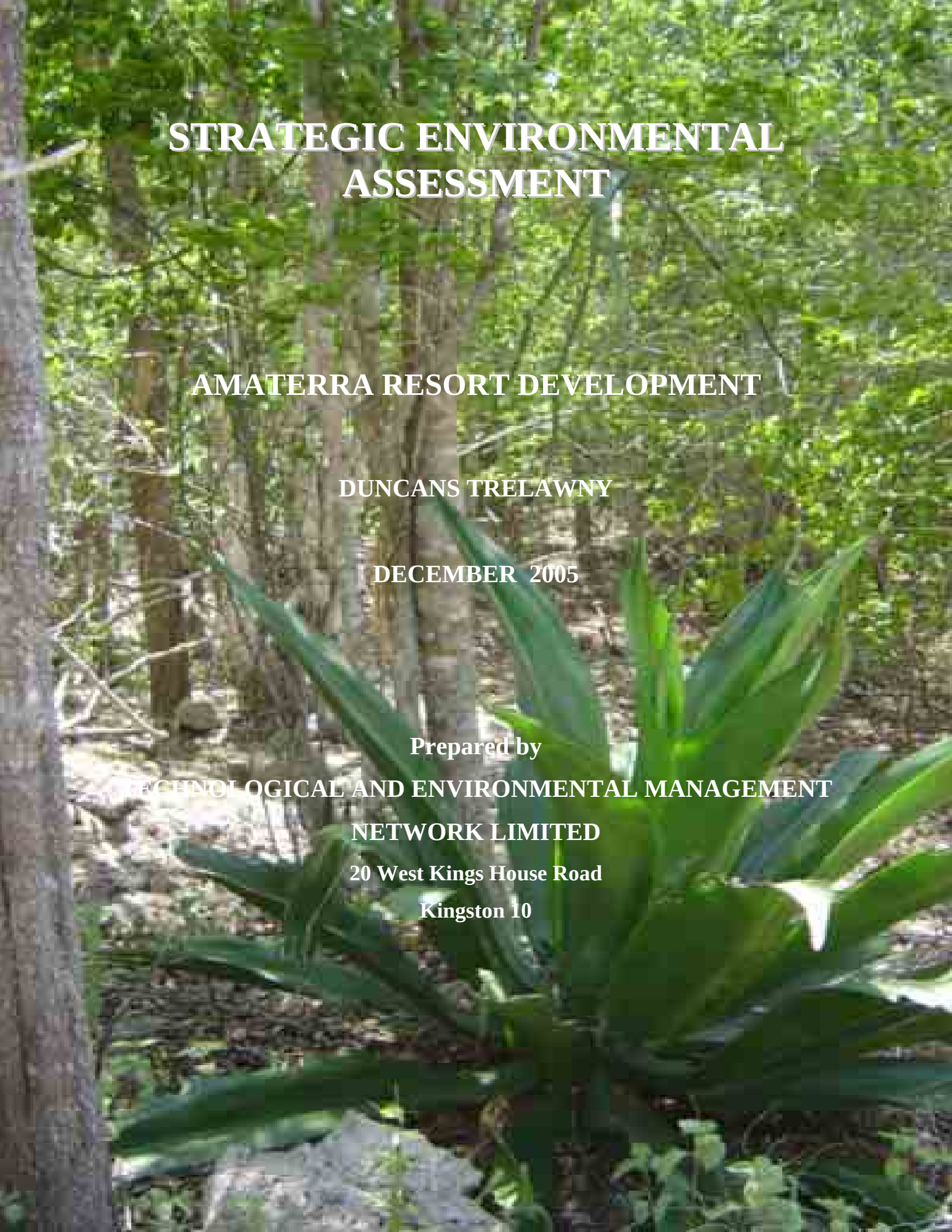

STRATEGIC ENVIRONMENTAL ASSESSMENT

AMATERRA RESORT DEVELOPMENT

DUNCANS TRELAWNY

DECEMBER 2005

Prepared by

TECHNOLOGICAL AND ENVIRONMENTAL MANAGEMENT NETWORK LIMITED

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EXECUTIVE SUMMARY

The Strategic Environmental Impact Assessment (SEA) was carried out by the Technological and Environmental Management Network (TEMN) team and employed skills in biological and environmental sciences, environmental chemistry, hydrogeology, socioeconomics and project management. A comprehensive evaluation of the study area was done. This final report details the activities executed pursuant to fulfilling the approved Terms of Reference, analyses the data and makes conclusions and recommendations. This document provides an Impact Statement, Impact Matrix, mitigation strategies to address negative impacts and a programme for monitoring the development. This Strategic Environmental Impact Assessment is a requirement of the National Environment and Planning Agency (NEPA) in exercising their powers under the NRCA Act 1991.

1.0 The Development

Amaterra Jamaica Limited proposes to develop 850 acres (344.25 hectares) of beachfront land in the Duncans area of Trelawny as a resort community, likely to be called named "Ocean Pointe". The property is located on the Duncans-Coral Springs main road south and west of the Silver Sands property.

Plans call for the development of villas, condominiums, and hotels; and when completed would total approximately 2,000 hotel rooms (Five hotels planned), 2,200 villa lots, and an eighteen-hole golf course. There will also be a "Town Centre Village" with provisions for a business park with commercial units and public amenities including a fire station, police station, health and other services. The resort community will also include a water park, an equestrian centre a conference centre and amphitheatre.

A series of lined ponds and lakes will collect all the effluent from the sewage plants, as well as the storm water from the drainage system. These lakes and ponds will be incorporated in the golf course design and will provide a source of water for the fairways and greens thus reducing fertiliser requirement for the golf course. The fairways and greens will also be lined with geotextile materials to prevent intrusion of the irrigation waters and return flow as well as occlusion of leachate to the aquifers. All the storm water runoff from the development will be collected in the drainage system for reuse.

It is proposed that the development be carried out on a phased basis with the completion of most of the infrastructure scheduled to be ready by the end of 2008. The infrastructural construction will begin in 2006 and should be complete within thirty months. This construction will involve the provision of roads, adequate drainage, sewage treatment facilities, and a golf course. Construction of the first building is scheduled to begin in late 2006 with "Oceanfront Golf Villas" and the "Highway Commercial Centre" (See map E in appendix 6.). This is to be followed in 2007 by a beach hotel, the Conference Centre, and several villas "manors" and commercial buildings. Construction of the resort is scheduled to continue until 2013.

The Coastline

The coastline is divided in two by a section of high cliff shown in Figure 1. The developers propose to create usable recreational areas to serve the needs of the overall proposed development, and at the same time minimize adverse impacts to the marine environment. As a result the main type of proposed development of the coastline will take the form of coves excavated from the bedrock.

Proposed shoreline modifications (starting from the eastern boundary) are as follows (See Map C in Appendix 6):

i) Four coves – 30m diameter & 1.5m depth
ii) Two 10m wide channels perpendicular to shore
iii) Two excavated bays utilizing existing indentations ion the shoreline; depth 0.75m
iv) A sea pool – 30m x 15m
v) One pier – dimensions & purpose unknown
vi) One groyne 75m long x 3m wide
vii) Submerged nearshore area 150m x 50m excavated to 1m depth
viii) One groyne 100m long x 3m wide

Sewage Treatment

Three secondary Sewage treatment plants are proposed, the first of which would be built at the "Village" or Town Centre near to the North Coast Highway. The next would be at the maintenance compound "M2" (See map E in Appendix 6) and will serve Duncans Bay and the hotels and villas to the northeast. Both these plants discharge into lined lagoons which will serve as water sources for the golf course. The third plant will be to the west of the property near to the hotel site "H1". The quality of the sewage effluent would be checked daily for compliance with NRCA/NEPA Standards, and to provide a basis for adjusting the use of fertilisers according to the level of nutrients in the "grey water" discharged to the ponds and lakes.

The Sewage treatment plants proposed are "package plants" utilising activated sludge and fixed film processes. (See Appendix 7). It is expected that all the NRCA standards for Sewage effluent will be met by these plants and no effluent will be discharged to the sea. The plans for these plants have been submitted to the Environmental Health Division of the Ministry of Health for their approval.

2.0 Environmental Impacts

Environmental Chemistry Impacts

a) Present Impact

From baseline data collected it as well as field observations, coastal water quality as well as air quality in the vicinity of the proposed project site are good.

The **criteria air pollutants measured (PM_{10}, NO_2, and SO_2)** were within the NRCA ambient standards at the time of sampling. These results were in keeping with the absence of any industrial or development activity close to most of the monitoring sites.

The Nitrate level in **ground water** 0f 3.6mg/l was well below the drinking water standard of 10mg/l. Phosphate level was similar to that determined in coastal water. These levels in addition to the absence of faecal coliform indicated that ground water was not contaminated by sewage. The high conductivity however indicated significant sea water intrusion. Use of this water for irrigation could lead to accumulation of salt in soils and sensitive plants would have difficulty obtaining stands. It should be noted that sampling was carried out during a relatively dry spell when the ground water level was low. This could change significantly during a wet period.

The presence of faecal coliform at Jacob Taylor Beach suggests that there is the possibility of a local source of sewage contamination although the levels are not yet significant. The levels of nutrients (nitrate and phosphate) determined at the coastal sites though within the interim standards are close to the upper limit suggesting that any increase in these levels may lead to conditions which do not favour coral reef growth.

From the short term monitoring carried out, impact from **noise** at the residential/ rural sites monitored was minimal and was associated mainly with the intermittent movement of vehicles. Background values (no human activity) were typical of literature values for quiet surroundings falling well below the lowest level in the US Dept of Labour regulations for permissible noise exposures.

Levels encountered at sites close to the highway impacted much more frequently by traffic and by highway construction activities nevertheless had maximum noise levels around 10% lower than the lowest level in the US Dept of Labour regulations for permissible noise exposures.

b) Projected Impact

The proposed development will involve activities that could lead to changes in coastal water quality, air quality, as well as noise levels.

Changes to local **air quality** issues could be associated mainly with the movement of heavy duty equipment in the area and earth moving activities. As with all land conversion operations there

could be significant generation of fugitive dust/particulate matter. The generation of noxious gases from traffic is expected to be minimal especially given the location.

Changes to coastal **water quality** could be associated with changes in the run off characteristics of the area and the use of fertilisers to maintain landscaped areas. Changes could also be due to the possible discharge of treated/untreated sewage. Increased fresh water run off as well as increased nutrient input could lead to disturbing of the ecological balance and deterioration in conditions necessary for coral reef growth. This could lead to the proliferation of nuisance species of marine organisms at the expense of coral growth.

The **noise** readings obtained for Stewart Castle near the North Coast Highway and Duncans Hills are typical of the impact from regular flow of traffic (heavy and light-duty vehicles). These values should give a good indication of the type of sound levels that can be expected during the construction phase of the project. Given the nature of the proposed development, impact during the operational phase is not expected to be significant at a distance of 30m from construction activity. Based on spot measurements conducted, it is unlikely that average noise levels would be greater than around 60db with peak levels of not more than 80db at a distance of around 30m.

Ecological Impacts

The most significant impacts to the area as a result of this development are considered to be:

1) Siting of permanent buildings, temporary construction camps and materials storage areas that would reduce existing habitat for resident, migratory and endemic bird species as well as endemic species of plants and insects which presently serve as food for the birds.
2) Transportation of building materials through the area resulting in dust, fuel emissions and noise which can impact the natural flora & fauna esp. nesting birds. Increased noise levels and movement of people may also affect the willingness of particular species to feed or rear young in the area.
3) Paving and surfacing of roads and community areas; the laying of pipes for water and sewage would necessitate vegetation clearance on a large scale and cause direct as well as indirect loss of vegetation. Loss of vegetative cover will change drainage patterns and increase the base levels of water runoff from the site. This could also reduce the stability of steep slopes and expose thin soil layers / patches to erosion with consequent loss of topsoil as well as the facilitation of unwanted flora and fauna.
4) Solid waste generated during construction could become a health hazard by the facilitation of undesirable species. Storage onsite prior to final disposal is a factor to be considered since abnormal weather conditions might distribute these products to other unsuitable areas. During the post construction/occupancy period, solid waste will also be of concern for similar reasons.
5) There is the potential for improperly maintained drainage systems to create areas of localised flooding and thereby periodically generate nuisance species of animals e.g. mosquitoes.

Ecological investigations of terrestrial flora and fauna indicate that other than the Jamaican Yellow Snake, no plant or animal species of unique or protected status are to be found on this property which might be significantly impacted by the proposed development. Of those species which likely to suffer negative impact, mitigative measures have been proposed to compensate which could actually enhance both the environment for avifaunal species and its subsequent use by stakeholders in the area.

The nearshore marine environment supports several small scattered seagrass beds, accompanying populations of urchins (*Tripneustes* and *Diadema* spp.) and small patches of coral (heads). The long term impact on these marine flora or fauna by the placement of groynes, excavated bays or pier structures is likely to be low. However, due to the already impacted and depressed state of the fish and coral populations in the area it is recommended that significant efforts be made to maintain and even facilitate the spread of existing local populations of flora and fauna.

Coastal Dynamics Impacts

In some areas (marked: on map C in Appendix 6) some excavation of the nearshore bedrock is proposed in order to re-establish a suitable beach-profile. The technique employed for excavation will rely mainly on the use of a hydraulic rock-hammer attached to a standard excavator. In some cases a pipeline-trench digging machine will be utilized to accurately control the configuration of the coves.

In two of the cases however, because the existing wave-refraction patterns and beach profiles already lend themselves to enhancement, shore connected groynes will be utilized to anchor and stabilize the coastline. These will be situated nearer the western end of the property and are shown on the map in Appendix 6. In this area waves approach the coast at an acute angle and sand transport is predominantly to the west. The groyne at the western boundary will therefore accrete sand on its eastern side, while the rocky nature of the coast further west will prevent erosion.

The groyne by the beach park will act as a shore-connected breakwater and accrete sand on its western side by wave refraction. No erosion to the adjacent areas will result from the installation of this structure.

In some areas (marked:) some excavation of the nearshore bedrock is required in order to re-establish a suitable beach-profile.

Socioeconomic Impacts

Positive Impacts

The people of Trelawny on the whole welcome the development as they see it as the answer to their dream for the development of the area. From a commercial standpoint, there was general consensus among the stakeholders that the development would have a number of positive impacts on the immediate communities (2-5 kilometers) and even on the town of Falmouth approximately 13 kilometers away. In fact there is great anticipation among stakeholder that this development will be consistent and supportive of the Greater Falmouth Development Plan, which was prepared in 1998. In commenting on the proposed development, the president of the Trelawny Chamber of Commerce and Industry- Mr. Dennis Seivwright, wrote " I think this will be a welcoming development and will impact positively on the economy of the parish and to Duncans in particular".

Some of the positive impacts envisioned include:

a. **Employment:**
   Infrastructure Stage. It is estimated that based on the planned cost of infrastructure of some US$50,000,000. The estimated labour cost is approximately US$2,000,000 per year spread over the next five years. With an average per job expenditure of approximately US$8,000 per year, about 250 new jobs will be created per year in the infrastructural development stage of the project.
   The building works stage will see a total expenditure of US$800,000,000 over a twelve year period. This works out to an average US$65,000,000 per year. Based on this expenditure, it is estimated that some 2,500 jobs/year will be created in this phase of the project . This will bring the total number of jobs over the 12 year period of construction to some 30,000.
   The Operational stage: A total number of 2000 hotel/resort rooms are being planned for the project as well as 2200 villa lots. Current projection is that there will be at least one new job created per room. Assuming one bedroom per villa This will give a total of at least 4,200 jobs per year as at full development of the project .
b. When connected to Harmony Cove and Oyster Bay/Glistening Waters, the development will enhance visitor arrival in the area and will add significantly to the attraction of the whole Silver Sands/Falmouth/ Duncan's area.
c. Significant enhancement of Job creation and employment opportunities as well as increased demand and market for the products produced by the pool of self-employed persons including fishermen in the project area.
d. The project area now suffers from an acute shortage of water linked to problems with their domestic water supply, which comes from the Charles Town system through the NWC. The project will impact positively on the water situation in the area, as the Amaterra developers will co-finance a major water supply scheme to the tune of US$ 7.83. Million of a total cost of US$25.0 Million with the NWC.

