfaces (%)
Multi-family residential	25.3	6.3	25%
Single Family Residential	174.8	43.7	25%
Commercial	33.6	16.8	50%
Light Commercial	5.9	3.0	50%
Educational	22.3	5.6	25%
Roadways and walkways	84	84.0	100%
Green Area/Landscaped	21	0	0%
Drainage & Park Area	71	0	0%
Homestead Farms	114.8	11.48	10%
Sewage Plan	5	0	0%
Civic Community Facilities	10.4	1.04	10%
Total	557.7	172	31%

This increase in built surface would result in increased levels of peak discharges. This is of concern in the areas above the gravel fans in the three storm drains on the property. Flooding of downstream properties and highways is not expected to be a significant problem due to the high permeability of the riverbed material, and the capacity provided by the storm drains under the highways.

It can be expected that the peak flows would increase. A run-off co-efficient of 0.95 is normally used for impervious urban areas. The project acreage in the Cave River sub-basin is mainly

farmlands, which would not significantly increase the run-off co-efficient. Project development in the Richmond drain sub-basin (which is almost wholly contained on the project site, but includes the village of Lewis) is expected to increase the run-off co-efficient by about 30%, which would also translate to a 30% increase in peak flow off the areas east of the Richmond Gully culvert. It should also be noted that the site reaches field capacity rapidly due to the relatively small thickness of the gravel facies, and low permeability of the underlying Coastal Group, and Montpelier Limestone. **(Direct, long-term, negative impact)**

Measures Incorporated by Project Design and Mitigation Measures

Suitable mitigation measures during the construction phases would adequately mitigate these potential impacts. NB No storm drain plans have been evaluated by this study.

Groundwater Hydrology

The greatest risk to ground water quality is the effluent discharge from the sewage treatment plant that would be fed into a constructed reed bed. **(Direct, long-term, negative impact)**

Measures Incorporated by Project Design and Mitigation Measures

The Sewage Treatment Unit (Waste Stabilization Ponds) would be built within the conditions of the Environmental Permit and License issued by NEPA. It would be located on the far north-eastern corner of the property at the lowest elevation. This will enable gravity feeding of wastewater down to the plant, so no major pumping is expected. The Sewage Treatment Plant (STP) would be located near to the Stony River dry bed. This river only flows following major storm events, and therefore the Sewage Treatment Plant (STP) is not in at risk from flooding.

Sewage effluent would be monitored to ensure adherence the Environmental Health Unit of the Ministry of Health and the NEPA in order to ensure low contamination risk.

Coastal Water Quality

a. Turbidity

Increased coastal turbidity due to site clearance is not expected as site run-offs are expected to sink rapidly into beds of the major streams draining the property. Under heavy rainfall periods (May, September-December) erosion of marls are associated.

b. Nutrients

Outfalls of effluents into the Stony River would not pose a health risk as there is no flow in the river, and the ground water below the outfall is not used for human consumption. The main impact of impacted groundwater entering the coastal environment would be enrichment with respect to nitrates, as coliform bacteria are expected to die off rapidly in the marine environment. **(Long term, negative, indirect impacts)**

It is assumed that at least 100 per cent of potable water would result in wastewater.

4.3.2 Impacts on the Biophysical Environment

The aesthetics of the area would also be significantly advanced by retaining as many of the larger trees as is possible and re-establishing of vegetation.

Measures Incorporated by Project Design and Mitigation Measures

Impervious surfaces will be minimized as far as possible and cleared areas and exposed soil replanted and grassed as soon as possible after building to reduce sediment runoff and naturally improving site aesthetics.

4.3.3 Impacts on the Socio-economic Environment

School Enrolment/Capacity

A Primary School is slated for the community; however, within the area Primary/Junior High School and High school capacities are below the town's demand. Planning for increased capacity at these levels should be planned based on present and future demand.

Transportation

Land use is directly related to transportation. The development of transport infrastructure such as roads has been proven to have spin off effects which lead to land use development and vice versa.

Land use categories such as schools, offices and markets are considered trip attraction sites; such trip attraction sites are limited in Priory but are in neighbouring towns of St. Ann's Bay,

and Ocho Rios. This of course would result in there being trips generated from the site and to these locations. This increase in travel demand may result in traffic congestion which also has its associated negative impacts (noise, air pollution), therefore the need to provide the required transportation infrastructure such as a transport terminal and upgrading of roadways.

4.3.4 Impacts of Agricultural Production

Environmental Checklist for Agricultural Development at Richmond

AIR QUALITY (INCLUDING NOISE)	Minimal Impact	Moderate Impact	Significant Impact	Analysis of Alternatives/Strategies to reduce or eliminate impact/Environmental Management Practices/Training/Monitoring
1. To what extent will the following affect air quality?				Pesticides will not be applied when it is windy. An IPM approach will be used to ensure rational use of pesticides. This approach will allow use of approved pesticides in conjunction with mechanical and cultural practices. A decision is made to use pesticide when pests become an economic threat i.e. when the pest population on the crop exceeds an acceptable threshold. Additionally, pesticides will be applied according to the guidelines of the manufacturer, PCA and extension agents. Farmstead owners and their workers will be trained in the use of pesticides, appropriate equipment and protective gear. Attempts will be made to minimise the number of pesticide application during a growth cycle.
Use of pesticides	v			
Emissions for machinery used for land clearing, construction	v			
2. Is the project designed to comply with the NEPA's national standard/regulations governing air quality and air pollution? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>				Extensive land preparation is limited only to a few crops. Hence emissions from heavy equipment will be minimal and seasonal. Owners of machinery will be encouraged to service such machinery as appropriate in order to reduce emissions.
3. What will be the extent of the impact from noise (e.g. from blasting, movement of heavy equipment such as tractors, trucks etc, driving piles)	v			
WATER RESOURCES <i>(E.g. rivers, springs, underground water)</i>				
1. To what extent will the following affect water resources:				Minimal use and placement applications reduce runoff from pesticides and fertilizer to insignificant levels. The agricultural area of the property is bordered by a gully that mostly serves as the main drainage channel for the property.
Contamination from the use of pesticides, fertilizers, manure and other agricultural runoff	v			
Irrigation water is taken from an irrigation channel that traverses the property. This water does not originate on the property				

AIR QUALITY (INCLUDING NOISE)	Minimal Impact	Moderate Impact	Significant Impact	Analysis of Alternatives/Strategies to reduce or eliminate impact/Environmental Management Practices/Training/Monitoring
Is the project designed to comply with NEPA's trade effluent standards or sewage effluent standards 2. Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>				
COASTAL RESOURCES				
1. To what extent will the following affect coastal resources (marine water quality, coral reef, sea grass beds etc.)?	v			See note above.
Increased surface runoff due to paved areas including roads and clearing vegetation from land	v			
2. Is the project designed to comply with NEPA's trade effluent standards or sewage effluent standards Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>				
LAND RESOURCES				
1. To what extent will the following affect land resources				The land was recently planned in papaya, sweet potato and several other crops. Therefore, the land is already adapted to agricultural used and cleared. The process involves mostly re-cropping and widening the crop diversity. Where possible, zero-tillage methods will be used.
Soil erosion (land clearing for construction and farming)	v			
b. Will this enhance the project or mitigate potential adverse impacts? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>				The project is designed to introduce environmental friendly farming techniques and to transfer these farmers. Mitigating measures such as IMP, erosion, moisture and fertility management are integrated into the farming protocols.
NATURAL HABITATS & ECOLOGICAL RESOURCES				
Soil erosion (agricultural practices, construction)	❖			The area is relatively flat; hence erosion hazard is very low. Soil types are also stable
Pesticides & fertilizer use	❖			
3. Will the project be situated in a protected area declared by the NRCA? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>				
VISUAL RESOURCES				
HISTORICAL & ARCHAEOLOGICAL RESOURCES				
1. To what extent will the project affect historical or archaeological resources				
2. Will project be site near any site or structure with historic or archaeological significance? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>				There is an old factory of historical significance of which will be improved with the resumption of agricultural activities on the property.