The project will receive one million gallons of water per day from this water scheme under the co-financing arrangement with arrangement with the NWC.

e. The developments planned for the Parish of Trelawny, including the Amaterra development, should give support to the development of the eco-tourism potential of the nearby attractions such as the Phosphorescent Lagoon at Glistening Waters, The crocodile farm in the swamp, and rafting on the Martha Brae River. These attractions now provide employment and income for many residents of the area. For example in 1998, the Rafting on the Martha Brae attraction employed at least 80 raft captains. Additionally, a number of craft vendors sell their craft at the raft stand and along the rafting route.

f. The Project also plans to manage the Stewart Castle historic/heritage site as a tourism attraction through a long-term lease of the site from the National Heritage Trust.

g. There is general consensus among the various stakeholders, including the Trelawny Chamber of Commerce, that the development will bring significant improvements to the physical infrastructure and amenities as well as the commercial activities in the Study area. This view is supported by the following aspects of the Amaterra development as planned:

- The creation of a new town centre including, business park, convenience stores, warehousing, gas station and plaza. This will provide a commercial hub that will mitigate much of the negative impacts associated with the new north coast highway given that this highway by-passes the existing urban centres of Rio Bueno, Duncans and Falmouth.
- Reservation of lands for the construction of a community centre, church and school in the study area as well as Administrative and municipal buildings including police and fire stations.
- Greater opportunity for fishermen in particular who were happy as they saw more potential for selling fish and lobster although they can barely cope with the present demand .
- Improved transportation and access to the area and the hotels is envisioned.
- Providing greater stimulus for the ongoing development of the Falmouth area.

Negative Impacts

The major negative impacts envisioned from the development as perceived by the stakeholders are as discussed below.

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a) The development will bring further pressure on the already strained infrastructure and amenities of the study area.

b) There is a concern about some 22 households that are currently located on the property. The group of squatters was taken to court and has been served with Court Orders to vacate the property. The developers have so far evicted three of

those who were served court orders, in order to proceed with some development/maintenance activities on the property.

c) Restricted access to the beaches by the Fishermen when going to sea will negatively affect their fishing business.
d) The fishermen envision destruction of fish breeding grounds and turtle nesting areas.
e) Pollution of the environment through dynamite blasting.
f) The fishermen felt that the development will prohibit them from rearing their animals and for conducting other agricultural activities thus impacting negatively on their livelihood.
g) Increase in crime and violence in the area, as it would have many persons outside the area coming in to do business there.
h) Generally the fishermen felt powerless to stop any development that would adversely affect their livelihood.

Hydrogeology

The entire study area has a drainage area of approximately 18.0 square kilometres (4,448 acres) and constitutes three distinct sub-basins of areas 7.7, 9.5 and 0,8 square kilometres (1903, 2422 and 185 acres). Field reconnaissance confirmed no perennial stream in the area; however each sub-basin is characterized by well defined drainage networks for discharging flood flows. The impermeable nature of the geologic strata of the area would make it vulnerable to floods of the higher return period rainfall.

The flooding impacts associated with the development are as follows;

i) The ***Basin1*** area that is designated for project development will experience significant increase in peak flows and runoff volumes and may pose a flooding threat to the existing community at Silversands.
ii) Flooding of the north of the ***Basin1*** area will be aggravated if the depression east of Carey Park that serves as a natural detention pond for controlling the extent of flooding is encroached by the proposed project development area.
iii) For ***Basin2*** and ***Basin3,*** the proposed project development will also give rise to significant increase in peak flows and runoff volumes. These however should not have any negative flood impact on the environs but may create problems for the development area itself.

3.0 Assessment Of Alternatives

Three alternatives are considered for utilisation of the project area, namely, without project, with project and other development options.

The discussion of alternative options for the development of this property is based on the Economic and Social Survey of Jamaica (ESSJ), 2004 which identifies the major productive sectors in the Jamaican economy as:

- Agriculture
- Mining and Quarrying
- Manufacturing
- Construction and Installation and
- Miscellaneous Services under which the tourism sub-sector falls.

The "Construction and Installation" and "Miscellaneous Services" sectors are both involved in the "With Project" Alternative, hence alternatives 3, 4 and 5 are based on the alternatives of Agriculture, Mining and Quarrying and Manufacturing.

Alternative 1: Without Project Scenario

The without project scenario from a socioeconomic perspective would mean that the use of the site continues in a marginal manner with substantial underutilisation of resources. This alternative was the least favourable.

Alternative 2: With Project Scenario

The with project scenario contributes toward a national goal to expand the opportunities for Tourism Development, add to housing stock, provide for a diversified recreational product with heritage components, and a foreign exchange earner. According to the parish of Trelawney Development Order, 1980 the parish has potential for resort development and New Falmouth, Silver Sands and Rio Bueno were proposed locations for expansion. The Amaterra development site lies between New Falmouth and Rio Bueno and is one of the boundaries of Silver Sands. The property therefore falls well within the areas proposed for resort development by the Development Order. The Development Order also identified and documented a large number of historic sites, historic buildings and national monuments in the general area including the site for the Amaterra development project.

Located about midway between the two major tourist/resort centres (Montego Bay and Ocho Rios) on the north coast, the Amaterra property can be said to lie in the heart of the tourism belt. The developers' proposals for the property features an integrated development with a strong tourism component, comprising some 2,000 hotel rooms, 2,200 villa lots, an 18 hole golf course, bathing beaches, commercial and housing developments as well as a number of attractions. This development would also be compatible with the existing and future planned land uses. The developers have already started the Duncans Hill housing scheme which to date has provided 550 lots out of a proposed 900 planned for primary and middle income housing. Significant forward and backward linkages associated with the local sourcing of construction material and employment opportunities during construction would be created. Other advantages include the maintenance of open space areas via the golf course and woodlands.

Alternative 3 : Agriculture

The size of the Amaterra Development property (some 870 acres) would suggest agriculture as a logical option for the development of this property. However, the land capability, the soils and the climate of the area are not suited to the development of viable agricultural enterprises. The area suffers from low rainfall while its physical characteristics in terms of soil types and land

capability classifications are serious constraints to agricultural production. Agriculture is therefore not considered to be a viable development option for this property.

Alternative 4: Mining and Quarrying

The land-use information shows that the site consists mainly of limestone shrub forest with limited opportunity for mining and quarrying. In addition, the areas zoned for Bauxite and Conservation (BC) under the parish of Trelawny Development Order, 1980, fall well outside the site for development under the Amaterra Development Project. For these main reasons, Mining and Quarrying are not options that can be considered for this site.

Alternative 5: Manufacturing

Manufacturing is not a strong competitor for the Amaterra Development site for the following main reasons:

- Small and medium scale manufacturing which is typical of the Jamaican economy is an intensive activity requiring much less land than that which is being proposed for the Amaterra Development.
- The area is not readily accessible to cheap sources of raw material and labour which are the main prerequisites for viable and competitive manufacturing businesses.

From the foregoing discussion, it can be seen that alternatives to the proposed Amaterra Development are constrained not only by the Trelawny Development Order but by the geographic location, the climate (especially rainfall), land capability and soil type.

4.0 Recommended Mitigation

Water Quality

A mitigation plan to minimise impact of the development on air and water quality should focus on minimising the impact of fugitive dust on the surrounding communities as well as taking steps to minimise impact on coastal water quality. This could include but not necessarily be restricted to the following:

- Regular sprinkling of haul roads and other sources of probable fugitive dust near to communities/receptor sites.
- Covering of basement material of marl, gravel etc to limit dust generation.
- Create a sod farm to provide material for the fairways and greens. The suggested sequence of activities for course development should be land clearance, basement preparation, and sod placement. All these steps should be carried out at a specific location before commencement of work at another site. This would limit the areas of the course construction exposed to the effect of wind, which could generate dust.
- Monitoring of coastal water quality during and after construction to track any changes in levels of nutrients, TSS and bacteria.
- Monitoring of ground water quality over the long term to determine suitability for use as irrigation water without leading to build up of salt in soil.

- The allocation of adequate land area to allow containment of surface run off to allow recycling especially for irrigation. Containment areas should be adequately lined to prevent seepage into the aquifer.
- Monitoring of the development to ensure compliance and the early identification of negative trends

Ecology

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1. Increase the size of green / natural forest areas with appropriate siting so as to be as close as possible to existing areas favoured by current avifauna.
2. Temporary storage of solid waste on-site in a manner that will resist pollution of adjacent areas until it can be transported to an approved dump site.
4. A specific search and capture operation for snakes should be carried out in areas designated for clearing of vegetation either for golf course, building, construction or access purposes to allow for translocation of these specimens to other /remaining green areas.
5. The footprint areas for the proposed shoreline structures (inclusive of a 5m buffer zone) should be carefully examined immediately before the commencement of construction for the purpose of identifying the presence of any corals, urchins or growing margins of seagrass beds and relocating them to suitable sites nearby.

Socio-economics

The main mitigation measures as they relate to the socioeconomic assessment are as discussed below:

a) An important mitigation measure arising from the socio-economic assessment relates to the residents now squatting on the property. Notwithstanding the fact that the squatters have been ordered by the courts to vacate the property, the developers have identified the nearby Steelfield Housing Development Project as a possible option for the squatters and have initiated discussions on the matter with the sitting member of parliament for the area as well as with the project authorities- the National Housing Corporation (NHDC). The Steelfield Housing Development Project is one of the Government's low income housing projects being implemented by the National Housing Development Corporation (NHDC). Lots are currently being offered for sale. This initiative could provide the squatters an option for relocation and hence reduce tensions, animosities, dislocation and trauma that could arise from the forced but legal eviction.

b) The involvement of community leaders in the detail planning and implementation of the planned facilities could serve to mitigate the feared isolation, exclusion and possibly alienation of the local residents by the upscale development aspects of the project. Additionally, the existing shopkeepers and other small business entities may be invited to become business owners in the new town centre being planned as part of the development.

c) Coordination of all the development projects to maximize the impacts on the area, rather than duplicating offerings etc.

d) A monitoring plan would need to be devised to be implemented at the construction and operational phases of the project, to ensure adherence to recommendations made to mitigate negative impact factors.

e) With respect to the negative impact of the development on the physical infrastructure and amenities of the study area, various steps are either planned or in progress to reduce these impacts. These include:

i) A major water supply scheme (Martha Brae/Duncans Water Supply) is being undertaken by the NWC at a cost of US$25 million. The Developers will co-finance this to the tune of US$7.83 million. This will not only mitigate the impact of the development on the existing water supply system, but will bring substantial improvements to the existing system, which as discussed above is currently under severe stress.

ii) The North Coast Highway, which bisects the property, will significantly improve access and transportation to the area.

iii) The Falmouth hospital has recently been upgraded and is now 2007 compliant

iv) School places have recently been significantly increased with the addition of three new schools in the area.

v) The fire service and police Command centre in Falmouth have been significantly strengthened while plans are in place to upgrade the existing police station in Duncans. The Amaterra developers have set aside lands for the construction of these municipal facilities.

vi) It is planned that the possible construction component will conform to the Georgian architecture that characterizes the historic buildings in the Greater Falmouth area.

Hydrogeology

i) The ***Basin1*** drainage network that is to be designed should be dimensioned based on the simulated flows in table 19 for Johnson, Kettering and R260. At least the 50-year return period flows should be considered. The culvert at location 5 should be re-assessed to determine its adequacy to discharge flows of Kettering and from the depression for the 50- and 100-year event.

ii) Only open space development e.g. golf course or lawns should be allowed in the depression area of ***Basin1***.

iii) For ***Basin2*** the drainage network should be dimensioned based on the simulated flows in tables 20 for at least the 50-yr return period. The relevant one would be the flows through reach R30, generated from the southern section of the basin, and the flows from the Stewart1, WS Park and Clermont sub-basins.

iv) For ***Basin3,*** the entire area will be developed and hence all the peak flow and runoff volumes over the entire basin should be considered.

5.0 Environmental Monitoring

The monitoring programme will be designed to ensure that the requirements of the Permit granted by NEPA are met. Monitoring and mitigation of impacts during the implementation of the project will also require co-ordinated scheduling of activities between Amaterra Ltd. and the

consultants, as well as preparation of regular reports as required by NEPA. Water quality and ecological parameters that may be affected by construction and operation of the development will be monitored with the necessary fieldwork component to provide the data as needed. Field observations and measurements will be correlated simultaneously with weather prevailing conditions, so that any change in weather can be compensated for, and unwanted impacts can be avoided.

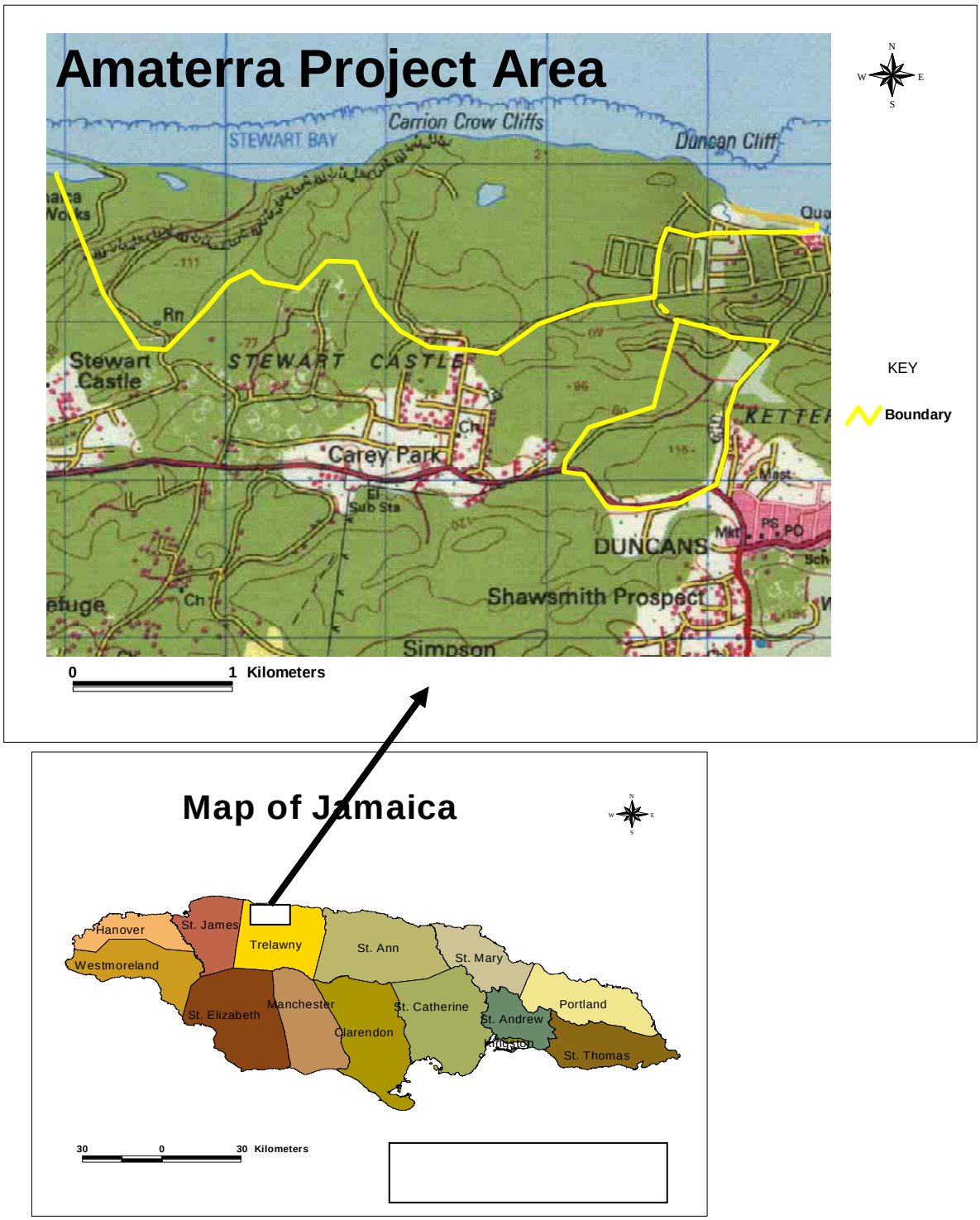
1.0 BACKGROUND.

Amaterra Jamaica Limited proposes to develop 850 acres (344.25 hectares) of beachfront land in the Duncans area of Trelawny as a resort community, likely to be called named “Ocean Pointe”. The property is located between the Duncans-Coral Springs main road south and west of the Silver Sands property. This Strategic Environmental Assessment (SEA) is a requirement of the National Environment and Planning Agency (NEPA) in exercising their powers under the NRCA Act 1991

The project area is located between GPS coordinates

18 deg 28.299 N & 077 deg 32.793 W ; 18 deg 28.757 N & 077 deg 32.110 W
18 deg 29.166 N & 077 deg 32.185 W ; 18 deg 29.342 N & 077 deg 32.328 W
18 deg 28.930 N & 077 deg 32.611 W ; 18 deg 28.769 N & 077 deg 33.193 W
18 deg 28.829 N & 077 deg 34.325 W

Figure 1: Location of Amaterra Project Area



1.1 Terms of Reference

The Terms of Reference as approved by NEPA as well as comments are located in Appendix 1.