AIR QUALITY (INCLUDING NOISE)	Minimal Impact	Moderate Impact	Significant Impact	Analysis of Alternatives/Strategies to reduce or eliminate impact/Environmental Management Practices/Training/Monitoring
OPEN SPACE & RECREATION				
2. Is this open and recreational space important to the community? Yes _____ No _____*				

Source: Tai Hossman, 2005

Minimal impacts are considered as those with a duration (hours, days and a few weeks) that do not result in permanent damage to the environment or human health. No (or simple) mitigation measures and required.

Moderate impacts are those spanning many weeks or months that may result in permanent damage to the environment or human health. Mitigation measures are required.

Significant impacts are those with duration of several years resulting in permanent damage even with mitigation measures. Such mitigation measures are usually costly.

4.4 Cumulative Impacts

The Richmond development over time will result in a variety of changes. The most evident of these changes may be:

- This development will see a significant change in the land cover and landscape of the area.
- Growth and expansion of Richmond/Priory
- The general culture of the area would change. A more likely result is a formal urban setting with the associated physical infrastructure and amenities
- The proposed development would be primarily residential in nature; as a result there would be a heavy demand for commercial activities. As a result a spin-off of the development may see the development of further commercial infrastructure in Priory.
- Apart from the expansion the town the development area may also be faced with standard urban problems, such as traffic congestion, noise, and air pollution and rural to urban migration. Management of lands within the region would also be necessary so as to avoid illegal land settlers seeking opportunities within the urban centre e.g. on undeveloped sections of the properties.

4.5 Residual Impacts

The process of planning is one which seeks to achieve the development of land through harmonious social and environmental integration. The mitigation measures put forward in this DEIA is an attempt at further achieving such a goal. Nonetheless this development will cause some significant changes to the environment.

There will be a general decrease in vegetation cover resulting in a slight change in the microclimate at the Richmond site. The mitigation measure of re-vegetation during landscaping may not be able to totally compensate for this loss.

There will be an increase in storm water runoff that will enter the engineered drainage channels and eventually empty into waterways, such as, the Stony River. As a result of this increased runoff the waterways require the maintenance of drainage structures to prevent flooding.

The general agricultural landscape along the North Coast corridor would be permanently altered.

5.0 MANAGEMENT/MONITORING PLAN

The impacts, which require management and monitoring, are outlined below.

ACTIVITY	AGENCY/INDIVIDUAL
PREPARATION AND CONSTRUCTIONAL PHASE	
1. Construction of sewage treatment facility within NEPA's permitted guidelines.	Engineer/Contractor
2. Flooding control measures: a. Measures to prevent flooding of lots. b. Measures to protect roads from inundation c. Measures to protect the sewage treatment facility from flooding	Engineer/Contractor
3. Marking of trees to be maintained for landscaping.	Developer/Contractor
4. Introduction of traffic control measures, e.g. Erection of signs and use of flagmen	Developer/Contractor
5. Pollution Control: Control of fugitive dust, reducing noise nuisance, employees using dust masks etc.	Developer/Contractor
6. Obtaining construction materials from nearest legitimate sources.	Developer/Contractor
7. Strict adherence to the approved building plans. Care to be exercised in preserving ruins	St. Ann Parish Council/Developer
OPERATIONAL PHASE	
1. Initial monthly monitoring of effluent quality from wastewater treatment facility and efficiency of the pond system especially during the early stage of operation based on NEPA guidelines and standards.	The Developer, National Water Commission
2. Public amenities: a. Schools – the construction of a Schools should be negotiated	Ministry of Education, Developer
3. Education of residents and haulage contractors in the importance of proper waste management practices	National Solid Waste Management Authority,
5. Water supply quality must be monitored monthly in order that the integrity of the potable water supply be maintained	National water Commission
6. In establishing agriculture/floriculture need for management of soil erosion, pesticide use etc.	Developer, Consultants
7. Institute penalties for the indiscriminate removal/cutting of tree species.	NEPA/The Developer
8. Landscaping and plant species: Few attractive, naturally occurring plant species are located on the site. Those required for use in the landscape	The Developer, the Citizen's Association

ACTIVITY	AGENCY/INDIVIDUAL
design will be obtained from legitimate sources.	
9. Education of householders of the operation of the sewage treatment facility.	The Developers, Engineer and the Public Health Department

6.0 REGULATORY AUTHORITIES AND LEGISLATION

The regulatory frameworks within which the proposed project to be developed are addressed below. The areas of relevance concern environmental quality, health and safety, protection of sensitive areas, protection of endangered species, site selection and land use control at the regional, national and local levels that relate to or should be considered within the framework of the project.

6.1 Regulatory Authorities

6.1.1 The Natural Resources Conservation Authority (1996)

Under the Natural Resources Authority Act and the Permits and Licences Regulations of 1996, the National Environment and Planning Agency (NEPA) is responsible for environmental protection on the island. In discharging its responsibilities, NEPA not only responsible for the environmental protection but also manages the nation's natural resources and the enforcement of environmental and development planning laws. Its functions include ensuring that developments are undertaken within its environmental guidelines by requiring environmental impact assessments, reviewing proposed developments and granting permits and licences.

Besides the NRCA Act, NEPA monitors and enforces laws and regulations such as The Beach Control Act, The Watershed Protection Act and the Wildlife Protection Act.

6.1.2 The Ministry of Environment and Housing: The Housing Act - Act 55 of 1968

This development falls under Sub-section (1) of Section and Sub-section (a) of Section 8 of the Housing Act. Under the Act the Ministry of Environment and Housing has the power to override the Town and Country Planning Act and declare a site a Housing area.

This development does not fall directly under the Town and Country Planning Act of 1957 (amended 1993 and 1999) and the Local Improvements Act of 1944. However, the guidelines of the St. Ann Development Order (2000) should generally be adhered to. These statutes control the development and subdivision of land. In such cases, normal procedures for building and development applications would be pursued by being channelled through the St. Ann Parish

Council and NEPA respectively. However, as a Joint Venture programme of the Ministry of Water and Housing this development falls under the Housing Act where the processes mentioned above are bypassed.

6.1.3 The Ministry of Health

The Environmental Health Unit (EHU) of the Ministry of Health is the agency responsible for the approval of the proposed sewage treatment and disposal system and setting the discharge limits.

6.1.4 Ministry of Transportation and Works

The Ministry of Transportation and Works requires that the drainage and road design meet its approval.

6.1.5 National Water Commission

The National Water Commission is responsible for potable water supply and sewerage services.

6.1.6 The National Housing Trust

This agency will provide mortgages for the housing units, which are to be constructed on the site. The low interest rates of the NHT make the mortgages it provides accessible to low income earners.

6.1.7 Water Resources Authority

This government Agency is responsible for the monitoring and ensuring the proper use of the surface and ground water resources of the island.

6.1.8 The St. Ann Parish Council

The St. Ann Parish Council has responsibility for the provision of certain public services including public health, fire protection, abattoirs, cemeteries, street cleaning, parks and play fields and markets. The Parish Council is also responsible for solid waste disposal but North Eastern Parks and Markets are managing this.

6.2 Relevant Legislation

Legislation relevant to the establishment of a housing development in St. Ann is outlined below.

6.2.1 The Natural Resources Conservation Authority (NRCA) Act, 1991

The NRCA Act (1991) is the overriding legislation governing environmental management in Jamaica. It requires that all new developments (or expansion of existing projects) which involve the sub-division of more than ten (10) lots be subject to EIA

The regulations require that eight (8) copies of the EIA Report be submitted to the Authority for review. Therefore is a preliminary review period of ten (10) days to determine whether additional information is needed. After the initial review, the process can take up to ninety (90) days for approval. If on review and evaluation of the EIA the required criteria are met, a permit is granted. In the event that the EIA is not approved, there is provision for an appeal to be made to the Minister.

Specifically, the relevant section(s) under the Act that addresses the proposed project are:

Section 10: Empowers the Authority to request EIAs for the construction of any enterprise of a prescribed category.

Section 12: Addresses the potential for contamination of ground water by trade effluent and sewage.

Section 15: Addresses the implementation of stop orders and fines associated with the pollution of water resources.

Section 16: Authorizes the government to intervene in order to prevent the contamination of ground water.

Section 17: Addresses the authority of the government to request in writing, any information pertaining to the:

- performance of the facility
- quantity and condition of the effluent discharged
- The area affected by the discharge of effluent.