1.2 Scope

The Environmental Impact Assessment was carried out by the Technological and Environmental Management Network (TEMN) team and employed skills in biological and environmental sciences, environmental chemistry, hydrogeology, socioeconomics and project management. A comprehensive evaluation of the study area was done. This final report details the activities executed pursuant to fulfilling the abovementioned Terms of Reference, analyses the data and makes conclusions and recommendations. This document provides an Impact Statement, Impact Matrix, mitigation strategies to address negative impacts and a programme for monitoring the development.

1.0 DESCRIPTION OF PROJECT

2.1 The Development

Plans call for the development of villas, condominiums, and hotels; and when completed would total approximately 2,000 hotel rooms (Five hotels planned), 2,200 villa lots, and an eighteen-hole golf course. There will also be a "Town Centre Village" with provisions for a business park with commercial units and public amenities including a fire station, police station, health and other services. The resort community will also include a water park, an equestrian centre a conference centre and amphitheatre. (See map E in Appendix 6)

A series of lined ponds and lakes will collect all the effluent from the sewage plants, as well as the storm water from the drainage system. These lakes and ponds will be incorporated in the golf course design and will provide a source of water for the fairways and greens thus reducing fertiliser requirement for the golf course. The fairways and greens will also be lined with geotextile materials to prevent intrusion of the irrigation waters and return flow as well as leachate to the aquifers. All the storm water runoff from the development will be collected in the drainage system for reuse.

The development is proposed to be carried out on a phased basis with the completion of most of the infrastructure scheduled to be ready by the end of 2008. The infrastructural construction will begin in 2006 and should be complete within thirty months. This construction will involve the provision of roads, adequate drainage, sewage treatment facilities, and a golf course. Construction of the first building is scheduled to begin in late 2006 with "Oceanfront Golf Villas" and the "Highway Commercial Centre" (See map E in Appendix 6.). This is to be followed in 2007 by a beach hotel at H4, the Conference Centre (A6) and several villas "manors" and commercial buildings. Construction of the resort is scheduled to continue until 2013.

2.2 The Coastline

The coastline of the property is characterized by protruding bedrock extending into the nearshore areas. This has been the main obstacle to development in the past, as any attempt to create a suitable profile for beach-use must effectively deal with this.

Offshore, a shallow shelf up to 1.5 m deep runs to a barrier reef some 300 m outside. This reef extends to the west where it deepens and then re-surfaces in the vicinity of the Stewart Castle property.

The entire stretch of coast is divided in two by a section of high cliff shown in Figure 1..
The developers propose to create usable recreational areas to serve the needs of the overall proposed development, and at the same time minimize adverse impacts to the marine environment. As a result the main type of proposed development of the coastline will take the form of coves excavated from the bedrock.
Proposed shoreline modifications (starting from the eastern boundary) are as follows (See Map C in Appendix 6):

ix) Four coves – 30m diameter & 1.5m depth

x) Two 10m wide channels perpendicular to shore

xi) Two excavated bays utilizing existing indentations ion the shoreline; depth 0.75m

xii) A sea pool – 30m x 15m

xiii) One pier – dimensions & purpose unknown

xiv) One groyne 75m long x 3m wide

xv) Submerged nearshore area 150m x 50m excavated to 1m depth

xvi) One groyne 100m long x 3m wide

2.3 Sewage Treatment

Three secondary Sewage treatment plants are proposed, the first of which would be built will be at the "Village" or Town Centre near to the North Coast Highway. The next would be at the area designated "M2" (See map E in Appendix 6) and will serve Duncans Bay and the hotels and villas to the north east. Both these plants discharge into lined lagoons which will serve as water sources for the golf course. The third plant will be to the west of the property near to "H1" , and the effluent from that plant will be pumped up to the golf course for irrigation. The quality of the sewage effluent would be checked daily for compliance with NRCA/NEPA Standards, and to provide a basis the adjusting use of fertilisers according to the level of nutrients in the "grey water" discharged to the ponds and lakes.

The Sewage treatment plants proposed are "package plants" utilising activated sludge and fixed film processes. (See Appendix 7). It is expected that all the NRCA standards for Sewage effluent will be met by these plants and no effluent will be discharged to the sea. The plans for these plants have been submitted to the Environmental Health Division of the Ministry of Health for their approval.

2.0 METHODOLOGY

All components of this SEA required that the following tasks be performed:

- Review of Literature
- Site Visits
- Data Collection and Sample Analyses
- Review of results, impact analysis, mitigation recommendations.

3.1 Environmental Chemistry

Fulfilment of the Scope of Work (SOW), for the environmental chemistry component specifically required physical/chemical studies to determine the baseline levels of the selected environmental indicators of Water and Air quality and Noise

A statement on ***water quality*** was required to identify and quantify actual and/or potential impacts. The terms of reference required a description of the physical/chemical aspect of water quality by establishing baseline concentrations of the following parameters:

- Coliform bacteria (total and faecal)
- Nutrients (nitrate and ortho-phosphate)
- Dissolved Oxygen
- Biological Oxygen Demand (BOD)
- Temperature
- Suspended solids/Turbidity
- Salinity

The location of the project in close proximity to the coastline introduces the possibility of impact on existing coastal resources (coral reefs sea grass beds etc) due to changes in water quality. The impact of pollution on marine/coastal resources has been extensively researched and documented and worldwide focus emphasises the protection of coral reefs by improving coastal water quality by controlling fresh water run off as well as nutrient and sediment loading. From a water quality perspective, coral reef survival and growth is optimised within a narrow range of salinity, nutrients (especially N & P), and turbidity/suspended solids.

Research in the Caribbean and in the Great Barrier Reef of Australia has established the critical levels of Nitrogen and Phosphorous which must not be exceeded if reefs are to remain healthy and not be smothered by filamentous algae (Lapointe et al., 1992, 1993, in press; Bell, 1992). These concentrations are 0.014 ppm N or 0.040 ppm NO_3 and 0.003 ppm P or 0.007 ppm PO_4. It has been noted that when salinities remained consistently low the carbonate skeletons tended to become dominated by encrusting invertebrates (e.g. oysters and serpulids) and blue-green algae (Teichert, 1958).

Some international and local standards/draft standards are presented in **Table 1.**

Table 1

Ambient Standards For Marine Waters

Parameter	Draft Standard
Nitrogen as NO_3	.001 -.081 mg/l
Phosphorous as o-PO_4	.001-.055 mg/l
BOD	.57-1.16 mg/l
Dissolved Oxygen	4.8 mg/l*
Suspended Solids	< 10mg/l**
Total Coliform	48-256 MPN/100 ml
Faecal Coliform	<200

(**Source: USEPA Water Quality Criteria September 1999*)

***Proposed Coral Reef Criteria Value –* (*Draft NRCA Coral Reef Policy*)

Goreau & Thacker (1994) reported measurements of 0.3 to 0.6 mg/l nitrate in Discovery Bay around 1980 and that by the late 1980s these had risen to between 0.6 and 0.9 mg/l per litre. This change, accompanied by significant ecological replacement of corals by weedy algae was nearly complete in 1992 (Goreau, 1992).

In examining the potential for salinity to negatively affect the potential of the groundwater for use for irrigation, **Electric conductivity (EC)** is one way of expressing salinity and is a measure of the amount of dissolved salts present in water. Some permissible limits of EC for classes of irrigation water are given in **Table 2**.

Table 2 Permissible limits of conductivity for classes of irrigation water. (from James et al., 1982)	
Classes of water	**Electrical conductivity µmhos***
Class 1, Excellent	250
Class 2, Good	250-750
Class 3, Permissible1	750-2000
Class 4, Doubtful2	2000-3000
Class 5, Unsuitable2	3000
1 Leaching needed if used	
2 Good drainage needed and sensitive plants will have difficulty obtaining stands	

3.1.1 Fieldwork:

Four sampling sites were established in the near shore marine environment for the collection of samples. Samples were generally collected at depths of approximately 45 cm, close to the shoreline to establish background levels of indicator parameters in the zone considered susceptible to the greatest impact from the proposed development. Location details of the sites sampled (See Map D in Appendix 6) are presented in **Table 3**.

Table 3

Location of Water Quality Sites

Station ID	Description	N 18^{o}	W 77^{o}
OP 1	Jacob Taylor Beach	29.157	31.895
OP 2	Near East Boundary – Emergent Coral Reefs	29.240	32.207
OP 3	Further West – Near Salt Lagoon	29.412	32.471
OP 4	Well Near Silver Sands	28.855	32.320

Sample Analysis:

- Samples were analysed by the National Water Commission Laboratory, in accordance with APHA, AWWA, Standard Methods for the Analysis of Water and Wastewater. Dissolved Oxygen and salinity were determined *in situ* using portable instrumentation.
- Nitrate was determined using the cadmium reduction method which is a chloride tolerant method.
- Phosphate was determined by the molybdenum colorimetric method.
- Suspended Solids was determined by filtration through 0.45u filter paper.
- Turbidity was measured by photometry,
- Dissolved Oxygen was measured using the YSI Model 51B Oxygen meter calibrated in ambient air.
- BOD was determined using the bottle method.
- Temperature was measured using the YSI Model 51B Oxygen meter which employs a thermistor. Accuracy of the thermistor probe was ascertained by comparison with a standard mercury thermometer.
- Coliform was determined by the membrane filter method.
- Conductivity was determined using the Model 30 YSI Conductivity meter.

3.1.2 Air Quality

The terms of reference specifies the monitoring of present levels of PM_{10}, NO_2, and SO_2 in order to establish **background air quality**. NRCA/NEPA has promulgated ambient air quality standards for these criteria pollutants (Table 4).

Table 4 National Ambient Air Quality Standards

Pollutant	Averaging time	Standard (Maximum concentration) μg/m^3
[a]PM_{10}	Annual 24 h	50 150
[b,c]Sulphur Dioxide	Annual 24 h 1 h	80 Primary; 60 secondary 365 Primary; 280 Secondary 700
Nitrogen Dioxide	Annual	100

a) PM_{10} refers to particles with an aerodynamic diameter of 10 micrometres or less as measured by the PM_{10} sampler.
b) Primary standards are to protect human health; secondary standards are protective of welfare e.g. property, crops etc.
c) The secondary standards for sulphur dioxide are designed to protect public health and welfare. They represent the long term goal for air quality and provide the basis for an anti-degradation policy for unpolluted areas of the country and for continuing development of pollution control technology.

Given the nature of the proposed development, air quality is not expected to be a problem during the operational phase and potential impacts during the construction phase is likely to be associated with dust generated by land clearing/earth moving and the movement of heavy duty equipment. Nevertheless short term short term monitoring included not only respirable particulates (PM_{10}) but also nitrogen dioxide (NO_2) and sulphur dioxide ($SO_{2.}$).

Short term monitoring was carried out to determine background concentrations of PM_{10}, NO_2 and SO_2, using the Airmetrics Minivol Portable Air Sampler. The Airmetrics system enables the monitoring of particulates simultaneously with the collection of an air sample for the determination of noxious gases. The unique tripod mounting assembly used by the Minivol sampler allows the possibility of easy installation at a height of 10' on utility poles to discourage tampering. The portable nature of the system also makes it ideal for making short term measurements, and for use in remote areas where access to power mains is difficult or not possible.

The Minivol sampler system measures **PM_{10}** by drawing air through a particle size separator and then through a quartz filter medium. Prior to filtration, desired particle size is achieved by

impaction. The Minivol sampler features an active flow control circuit for a constant sampling flow rate. Volumetric flow rate through the inlet is regulated to 5 lpm using a double head diaphragm pump.

For the monitoring of **noxious gases** (SO_2, and NO_2), the Minivol sampler electronics is fitted with a valve driver board to enable integrated gas sampling. Air is drawn into a Tedlar bag from which the contents are extracted to a drager tube containing a reactive medium that gives a colour change when exposed to the gas. Drager tubes are calibrated to allow direct reading of concentration based on the extent of colour change in the reactive medium. The principles of the reactions are given in the following equations:

NO_2:

NO_2 + diphenyl benzidene $\longrightarrow$ bluish-grey reaction product

SO_2:

$SO_2 + Na_2[HgCl_4] +$ Methyl Red $\longrightarrow Na_2[Hg(SO_3)_2] + 4HCl$

(yellow to orange colour change)

Field Work:

Samplers were installed around the periphery of the Project area at four locations within the zone of influence and programmed for an exposure period of 24hrs from June 29 – 30. Samplers were deployed at the project site near Silver Sands, Carey Park, Stewart Town, and Duncans Hill.

PM_{10}, NO_2, and SO_2 were monitored at all sites except Stewart Town where PM_{10} alone was monitored due to limitation of equipment. The coordinates of the monitoring sites are presented in **Table 5**. (See Map D in Appendix 6)

Table 5

Location of Air Quality Sites

Station ID	Description	N 18^{o}	W 77^{o}
OP 1AQ	Near Silver Sands - Roof of Residence	29.232	32.199
OP 2AQ	Carey Park - Roof of Residence	28.618	33.125
OP 3AQ	Stewart Town - Utility Pole	28.867	33.711
OP 4AQ	Duncans Hill - Utility Pole	28.228	32.772

3.1.3 Noise

3.1.3.1 Background

The impact of **Noise** is a function of sound level and the effect of that noise on people. Depending on the level and duration, noise can be a minor irritant, a definite disturbance, or a threat to ones hearing. In the absence of local standards reference is made to US federal regulations. Under US Department of Labour regulations, an exposure time of 8hrs. per day is stipulated for a sound level of 90db while allowable exposure for 100db is 2hrs. per day (See Table 6).

Table 6: Permissible Noise Exposures

(Extracted From U.S. Department of Labour Regulations)

Duration per day, hours	**Sound Level (dB), A-weighting**
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
.5	110
< .25	115

Typical noise levels and associated activities are presented in Table7

Table7 Sound Pressure Level Examples

Typical Sounds	SPL, dB
Chest wall vibrates, choking, giddiness	**150**
Jet taking off, 25 meters	**140**
Threshold of pain	
Artillery, 100 yards	**130**
Pneumatic chipper	
Riveter, nearby	**120**
Loud car horn, nearby	**110**
Inside N.Y. subway	**100**
Heavy truck	**90**
Inside motor bus	
Noisy traffic, corner	**80**
Noisy office	**70**
Business office	
Conversational speech	**60**
Private office	**50**
Background noise, city home	**40**
Background noise, suburb	
Library	**30**
Background, country night	
Whisper, leaves rustling	**20**
Good recording studio	
	10
Threshold of hearing	**0**

Original Chart: 1985 - R.A. Booty

3.1.3.2 Methodology

Sound pressure (noise) levels were monitored at five sites in the vicinity of the proposed development site to determined background conditions. Sites monitored included locations at Silver Sands (near the hotel and in the housing estate), Stewart Castle (in the community and along the border with the highway) and Duncans Hill (near to construction activity associated with the North-coast Highway). Coordinates for these sites are presented in Table 8 Measurements were made with the CEL Instruments Model 328 Integrating Octave Band Sound Level Meter mounted on a tripod Readings were recorded at random intervals and associated with activities occurring at the time. The exercise was conducted in order to distinguish between background noise levels and noise associate with the passage of vehicles and other human activities.

Table 8

Amaterra (Ocean Pointe)

Noise Monitoring Stations

KEY	**Location**	**N Coord**	**W Coord**	**Characteristics of Site**	**Monitoring Period**
1	Silver Sands Iintersection at bus stop	18 29 029	77 31 908	Main pick up point for those travelling out to duncans etc. Traffic includes taxis, prvt. Vehicles, light commercial and service vehicles connected with Jacob Taylor beach and Silver Sands hotel.	810 - 921
2	Housing Scheme near wells	18 28 959	77 32 262	Located near two home construction sites, one to the south and the other to the north east. Fairly large dwellings not close to each other. Substantial amount of undeveloped areas.	934 - 1039
3	In Stewart Castle on main road	18 28 559	77 34 395	On the mani road through Stewart Castle, sparsely populated area, few residents seen.	1004 - 1126
4	Stewart Castle Boundary with highway	18 28 083	77 33 862	Adjacent to highway just north west of JPSCo sub station	1225 - 1257
5	Duncans Hills	18 28 290	77 32 741	Main entrance to Duncans Hill housing scheme approximately 150' west of construction site for North Coast Highway	1310 - 1348

3.2 Ecology

1. The primary objectives of this section of the study were to provide an overview of the biological status of the marine and terrestrial areas in question and document any existing (or potential) biological impacts to the system which may occur as a result of the proposed activities at the site.