6.2.2 The Watershed Protection Act (1963)

This Act governs the activities operating within the island's watersheds, as well as protects these areas. The watersheds that are designated under this Act include the Rio Bueno – White River Watershed.

6.2.3 The Housing Act (1963)

Under the provisions of this Act, the Minister is declared “corporation sole” and thus has the power of perpetual succession with the capacity to acquire, hold and dispose of land and other property of whatever kind. The Minister, after considering the housing conditions and needs of an area may cause the area to be declared a housing area. Within nine months after the coming in force of such an order, the Minister shall cause to be prepared a housing scheme in the area. However, the Minister before approving a scheme must provide notice to the public, which must be gazetted, consider all objections and representations made with respect to the scheme, and afford opportunity for the objections to be heard.

The Act also provides for the Minister to (order the) “layout and construct public streets or roads and open spaces on the land, erect dwellings and convert buildings on the land into dwellings, and execute such works may be necessary for the perfecting of such a (housing) scheme”. The Belle Air Housing development is being built under the Housing Act.

6.2.4 The Public Health Act (1974)

This Act falls under the ambit of the Ministry of Health (MOH). Provisions are also made under this Act for the activities of the Environmental Health Unit (EHU), a division of the MOH. The EHU has no direct legislative jurisdiction, but works through the Public Health Act to monitor and control pollution from point sources. The Central Health Committee would administer action against any breaches of this Act. In addition, there are various sections of this legislative instrument that govern and protect the health of the public. Relevant sections under the Public Health Act of 1985 are:

Section 7 - (1) A local Board may from time to time, and shall if directed by the Minister to do so, make regulations relating to nuisances and,

Section 14 - (1) The Minister may make regulations generally for carrying out the provisions and purposes of this Act, and in particular, subject to Section 7 but without prejudice to the generality of the foregoing, may make regulations in relation to air, soil and water pollution.

6.2.5 The National Solid Waste Management Act (2001)

The Regulatory Agency, the National Solid Waste Management Authority will be responsible for the implementation of the National Solid Waste Management Act.

In Part II Section 4-1 the Authority shall –

(a) Take all such steps as are necessary for the effective management of solid waste in Jamaica in order to safeguard public health, ensure that waste is collected, stored transported, recycled, reused or disposed of, in an environmentally sound manner and promote safety standards in relation to such waste;”

In Section 23 – (i) Every person who:

- a. Operates or propose to operate a solid waste disposal facility:
- b. Provides or proposes to provide solid waste collection or transfer service; or
- c. Otherwise manages solid waste, “Shall apply in the prescribed form and manner to the authority for the appropriate licence.”

Part V Section 42 – (i) 7.The Authority may provide the occupier of any premises, on his request, with receptacles to be used for:

- a. Compostable waste which is to be recycled
- b. Non - compostable waste which is to be recycled; or
- c. Waste which is not to be recycled”

Subject to subsection (4), the Authority may, in relation to a request for receptacles:

- a. Where possible, provide them free of charge; or
- b. Provide them at such cost, and on such terms as to payment, as may be agreed with the occupier.

Part VII Section 45 - Every person who -

- a. Disposes of solid waste in any area or in any manner not approved by the authority;
- b. Operate a solid waste disposal facility, provide solid waste collection or transfer service or otherwise manages solid waste, without a valid licence or operating certificate under this Act or any regulation hereunder; commits an offence and shall be liable on summary conviction before a Resident Magistrate to a fine not exceeding one million dollars or to imprisonment for a term not exceeding nine months or to both such fine and imprisonment."

6.2.6 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.

6.2.7 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 include the following responsibilities:

- To promote the preservation monuments and anything designated as protected national heritage for the benefit of the land;
- To carry out such development, as it considers necessary for the preservation of any national monuments 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:

- Wilfully deface, damage or destroy any national monuments 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 monuments 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 Jamaica.

6.2.8 Town and Country Planning Act (1958)

The Town and Country Development (St. Ann Parish) Provisional Development Order, 1998 falls under this Act and guide physical development in the Parish.

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.

6.2.9 Land Development and Utilization Act (1966)

Under Section 3 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".

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