2. For the purposes of this study the delimitation of the immediate area of influence of the project was determined from maps supplied by the client showing the boundaries of the proposed development. Vegetation immediately adjacent the property boundaries was also examined in passing as well as from the aerial photographs.

3. Aerial photographs taken of the proposed development site and its surrounds were ground truthed by a series of traverses through the site. Floral and faunal species present and any physical and/or ecological characteristics of interest were noted.
This inspection and characterisation of the biological community facilitated determination of the presence, absence and/or extent of ecologically or commercially important species of flora/fauna at or immediately adjacent to the site.
Traverses through the property were made at various times of the day to reduce any possible bias on sightings due to the periodicity common to animal behaviour - especially the avifauna.

4. Identification of as much as possible of the existing species of flora and fauna was carried out on site. Photographs were taken and samples collected of the more obscure species for later identification in the Lab. Special note was made of ecologically or commercially important species of flora or fauna. Avifauna were sought by direct observation using Point Count and Transect Techniques. Physical descriptions and vocal peculiarities of any bird which could not be immediately identified were noted and later verified with field guides. This method is only capable of identifying the most common birds found in an area. Rare, migratory or cryptic species can be under represented by this technique.

5. Floral communities were recorded under the following headings:-
TREES; SHRUBS; HERBS; FERNS; GRASSES; WEEDS; EPIPHYTES; VINES; CACTI;.
The species observed were ranked using the DAFOR (dominant, abundant, frequent, occasional, rare) scale.

6. Faunal community composition was recorded under the following headings:

MACROFAUNA; INSECTS; AVIFAUNA;

Avifauna identified were ranked according to the following criteria:

R = resident 1 = common in suitable habitat

E = endemic 2 = uncommon

I = introduced 3 = rare

W = winter migrant 4 = vagrant/unexpected/accidental

S = summer migrant

Simple notes were taken with regards to habitat type, status and tree types. Tree species common to the habitat were noted, and any other species of interest were noted as well.

7. Swim line transects of the adjacent sublittoral area were carried out for a more detailed assessment of the composition and status of sublittoral areas. Substrate composition was obtained by random dot analysis of forty 0.16m^2 quadrats taken from 20m long transects at 9m depth using CPAC video methodology on randomly selected transect lines traversing the main reef buttresses immediately offshore the study site.

8. Random Dot Analysis data were recorded under the following headings:

Seagrass - 'r' (pioneer) species or 'k' (climax) communities, **Algae** – turf or macrophytic, **Coral** – branching, boulder or encrusting, **Macrofauna** – other cnidarians e.g. gorgonians, anemones or zoanthids. **Sponges** – fleshy, boring or encrusting, **Bare Substrate** – bare rock., rubble, sand or mud.

3.3 Socioeconomics

In conducting the socioeconomic assessment, the various target group/ stakeholders were first identified. These included:

a) Some nine communities within 2 kilometers from the boundaries of the property. A tenth community- a squatter community was also found on the property.
b) A number of groups and individuals both from the private and public sectors including statutory agencies. A list of these is attached as Appendix 8.
c) Development Projects being planned and or being implemented that are expected to impact on the Amaterra development directly or indirectly.

A combination of primary and secondary research was employed in conducting the assessment. The primary research consisted mainly of a socioeconomic survey of the nine communities falling within the two kilometers boundaries of the property as well as the squatter community found on the property. The survey design used a purposive sample of 40 households in the nine communities and a census of the 22 households found in the squatter community. Structured questionnaires were the main data collection instruments. The target communities were identified using a location map at a scale of 1: 50,000 prepared by Spatial Innovation Ltd. The secondary research drew heavily on the Jamaica population census conducted in 2001. The demographic and related data and information for the communities as a whole were collected at the level of Enumeration Districts (EDs).

Community specific data and information were collected through the structured questionnaires, which were administered by trained interviewers. Informal discussions with community members and community leaders also provided much of the required primary data and information. The surveys were conducted over the three-week period, September 6 to 24, 2004.

A series of discussions and consultations were held with the Stakeholder individuals and groups as a means of obtaining public perception of the development.

A land use survey was conducted for the property and for the areas within its two kilometers boundaries. Using the location map and a specially designed data collection instrument, the various land-uses were recorded based on the following categories:

	Land Use Code	**Definition**
a)	RES	Single Family (inclusive of single-family and multifamily)
b)	COM	Commercial
c)	OFF	Offices
d)	IND	Industrial (light and heavy)
e)	INST	Hospital, Clinics
f)	PA	Public Assembly (Churches etc)
g)	EDU	Schools
h)	O_S	Open Spaces (public and private)
i)	REC	Recreation (community Centre, playing field etc
j)	AGRI	Agriculture
k)	FOR	Forestry
l)	U	Utilities

3.4 Hydrogeology

This component of the SEA as stated in the Terms of Reference (Appendix 1), will address the hydrogeological issues including flooding and drainage issues.

The likely impact of this project on the water resources and drainage characteristics of the area are as follows:

1 The possible adverse change in the runoff characteristics of the area with implications for flooding of the development and the existing subdivision north of Kettering in the vicinity of Silver Sands.

2 An increase in water demand and its implication for possible pressures on the existing water supply and sewage disposal systems.

3 The possible adverse change in the ground water quality resulting from the generation and disposal of sewage.

4 Possible acceleration in erosion rate.

3.4.1 Scope of Work

The scope of work (Terms of Reference, Appendix 1) is as follows:

i) Procurement of baseline data and information including topographic maps, site plans, rainfall, streamflow and other hydrogeologic data.

ii) Drainage area determination

iii) Assessment of the geology, soils and Landuse for characterizing the drainage and flooding potential.

iv) Field reconnaissance for data and information gathering and for verification of the drainage definition.

v) Consistency checks and analysis of rainfall data for frequency determination over the area.

vi) Determination of the pre-development runoff from the drainage area for different return periods (10, 25, 50 and 100 years).

vii) Determination of the post development runoff for the above return periods.

viii) Recommendations for corrective and/or mitigative actions to negative impacts.

ix) Analysis and report preparation.

3.4.2 Baseline Data

Topographic map sheets at the 1:50,000 scale (sheet 3) and the 1:12,500 scale (sheet 51D) were procured and scanned. Landuse and soil maps of the area were also procured and scanned. Rainfall data for the 10-, 25-, 50- and 100-year return period for the Trelawny stations was obtained through literature reviews. Methodologies for deriving the temporal rainfall distribution were also reviewed from the available literature.

3.4.3 Drainage area delineation

A 20m resolution Digital Elevation Model (DEM) of the environs was obtained from Spatial Innovision Limited. The Hydrological Modelling System (HEC-GeoHMS) is an extension to ARCVIEW GIS and was used to define the surface drainage networks from the DEM, based on the flow directions and flow accumulations analysis. Three major drainage basins were determined to characterize the project area. These were superimposed on the 1:50,000 scale topographic map sheet as shown in figure 2

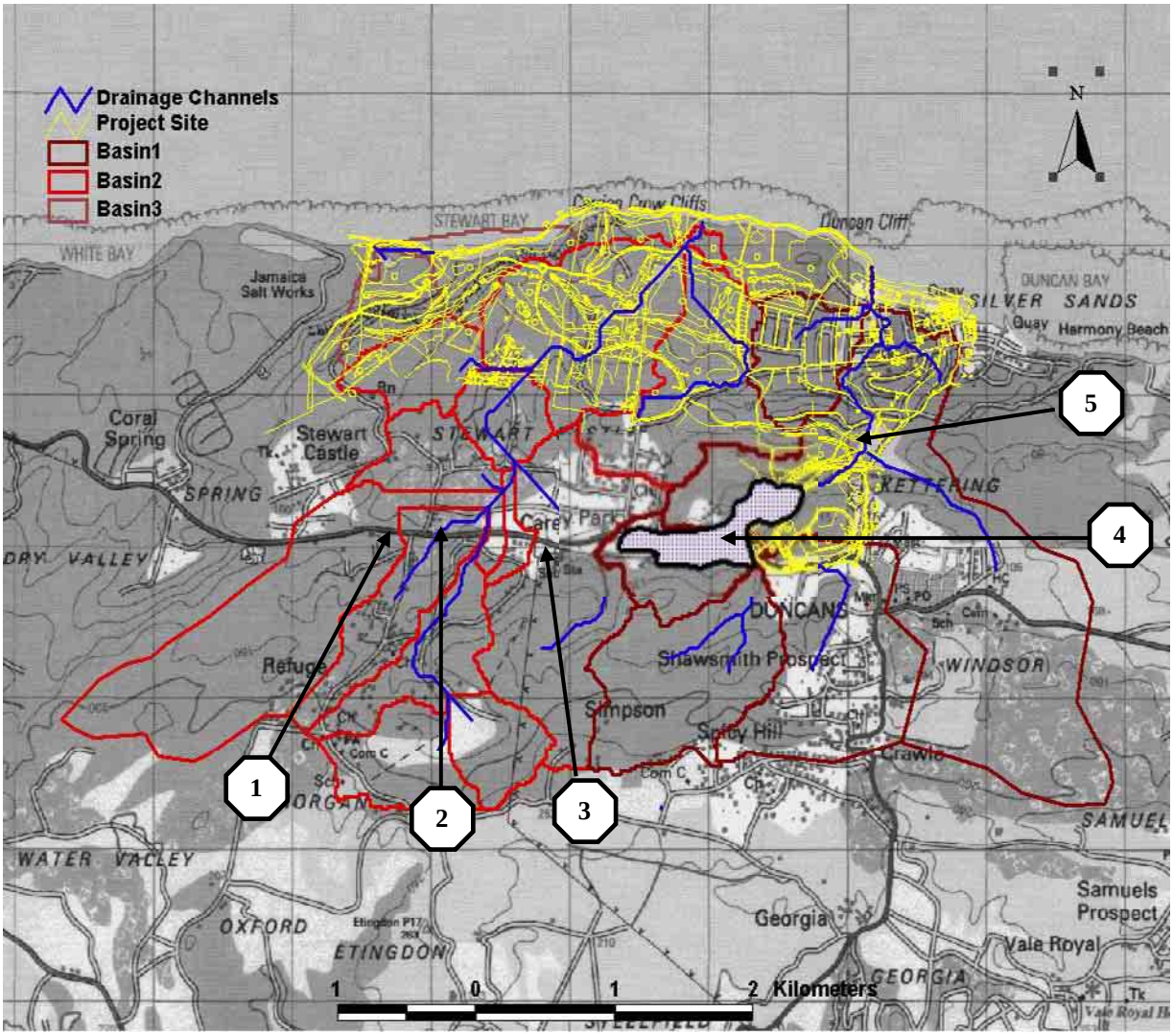


Figure 2. Amaterra Drainage Basins

3.4.4 Characterization of the Natural Drainage

The **Study Area** shown in figure 2 is demarcated as 3 distinct drainage areas (basins1, basin2 and basin3). Two field visits were made to verify the areas, and to identify the hydrologic structures characterizing the drainage of the area. There are no perennial streams in the area however there are well-defined natural gully courses for discharging seasonal flows associated with the rainy season.

3.4.4.1 Topography, Relief and Existing Drainage

Basin1 in figure2 is characterized by a fairly well defined natural drainage system with a main trunk of approximately 4.0 km. The drainage area is approximately 770 hectares (1,903 acres) of which, the Project Area occupies 16 % or 122 hectares. Elevation in this area ranges between sea level and 229 meters above mean sea level. The average overland slope was determined as 5 %. A natural depression is located east of Carey Park and is bisected by the Duncan's to Carey Park road segment. This is shown as location 4 in figure 2. Field reconnaissance done on the 19th June 2004 and photographic evidence as shown in figure 3, confirms that there is generally ponding of water in this depression after heavy rains. Discharge from the depression is directed under the main road and the new Highway 2000 road segment through a one meter diameter circular culvert shown in figure 4.

Figure 3 Depression south of road

Figure 4 Culvert at location 4

Figure 5 Culvert at Location 5

The culvert in figure 5 is located near the intersection of the Silver Sands main road and the North Coast Highway road segment (location 5 in fig 2). The culvert is elliptical with a height and width of approximately 6.0 meters and 6.5 meters respectively. Estimates of the flow rates expected through this culvert will be made to facilitate any review of its dimensions given the anticipated increase in flows envisage by the project and possible impact on the Silver Sands sub-division downstream.

Basin2 drainage occupies 950 hectares (2,348 acres) and ranges in elevation from sea level to about 255 meters above mean sea level. The proposed development in this basin is approximately 220 hectares and occupies 23 % of this area. The average slope of this area is 5 %. Runoff from the basin originates in the hills of Simpson, Glamorgan and Refuge and is drained via a gully network shown in figure 2. Flows through the gully network south of the Duncans main road is facilitated by a series of culverts shown in figures 6, 7 and 8. The locations of these culverts are shown in figure 2. The main channel is approximately 5.0 kilometres long and flows under the main road through several culverts to the northern reaches.

Figure 6 Culvert downstream of road at Location 1

Figure 7 Culvert downstream of road at Location 2

Figure 8 Culvert downstream of road at Location 3

Basin3 is located in the north west of the study area and has a drainage area of approximately 7.5 hectares (or 18.5 acres). It is completely occupied by the project area. The elevation in this area ranges from just over mean sea level to about 107 meters with an average slope of 6 %.

3.4.4.2 Geology

As shown in figure 9 the Montpelier Limestone (Mm) is the predominant geologic formation of the study area occupying more than 95% of Basin1 and Basin2 and 40% of Basin3. From the literature review this formation is a member of the White Limestone Group. The intrinsic properties of this rock give support to a very low primary permeability and hence high runoff potential. Faulting in this area has served to generate zones of increased permeability that may yield water to wells and springs. The groundwater flow direction is northward. The potential for

groundwater development is limited. The second rock type occurs in the north eastern and southern section of the area. It is a hard recrystallised, evenly bedded limestone with joints and fractures resulting in high permeability hence lower runoff potential.

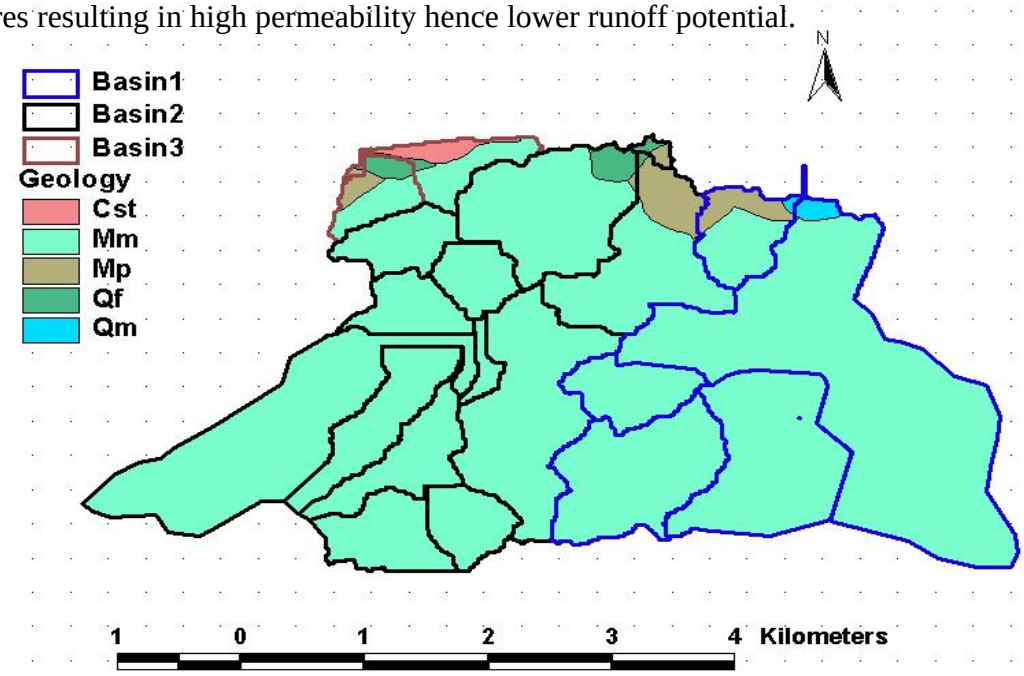


Figure 9 Geology Map of the Study Area

3.4.4.3 Soils

The soil group typical of the area, shown in figure 10 is classified as the Bonny Gate Stony loam soil by the Rural Physical Planning Division, Ministry of Agriculture. This is a thin brown or reddish soil with very rapid internal drainage. It is also classified as group B based on the SCS soil classification systemi, and is described in this system as a shallow loess, sandy loam.

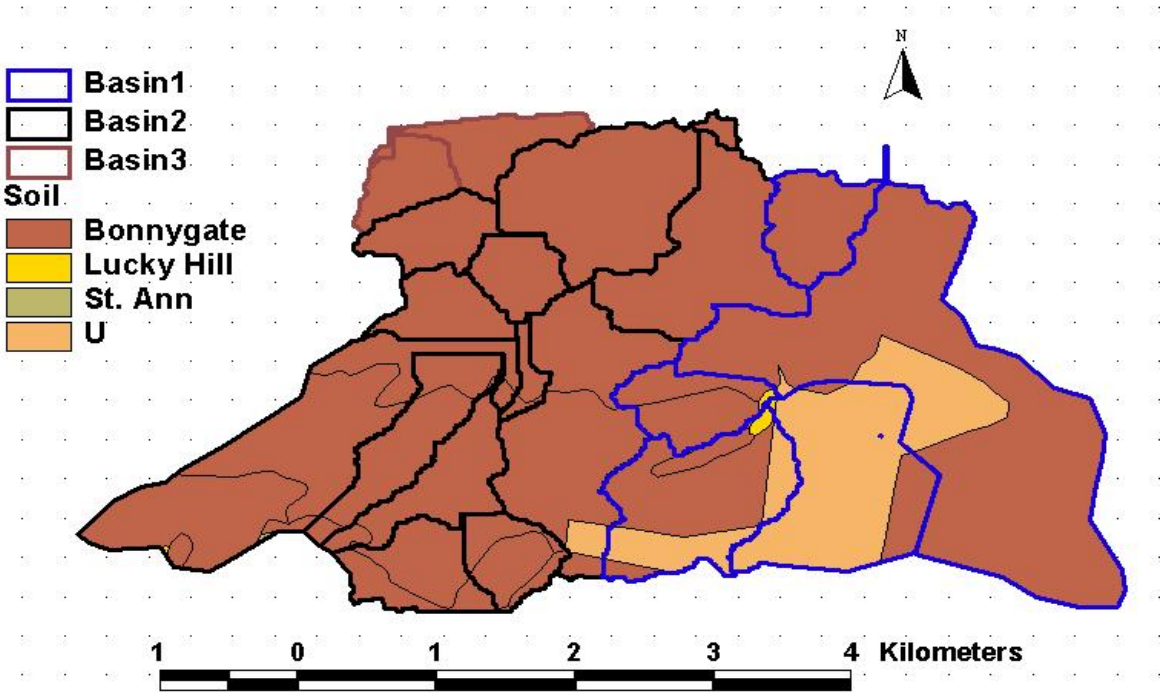


Figure 10 Soils in the Study Area

3.4.4.4 Landuse

As shown in figure 11, ***Basin1*** of the Study Area is primarily fields and built-up areas in the Silver Sands community near the coast and in the vicinity of Duncans. However there is also a fairly good cover of natural forest in the rest of the basin. This Landuse will promote a high runoff potential for the basin. ***Basin2*** is predominantly broadleaf trees and fields with thin forest in the coastal areas. ***Basin3*** is also mainly forested.

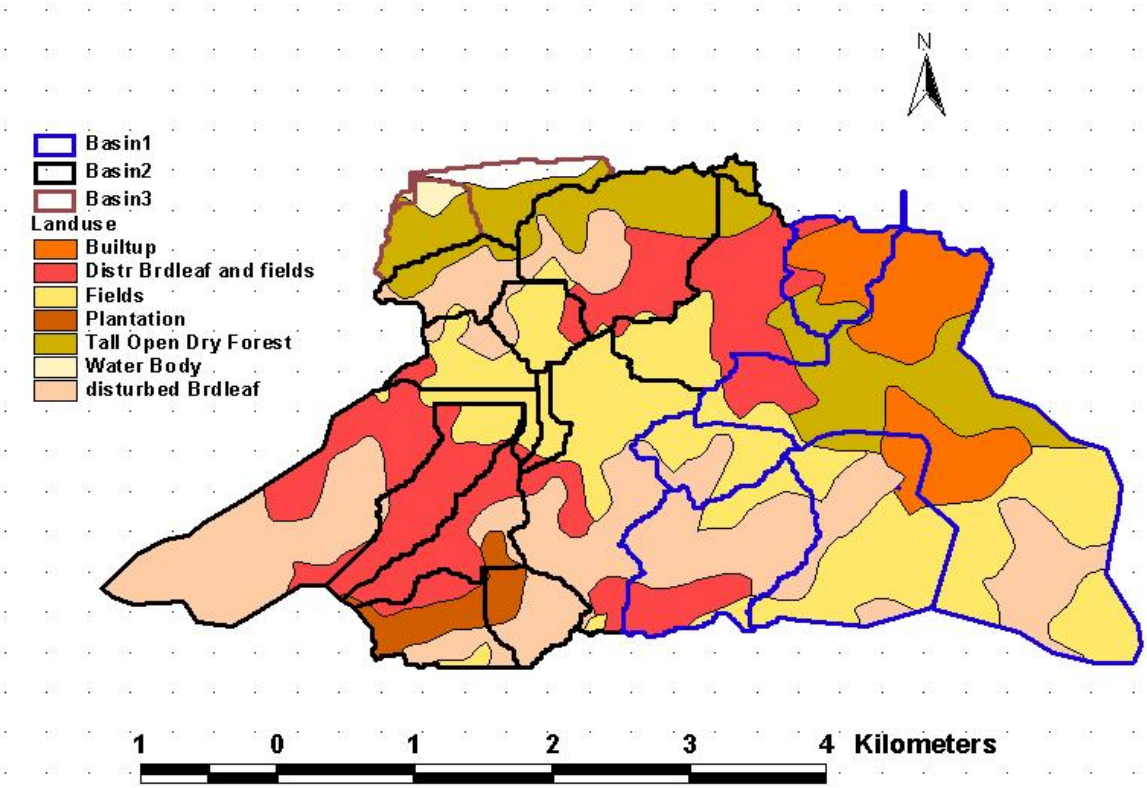


Figure 11 Landuse Map of the Study Area

3.4.5 Rainfall Characteristics of the Study Area

Rainfall characterizing the study area was determined from the data observed at the gauges located in figure 12.

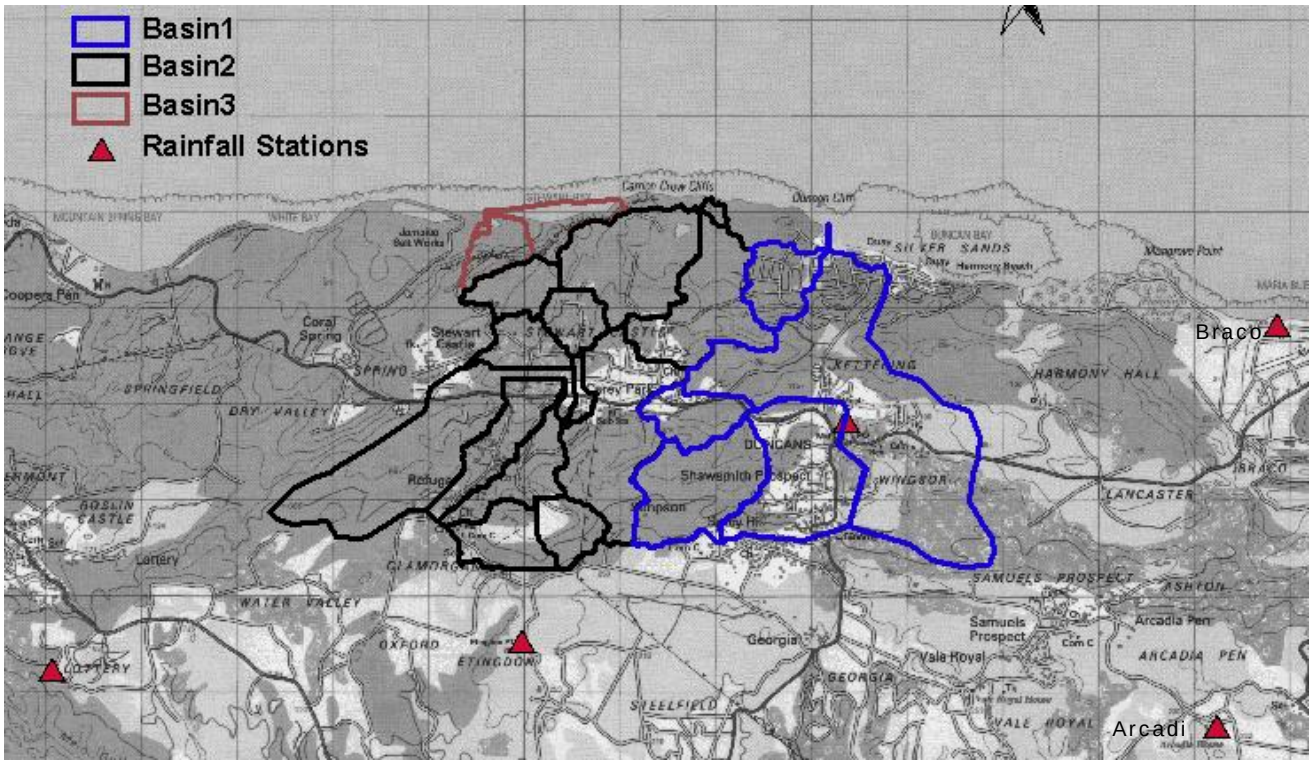


Figure 12 Location of Rainfall Stations of the Study Area

Table 9 Maximum 24-Hour Rainfall For Different Return Periods for the Study Area

LOCATION	PERIOD OF RECORD	Maximum 24-hour Rainfall (millimeters)				
		5-years	10-years	25-years	50-years	100-years
Lottery	1959-85	117	151	183	223	253
Evington	1959-85	95	138	166	202	228
Duncans	1950-86	64	104	130	164	189
Arcadia	1950-85	114	153	201	254	293
Braco	1950-87	101	146	186	237	274

Source: Meteorological Services Division

For the **Basin1** the rain gauge at Duncans located in the centre of the basin was selected as representative of the basin. The rainfall depths for the 5-, 10-, 25-, 50- and 100-year return period and for the time distribution specified in column 1 of table 10 were calculated as follows:

i) For the 1-hour duration in table 10, the depths were calculated by multiplying the 24-hour depths (table 10) by the average ratios in table 11.

ii) For the 5 minutes to 30 minutes duration, the depths were calculated by multiplying the 1-hour depths (from step 1) by the ratios in column 2 of table 10.

For the 2-hour to 12-hour duration in table 10, the depths were calculated based on the equation $R_n = C_n * R_{24} + (1 - C_n) * R_1$, where R_n is the *n*-hour rainfall depth, C_n values are the ratios for the 2, 6 and 12 hour duration in table 10. The values R_1 and R_{24} are the 1-hour and 24-hour rainfall depths

Table 10 Rainfall Depths for Basin1 for various Duration and Frequencies

		Return Period				
Duration	Ratios	**5**	**10**	**25**	**50**	**100**
5 min	0.25	7	10	12	15	17
10 min	0.40	10	17	20	24	26
15 min	0.52	14	22	26	32	34
30 min	0.76	20	32	38	46	50
1 hr		26	42	49	61	66
2 hr	0.25	36	57	70	87	97
6 hr	0.50	45	73	90	112	128
12 hr	0.69	52	85	105	132	151
24 hr		**64**	**104**	**130**	**164**	**189**

Table 11 Ratios of the Tyear-1hour to the Tyear-24hour rainfall

(2yr-1hr)/(2yr-24hr)	**0.43**
(5yr-1hr)/(5yr-24hr)	**0.41**
(10yr-1hr)/(10yr-24hr)	**0.40**
(25yr-1hr)/(2yr-24hr)	**0.38**
(50yr-1hr)/(50yr-24hr)	**0.37**
(100yr-1hr)/(100yr-24hr)	**0.35**

For **Basin2** and **Basin3** the equivalent uniform 24-hour rainfall depths for the 5-, 10-, 25-, 50- and 100-year return periods are shown in table 12 and were derived based on a weighted average of the rainfall at Duncans, Etingdom and Lottery. The weighting was based oh the isohyetal method. The Rainfall depths for the other duration and frequencies were determined in the same manner described for Basin1 above.

Table 12 Rainfall Depths for Basin2 for various Duration and Frequencies

		Return Period				
Duration	Ratios	**5**	**10**	**25**	**50**	**100**
5 min	0.25	9	13	15	18	19
10 min	0.40	14	20	24	29	31
15 min	0.52	18	26	31	38	40
30 min	0.76	26	38	45	55	59
1 hr		35	50	59	72	77
2 hr	0.25	47	69	83	103	113
6 hr	0.50	60	88	107	134	149
12 hr	0.69	69	102	125	157	176
24 hr		**85**	**125**	**155**	**195**	**221**

3.4.6 Determination of the Pre and Post Project Runoff

For each of the sub-basins of Basin1, Basin2 and basin3, the peak flow and runoff volume for the designated return period was simulated from the basin rainfall in the above tables. The **HEC-Hms** computer model developed at the Hydrologic Engineering Center by the US Army Corps of Engineers was used in the simulation. The model form used in the determination of the runoff for

the pre and post project cases is based on the **SCS[1] Rainfall-Runoff Relation**: - $Q_d = \frac{(P-0.2S)^2}{P+0.8S}$ where Q_d is the accumulated runoff in millimeters, P is the accumulated rainfall depth in millimeters and *S* the available soil moisture storage deficit in millimeters given by: $S = \frac{25400}{CN} - 254$

The curve ***number*** *(CN)* is an index of runoff and is a function of the soil group, land use and antecedent soil moisture conditions. The basin outflow *Q* is the result of a transformation of Q_d using the SCS dimensionless unit hydrograph option of the **HEC-1** model. The SCS-unit hydrograph parameter is the L**ag**, which has unit of hours and is computed as: $Lag = \frac{L^{0.8}(S+1)^{0.7}}{19000Y^{0.5}}$**.**

For this empirical formula, *L* the hydraulic length has units of feet, *S* the storage deficit has units of inches and *Y* is the percent slope of the basin.

For ***Basin1***, the post project runoff conditions are characterized by the development of: (1) 11% of Kettering sub-basin (43 hectares or 107 acres north of the Duncan's main road and south of the Highway_2000 main road at Kettering) to commercial areas and (2) hotel and town houses near the coast and north of the existing development occupying about 17.0 hectares (47 acres) or 88% of the Johnson sub-basin. Significant changes in the runoff could have implications for the adequacy of the existing culvert (figure 5), located at Kettering (location 5 in figure 2) and also for the proposed drainage in the areas near the coast.

For ***Basin2,*** the post project runoff conditions are characterized by the land use change in 50% of the Stewart1, 100% of the WS_Park and 60% of Clermont sub-basins. These areas are predominantly forested and will be converted to hotels, villas, townhouses and golf courses.

Future runoff conditions in ***Basin3*** will be characterized by the landuse change of the entire basin from a predominantly forested area to hotels, villas and townhouses.

[1]SCS - Soil Conservation Services, United States Department of Agriculture, Washington, D.C.

The landuse change in each basin is represented in the model by adjusting the pre-project *CN*. Adjustments to the *CNs* are made for those sub-basins in which the project area lies (the shaded rows in table 13). A new CN of 79 was assumed to be a conservative estimate for the proposed landuse. This is the average for industrial districts (CN=88) and for open spaces (CN=69) including lawns and golf courses. This was weighted using the percent of the sub-basin occupied by the project area.

Table 13 Study Area Parameter Estimates

Name	AREA (HECTARES)	SLP_1085 (*y*)	LONGESTFL (*L*) (meters)	*CN*	*S* (mm)	*Ia=0.2S* (mm)	*Lag* (hrs)
Johnson	53.0	0.05	1698.07	**60 (77)****	169 (76)	**34 (15)**	**1.0 (0.6)**
Kettering	401.3	0.03	3142.37	**65 (68)****	137 (120)	**27 (24)**	**1.8 (1.6)**
CareyPark	49.4	0.08	1223.95	**63**	149	**30**	**0.5**
Retirement	121.1	0.10	2078.20	**65**	137	**27**	**0.7**
Duncans	144.3	0.09	2605.75	**64**	143	**29**	**0.9**
Sea	4.88	0.05	354.72	**58**	184	**37**	**0.30**
Stewart1	42.54	0.04	1685.71	**40 (60)****	381 (169)	**77 (34)**	**1.88 (1.12)**
WS_Park	129.48	0.03	2046.71	**56 (79)**	200 (68)	**40 (14)**	**1.59 (0.85)**
Stewart3	34.25	0.02	1020.32	**68**	120	**24**	**0.90**
Stewart2	38.62	0.02	1264.52	**68**	120	**24**	**1.04**
Clermont	117.99	0.03	2948.59	**62 (72)**	156 (99)	**31 (20)**	**1.99 (1.53)**
E_Refuge	58.81	0.07	2065.84	**58**	184	**37**	**0.98**
Stewart4	10.34	0.06	970.66	**74**	89	**18**	**0.38**
Dry Valley	199.21	0.06	2087.09	**58**	184	**37**	**1.13**
W_Refuge	66.60	0.08	1942.00	**58**	184	**37**	**0.92**
CareyPark	156.19	0.09	2837.79	**53**	225	**45**	**1.32**
Glamorgan	54.27	0.08	1360.83	**54**	216	**43**	**0.74**
Simpson	39.13	0.09	1087.26	**41**	366	**73**	**0.82**
StewartBay1	1.9	0.096	376.65	**82 (88)****	56 (35)	**11 (7)**	**0.1 (0.1)**
StewartBay2	33.3	0.013	1007.27	**66 (88)****	169 (35)	**34 (7)**	**1.1 (0.6)**
StewartBay3	39.7	0.001	1573.55	**60 (88)****	131 (35)	**26 (7)**	**6.5 (2.8)**

60 (88)** … Pre and Post project values for parameters.

The HEC-Hms Basin Schematic is shown in figure 13 and the variables for input to the model shown in tables 13 and 14. The sub-basin flows are combined and routed throughout the respective basins (figures 13, 14 and 15), using Muskinghum Routing method. Here the storage (S) in a reach is related to the inflows (I) and outflow (O) by the relation: $S = KO + Kx(I - O)$, where K is the travel time through the reach and is given by: $K = 0.02L_c^{0.77}S_o^{-0.385}$. Lc and So are the reach length and average reach slope and x is a dimensionless weight $(0 \le x \le 0.5)$.

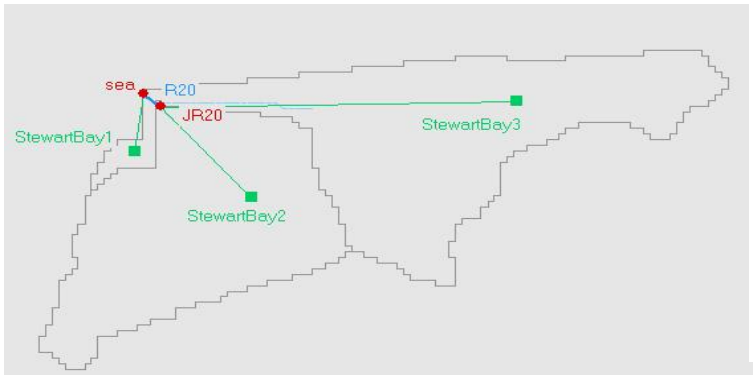


Figure 13 HEC-Hms Basin Schematics

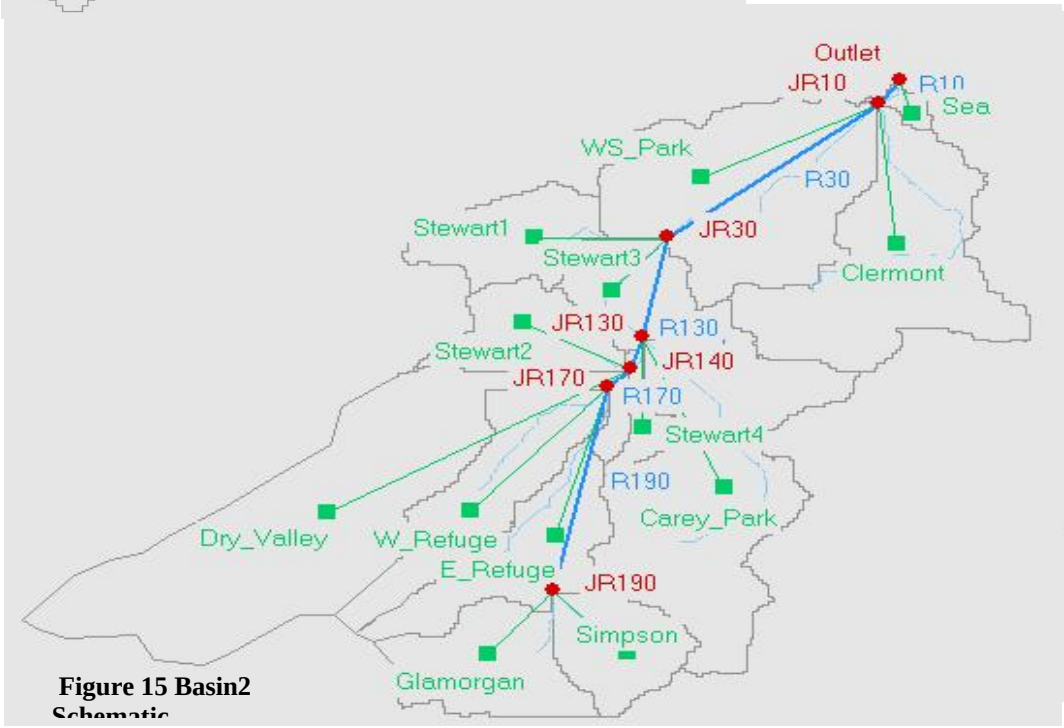


Figure 15 Basin2 Schematic

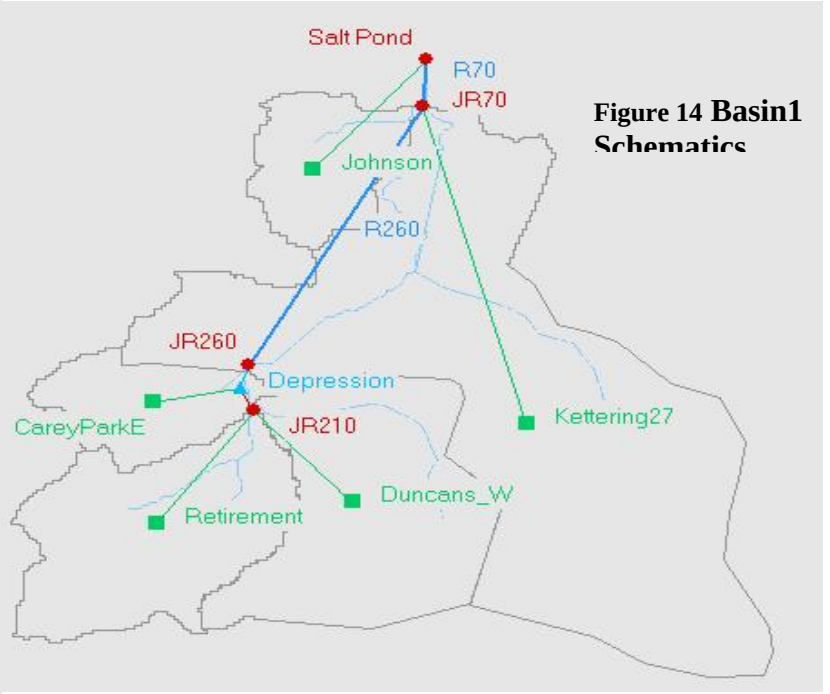


Figure 14 Basin1 Schematics

Table 14 Routing parameters for Study Area

Basin1				
Reach	**L_c(meters)**	**S_o(m/m)**	**X**	**K(hrs)**
R70	**279.500**	**0.05**	**0.2000**	**0.10****
R210	**209.400**	**0.034**	**0.2000**	**0.10****
R260	**2446.000**	**0.080**	**0.2000**	**0.36**
Bain2				
R10	**225**	**0.039**	**0.2000**	**0.10****
R30	**1631**	**0.034**	**0.2000**	**0.36**
R130	**830**	**0.024**	**0.2000**	**0.25**
R140	**225**	**0.060**	**0.2000**	**0.10****
R170	**162**	**0.059**	**0.2000**	**0.10****
R190	**1642**	**0.080**	**0.2000**	**0.26**

****** *K = 0.1 if K < 0.1*

3.0 THE ENVIRONMENTAL SETTING – RESULTS AND DISCUSSION

4.1 Environmental Chemistry

4.1.1 Water Quality

Water quality data are presented in **Table 15**

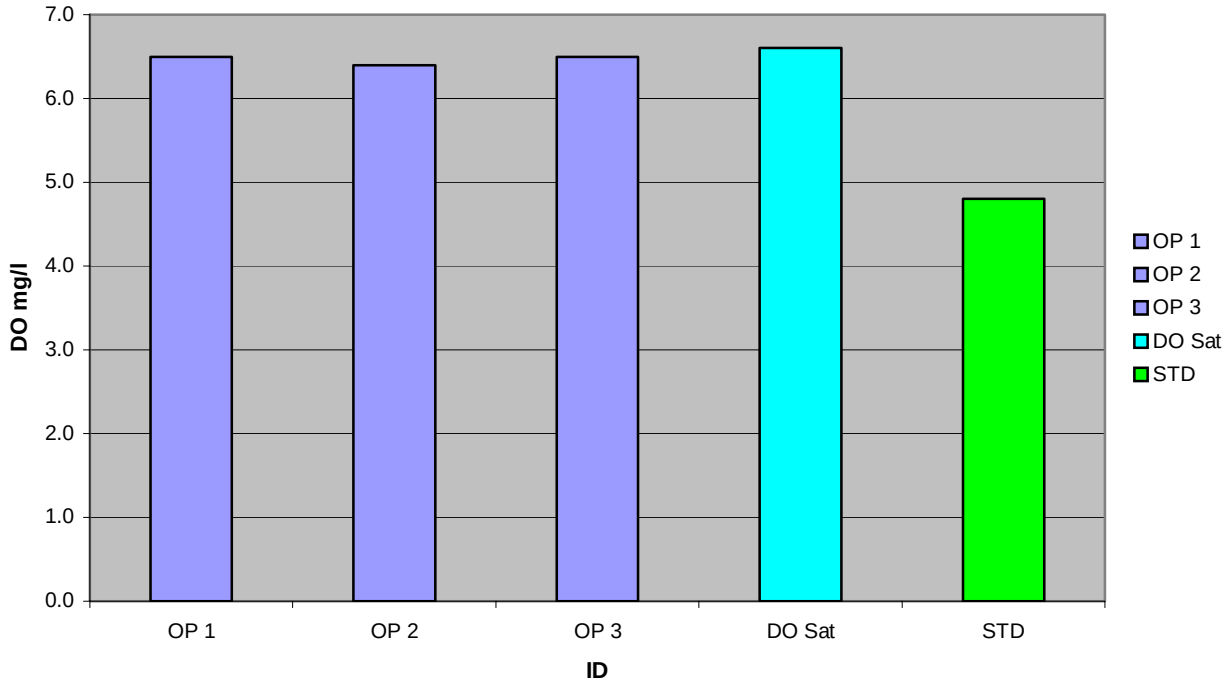
Table 15
Amaterra Devt.

Baseline Water Quality Data										
STATION ID	DO mg/l	ToC	BODm/l	NO3mg/l	PO4mg/l	TC (1)	FC (2)	EC (3)	TSSmg/l	TURB(4)
OP 1	6.5	28.0	0.5	0.057	0.046	23	23		7	3.3
OP 2	6.4	28.0	0.3	0.022	0.051	2	2		3	2.3
OP 3	6.5	29.0	0.5	0.090	0.030	<2	<2		0	1.2
OP 4		24.0	1.7	3.622	0.058	240	<2	3590	62	38.6
STD	4.8**		.57-1.16*	.001 -.081*	.001-.055*		<200***	250-750***	<10	
(1)TC - Total Coliform (MPN/100ml)										
(2) FC - Faecal Coliform (MPN/100ml)										
(3) EC - Electrical Conductivity (micro siemens = micro mhos)										
(4) TURB - Turbidity in Nephelometric Turbid Units (NTU)										
* - Interim Marine Ambient Standard										
** - EPA Standard For Marine Water										
*** - Irrigation Water Standard										

4.1.1.1 Coastal Water Quality:

At all sites sampled water clarity was good, and the water and shoreline were free of unsightly debris. Some algae were observed but these did not appear to be in sufficient quantities to present an aesthetic problem or odour nuisance.

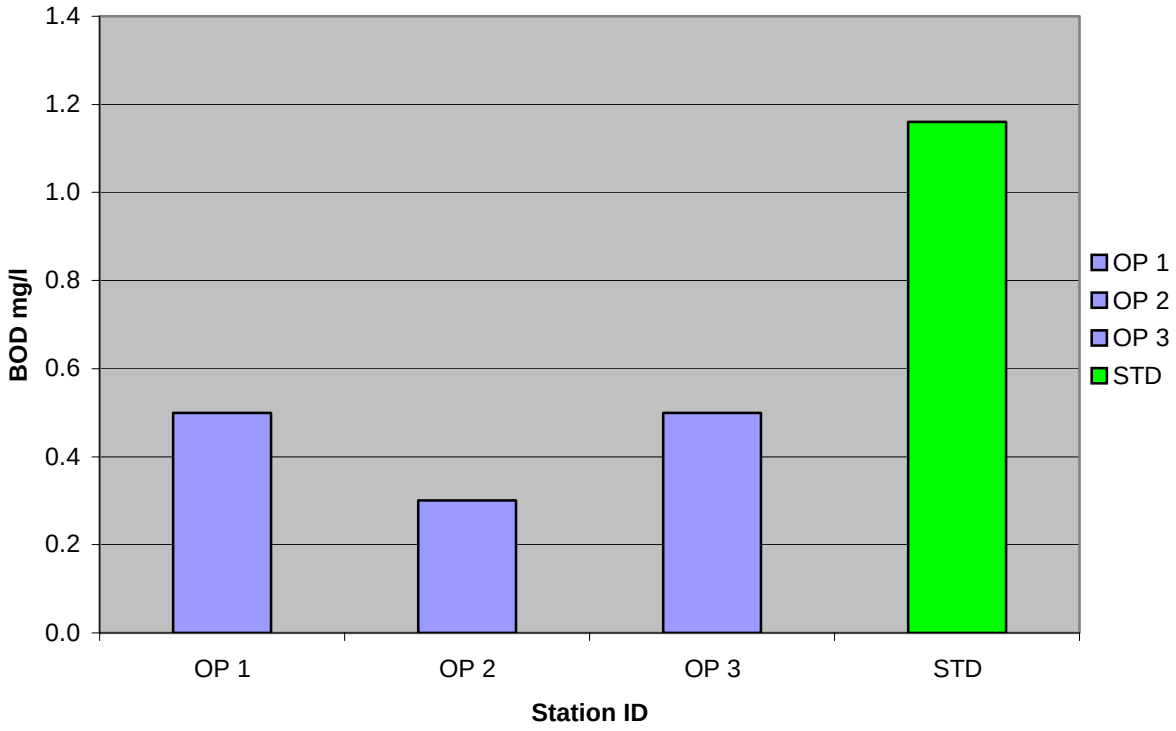
Figure 16
Ocean Point - DO In Coastal Water June 29, 2004



Dissolved oxygen (DO) was determined to be in the range 6.4mg/l - 6.5 mg/l for all coastal sites monitored (Figure 16). These values were close to the saturation value of oxygen (6.6mg/l) i.e. the maximum oxygen that can be dissolved in water at the measured salinity, temperature. The values were significantly higher than the EPA criteria value for marine waters (4.8mg/l).

Biological oxygen demand (BOD) was determined to be in the range 0.3mg/l - 0.5mg/l at all coastal sites monitored (Figure 17). These values were less than half the interim standard value of 1.16mg/l. The highest level (0.5mg/l) was determined for the samples taken at Jacob Taylor Beach (OP1) and Ocean Point West - just beyond the salt pond (OP3).

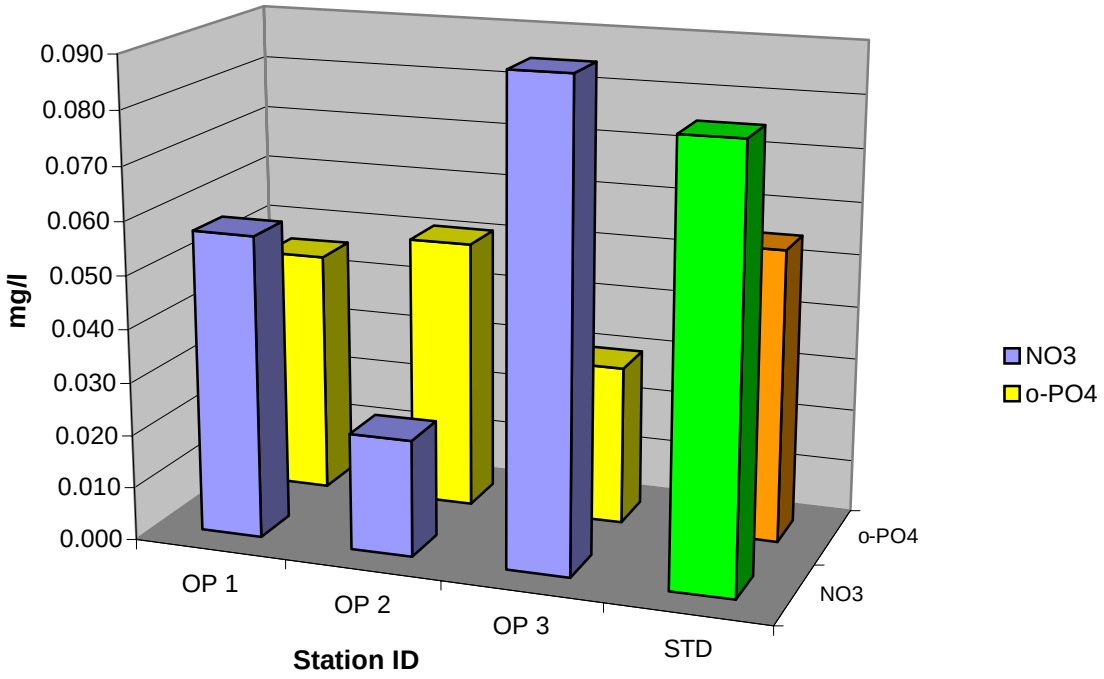
Figure 17
Ocean Point - BOD In Coastal Water July 14, 2004



Nitrate was determined to be in the range 0.02mg/l - 0.09mg/l at the coastal sites monitored (Figure 18). The highest value (0.09mg/l) was determined for Ocean Point West (OP3). At Jacob Taylor Beach the level was 0.06mg/l and at Ocean Point East (OP2) the level was 0.02mg/l. With the exception of OP3 which was slightly higher than the interim standard, the sites monitored were significantly less than the interim standard.

Reactive phosphate (o-PO4) was determined to be in the range 0.03mg/l - 0.051mg/l at the coastal sites monitored (Figure 18). These values were close to the NRCA interim marine ambient standard of 0.055mg/l. The levels at Jacob Taylor Beach (OP1) and Ocean Point East (OP2) were similar, 0.046 and 0.051mg/l respectively, while the lowest value (0.03mg/l) was determined for Ocean Point West (OP3).

Figure 18
Ocean Point - PO4 and NO3 June 30, 2004



Total and faecal coliform were identical at all coastal sites. At Jacob Taylor Beach the value was the highest (23MPN/100ml). At Ocean point East (OP2) the value was 2MPN/100ml and at Ocean Point West the value was <2MPN/100ml. These values were well below the NEPA interim standard of <200MPN/100ml.

4.1.1.2 Ground Water Quality

Three wells were observed – two at the same location near Silver Sands, and one further east along the Road to Carey Park. Of the two located in close proximity to each other, one was accessible. The other well located further west and along the road to Carey Park appeared to be dry. This uncapped well seemed to contain a significant amount of debris quite likely deposited by miscreants. Ground water level at the accessible well was approximately 14m below the earth's surface. Ground water was about 0.5M deep.

Conductivity of water from the accessible well near Silver Sands was determined to be was 3590 μ siemens. Nitrate level was 3.6mg/l and phosphate was .058mg/l.

4.1.2 Air Quality

Baseline air quality data are presented in **Table 16**

Sulphur dioxide and nitrogen dioxide were not detected at the sites monitored. Respirable particulate matter (PM_{10}) at all sites was low 56 - 153μg/m^3. This compares to the NRCA 24hr standard of 150μg/m^3.

Table 16

Amaterra Development.
Baseline Air Quality

STATION ID	DESCRIPTION	N 18o	W 77o	PM_{10} (ug/m3)	SO_2	NO_2
OP 1AQ	NEAR SILVER SANDS	29.232	32.199	111	ND	ND
OP 2AQ	CAREY PARK	28.618	33.125	28	ND	ND
OP 3AQ	STEWART CASTLE	28.867	33.711	153	ND	ND
OP 4AQ	DUNCANS HILL	28.228	32.772	56	Not done	Not done

ND – Not detected.

4.1.3 Noise

Average noise levels for all stations were between 49db and 69db (Table17). The low average levels were reflective of quiet rural/residential communities removed from the influence of highway traffic. The sites with the higher averages were all close to the highway or influenced by highway construction activities. All maximum values were associated with the movement of heavy-duty vehicles.

Table 17

Amaterra Development

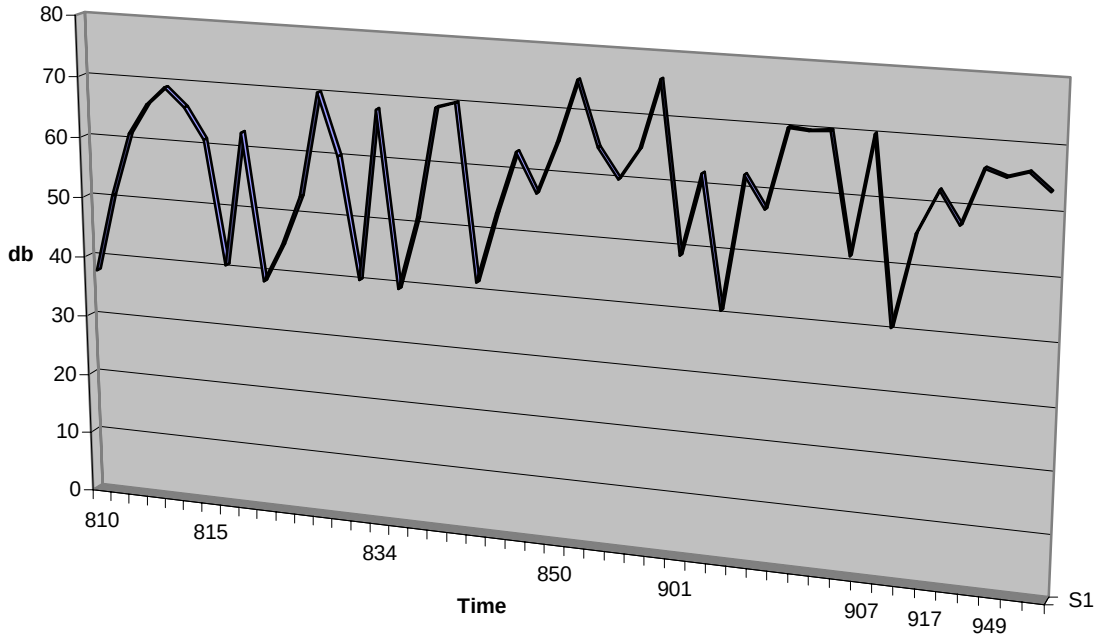
Summary of Noise Data

KEY	**Location**	**AVG**	**MAX**	**MIN**
1	Silver Sands Intersection at bus stop	59	76	38
2	Housing Scheme near wells	54	81	39
3	In Stewart Castle on main road	49	77	39
4	Stewart Castle Boundary with highway	69	80	43
5	Duncans Hills	66	77	54

Silver Sands Intersection At Bus Stop

Noise levels at the bus stop at Silver Sands were determined to average around 59db with a minimum of 38db and a maximum of 76db (Figure 19). The low value was typical of the values obtained at the site in the absence of human activity. The high value was generated by a motorcar engaged in activity atypical of those observed during the monitoring – a hasty, tyre screeching departure. In general the movement of traffic was associated with readings in the high 60s and above.

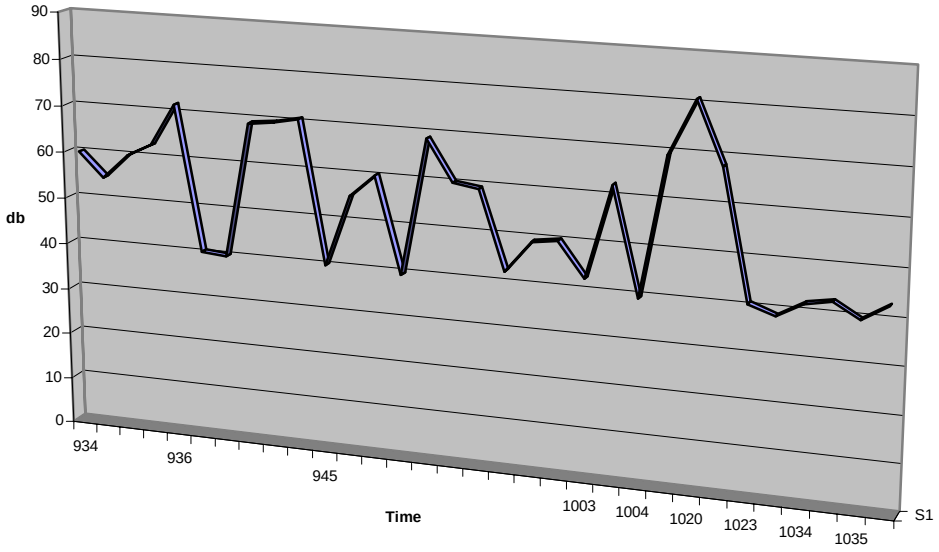
Figure 19
Ocean Point Silver Sands Intersection Noise
Tuesday 7, 2004



Silver Sands Housing Scheme Near Wells

Noise levels in the Silver Sands housing scheme near the access road to the wells were determined to average around 54db with a minimum of 39db and a maximum of 81db. (Figure 20) The low value was typical of the values obtained at the site in the absence of human activity. The high value was generated by a compactor garbage truck servicing the area. In general, the higher readings (>60 - 81) were associated with the movement of traffic and activities on two housing construction sites in the vicinity of the monitoring site.

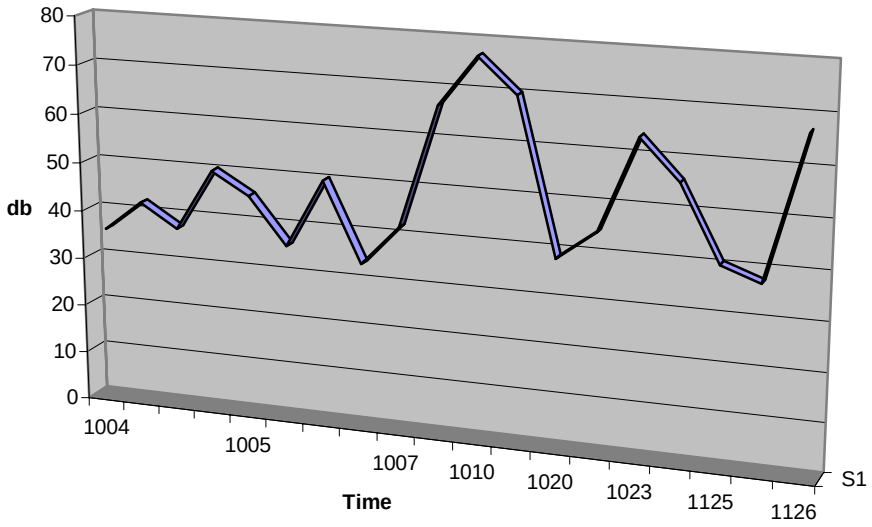
Figure 20
Ocean Point
Silver Sands Housing Scheme Near Wells
Noise December 7, 2004



In Stewart Castle On Main Road

Noise levels along the Stewart Castle main road were determined to average around 49db with a minimum of 39db and a maximum of 77db. The low value was typical of the values obtained at the site, where human activity was low at the time of monitoring. The high value was generated by a dumper truck that passed slowly by the meter. In general, the higher readings (>60 - 81) were associated with the movement of traffic and activities on two housing construction sites in the vicinity of the monitoring site.

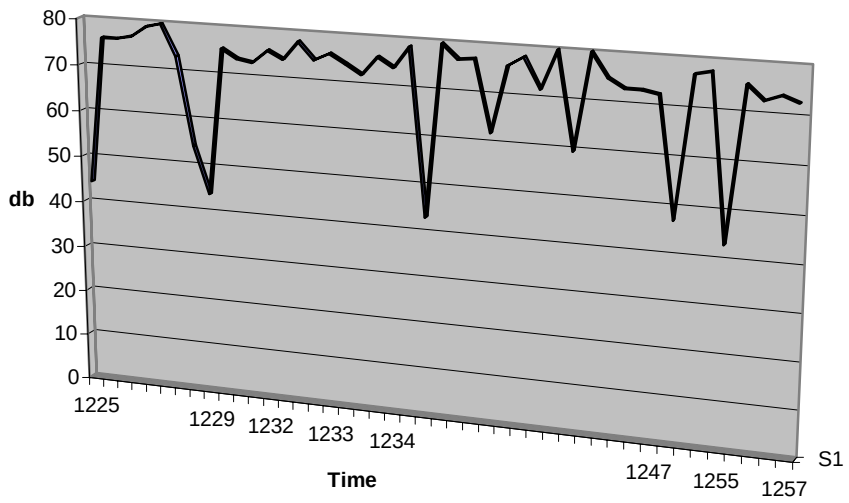
Figure 21
Ocean Point
Stewart Castle Main Road
Noise December 7, 2004



Stewart Castle Boundary With Highway

Noise levels along the boundary of Stewart Castle with the main road were determined to average around 71db with a minimum of 44db and a maximum of 80db. The low value was atypical of the values obtained at the site, where traffic movement was frequent. The high value was consistently generated by loaded flat trucks on different occasions. In general, noise readings for passing traffic were >72 - 80db.

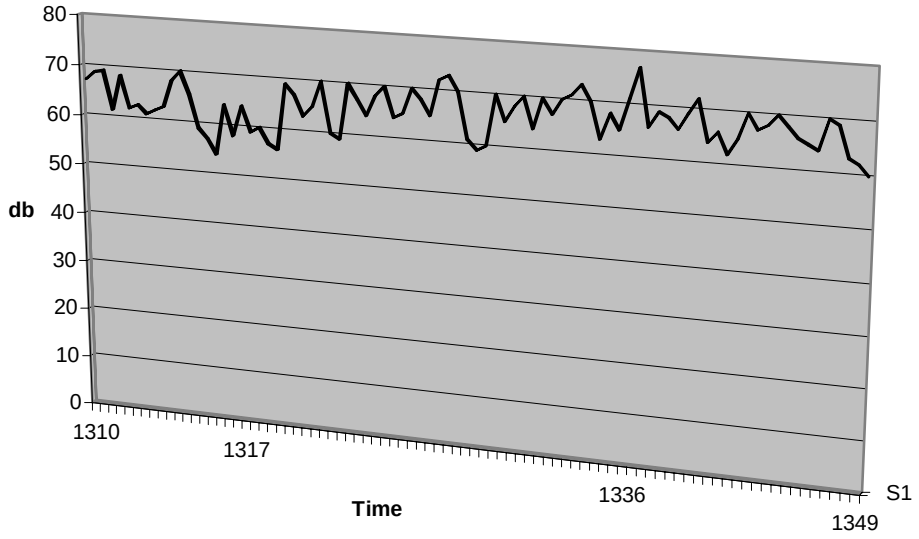
Figure 22
Ocean Point
Stewart Castle Boundary With Main Rd
Noise
December 7, 2004



Duncans Hills

Noise levels at the entrance to Duncans Hill at the time of sampling were determined to average 66db with a maximum of 77db and a minimum of 54db. The maximum reading was associated with heavy-duty equipment working on the North coast highway - hydraulic release from a dumper truck. The lowest reading was taken while there was no traffic passing and only the tractor was working on the North Coast Highway site.

Fioure 23
Ocean Point
Duncans Hill
Noise december 7, 2004



4.2 Ecology

4.2.1 Vegetation

A narrow coastal plateau gives rise quickly to a step cliff face (20 to 30m high) that leads to an elevated terrace which supports primary limestone forest vegetation typical of a karst substrate because of the arid nature of the climate and the porus substrate. The natural distribution pattern for most of the indigenous plants can be described as either 'random' or 'disperse-patchy'. A total of one hundred and four species of plants were identified from transects examined at this site. (See Table 1, Appendix 3).

Most of the species on the upper plateau were typical of a relatively virgin, dry, limestone scrub forest and were typified by sparse vegetative cover of low forest and tall scrub growing on bare limestone rock. Little soil was present except for relatively small amounts deposited in level areas or washed into small crevices. Leaf litter was not abundant and the forest floor was a jumble of broken stone or jagged honeycomb limestone rock. Plants obtained support and food

by means of long, branched root systems which sprawled over the rocks to exploit most crevices and crannies. Species composition was found to change rapidly and depended on aspect, slope, drainage and extent of soil deposits. Beach vegetation communities were typical of strand-beach; strand scrub and strand woodland associes in sequential order. The extent and development of the pioneer zones were dependent on the width and elevation of the beaches as well as on interference by man. Even the isolated beaches showed some evidence of human interference where mangrove trees had been cut to make space for access trails to the beach or for storage areas for small fishing canoes. The strand-scrub associes developed on sand overlying a coral rock shelf and was followed by the strand-woodland associes immediately adjacent the cliff face rising to the plateau above. On the slopes rising to the plateau, as well as on the plateau itself, the dry limestone scrub forest community dominated

To date anthropogenic impacts to the site focus on the use of limited sections of the coastal strip for cattle rearing and the southern edge of the property (near human dwelling areas) on the upper plateau for coal burning and bird hunting. Some removal of forest products to a fairly limited extent - wood for simple construction or the production of fish traps has occurred. The difficult terrain has served to protect much of the woodland from exploitation. The most extensive intrusion noted to date has been the cutting and clearing of large sections of vegetation in an east west path through the interior of the forest for the purpose of establishing the main golf fairway centre lines for this development. Modification of the shoreline near the eastern edge of the property has also taken place where the beach vegetation in and around a small salt pond has been removed and the structural elements along this stretch of beachfront rearranged.

4.2.2 Terrestrial Fauna

Introduced faunal species such as goats, pigs, dogs and chickens were seen around domiciles adjacent the study area. Other unremarkable and commonly seen animals - the mongoose, lizards, termites, ants, spiders, butterflies and bees were also noted. Several abandoned bee hives were noted on lands immediately adjacent the development site in the vicinity of the Stewart Castle ruins

Table 2 Appendix 3. provides the results of three (3) point counts, and fourteen (14) timed transects of 12 minutes each done over a two-day period for the detection of avifauna.

4.2.2.1 Bird Distribution and Habitat Usage

Not all the terrestrial avifauna observed were equally distributed throughout the entire property. Species such as Yellow – Shouldered Grassquit, Gray Kingbird, Red – Billed Streamertail, Jamaican Oriole, Zenaida Dove and Bananaquit were fairly ubiquitous. Other species like Jamaican Crow, and Olive Throated Parakeet were observed at the hilly sections to the north of the property. Only four species of shorebirds were observed. Of note was the fact that the larger of the two salt ponds, was a nesting area for a pair of Black – Necked Stilts, despite the recent clearing of vegetation that had taken place around this pond. The study area served as a feeding and nesting area for the birds inhabiting or frequenting it. Insectivorous birds such as the gray Kingbird, a summer migrant, were noted exploiting the insect population while the Red – Billed Streamertail and Bananaquit (nectavores) were observed feeding from flowering plants. Examples of breeding birds include Red – Billed Streamertail, Jamaican Lizard Cuckoo, Northern Mockingbird, Jamaican Mango, and the summer migrant, Gray Kingbird. Many of these species have a tendency to be territorial during the breeding season and were using the site as a nesting area

4.2.3 Marine Macro Flora & Fauna

Coral cover along the inshore coastline approximated 10% at both the 6m and 10m depth ranges examined. In contrast, algal percent cover varies drastically between 70% cover at 10m depth and 10% at the 6m depth. This is presumed to be the result of relatively high numbers of urchins (*Diadema sp*.) which reported approx. 3 individuals per sq. meter. Fishes seen included juvenile silversides, grunt, parrotfish and surgeon fish. Midwater and pelagic species seen included the Gerridae and the Bar Jack – ***C. ruber***). In deeper water the reefs exhibited the usual spur and groove formations typical of north coast reefs but the height of these buttresses was generally not that well emphasized. The main buttress supported a diverse and healthy population of fishes. No unusual species were seen. Semi emergent reef flats towards the eastern side of the property ensure that the beach there is well developed with a relatively large amount of sand stored in the

berm onshore and protected by beach vegetation despite the presence of foraging goats and cows.

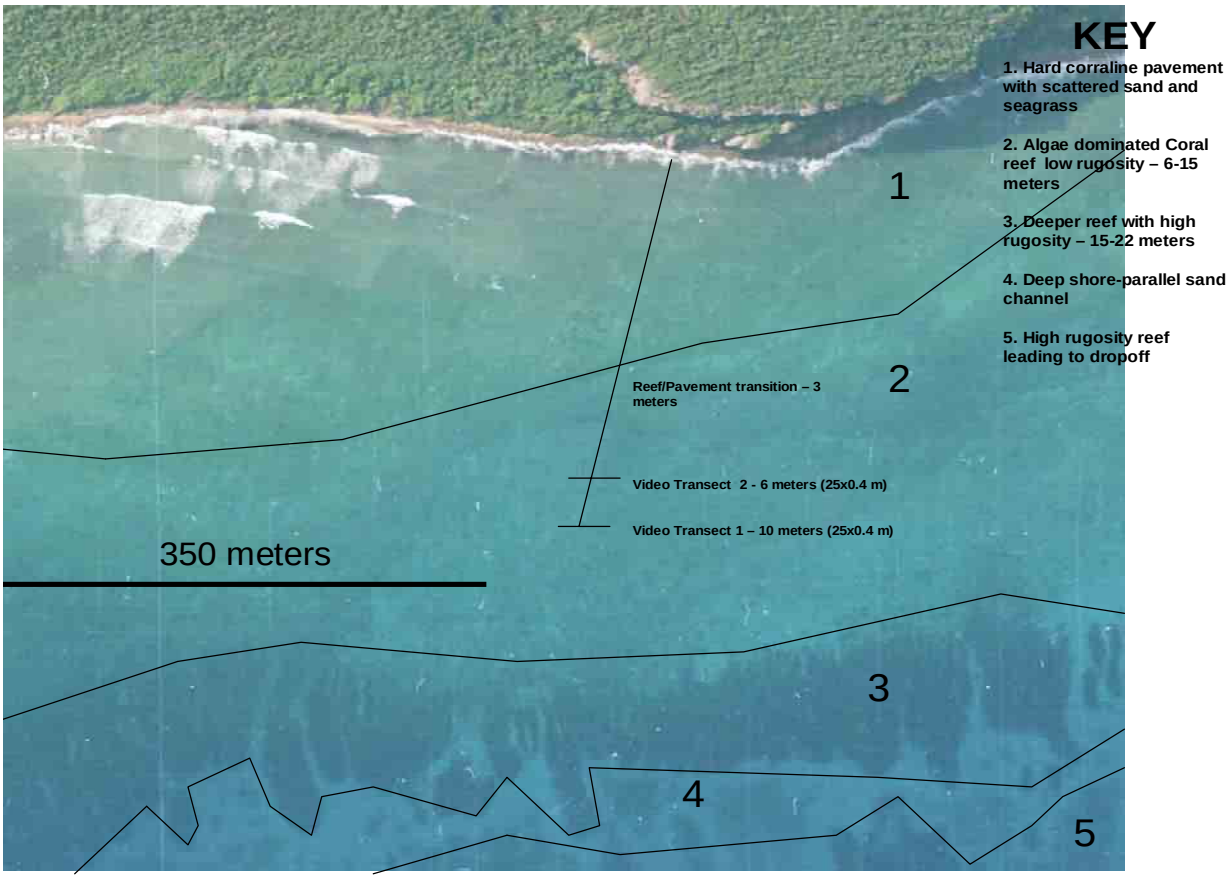


Figure 24 Offshore Transects

4.3 Coastal Dynamics

Jamaica lies in a branch of the North Equatorial Current which flows predominantly from east to west, except for infrequent reversals due to cold fronts emanating from the northwest. This general east to west current however is modified by the configurations of the barrier reefs just offshore, in conjunction with tidal changes and deep-water influences. This leads to an almost random pattern of current movements in the nearshore region which can be observed to change in a matter of hours when muddy waters are brought down by heavy rains. A more accurate predictor of currents is the actual angle of incidence of waves approaching the shoreline. These

waves are the main driving force of nearshore currents and thereby dictate sand movement. The angle of wave-incidence however is site specific and is determined by refraction patterns caused by offshore bathymetery. As such each proposed area of coastal modification must be looked at first separately to establish the main coastal processes at work there, and secondly to see if there will be any effect on adjacent sites

4.3.1 Coastline Construction Methodology

It is desired to create usable recreational beaches to serve the needs of the overall proposed development, and at the same time minimize adverse impacts to the marine environment. As a result the main type of proposed development of the coastline will take the form of coves, excavated from the bedrock. This methodology has two main benefits – firstly there is no impact or damage to the local benthos as the excavation takes place inland. Secondly, it is possible to control the configuration and bathymetery of the coves, thereby ensuring the stability of coastal processes.

The technique employed for excavation will centre mainly on the use of a hydraulic rock-hammer attached to a standard excavator. A pipeline-trench digging machine will also be utilized to accurately control the configuration of the coves.

4.4 Socioeconomic Assessment

4.4.1 Demography

According to the 2001 census, there are 4,613 persons living on and within a 2km radius of the property. Of this number, approximately 41% are below the age of 20 years, 14% between the ages of 20 to < 30 years, 15% between 30 to < 40 years, 11% between 40 to < 50 years, 9% between 50 to < 64 years and 10% above the age of 64 years. The area is characterized by a young population with 90% of the population being below the age of 65 (see Figure 25 below). There are 2,305 males and 2,308 females translating to a male to female ratio of 1:1.

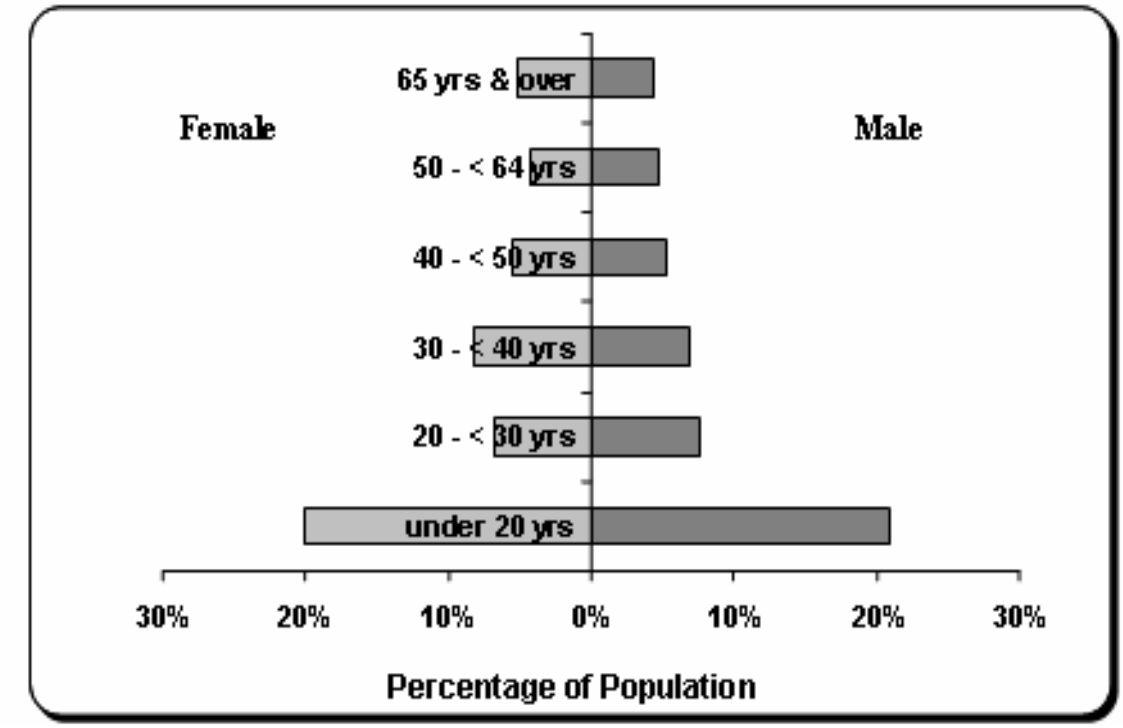


Figure 25: Population Distribution for lands within 2km of Subject Lands

According to the population census there are 1,969 residential dwellings within the area and 2,033 households translating to an average of 2.27 households per dwelling.

A socio-economic survey conducted in the area among the squatter community showed a total of 89 residents in 22 households translating to four persons per household. This is consistent with the national average of 4.3 persons per households. There are 4,613 persons living on and within a 2 km radius of the property. . It is expected that by 2013, which is the projected completion date for the proposed development, the population count for the project area will be 9,282. This estimated population count reflects a 0.06%[2] growth rate as seen over the period 1991 – 2001 for the entire island.

2 Growth rate calculated as the average change in population growth over the 1991-2001 period

4.4.2 Major Economic Activities.

A wide range of services provided by self-employed and small business persons dominates the economic activities of the study area. Duncans is a rural township that forms one of the immediate boundaries of the property. As a commercial centre, it serves not only the communities within the 2 kilometers boundaries but also the more rural communities that extend even beyond 10 kilometers mainly to the south. The Silver Sands and Duncan's Bay resorts (with some 175 villas) represent the bulk of the tourism-based services within the study area. Trading in a range of consumer goods (supermarkets, small grocery shops, hardware stores, pharmacy, wholesale/retail outlets, electrical appliances, restaurants and bars) represents a significant portion of the economic activities of the area.

Fishing is also a significant economic activity of the area as there are some 150 fishermen operating at the Derby's Fishing Beach that borders the property. Other economic activities are reflected in the main occupation of the residents of the adjacent communities as reported by the sample of households interviewed in the socioeconomic survey discussed above. For purposes of this study, occupations of the households were recorded under the following categories:

a) Professional (all persons with tertiary education including police, nurse, teacher, etc)
b) Technical (mechanic, technician etc)
c) Farmer
d) Fisherman
e) Shopkeeper
f) Housewife
g) Driver
h) Taxi/ bus /truck operator
i) Other Small Business Operators
j) Skilled worker Crafts-man
k) Unskilled laborer and
l) Craft Vendor

The socio-economic survey revealed a relatively wide range of occupational categories with 42 % of the residents falling in the professional category. This was followed by shopkeeper 12.5 % and another 21% accounting for Farmer, Fisherman and technicians. The most prevalent skills therefore appears to fall in the professional category.

The Duncans community functions mainly as a commuter transfer node. The North Coast Highway links the study area to Falmouth, Ocho Rios and Montego Bay. This highway project is on schedule to be completed by 2006 and it is expected that the main flow of traffic will be diverted from the town centre of Duncan. Transportation within the region is mostly by minibus. There are many taxis and private vehicles servicing the area.

4.4.3 Employment and Income

The communities within the study area fall within the lower middle and lower income groups. At least one community (Spicy Hill) is receiving support from the Jamaica Social Investment Fund (JSIF) under the Governments' Poverty Alleviation Programme. It is significant to note that there is no commercial bank in Duncans reflecting relatively low level of commercial activity.

From the sample of households surveyed in the project area, the data show a relatively high level of employment with 35% of the community members employed full-time and another 50% either self-employed or employed on a part-time basis. Just about 15% could be said to be totally unemployed.

The bulk of the labour force is located in the Town Centres of Duncans, Clarkstown, Rio Bueno and Falmouth, which are all in close proximity to the proposed development site. Additional visitor rooms created by the development in the region are expected to create many new jobs in the local economy.

4.4.4 Education

Data from the 2001 population census of Jamaica show that 35% of persons in the age group 15 years and over in the parish of Trelawny attained the primary school level of education while the secondary level of attainment accounted for 51% of these persons. Tertiary level education was attained by only 11% of this group. The remaining 3% was not reported.

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Data from the socioeconomic sample survey of communities revealed a similar education status to that of the parish as a whole with 27 % and 57.5% of the sampled household attaining the primary and secondary levels of education respectively.

According to the Education Statistics for the period 2001/2004 provided by the ministry of education, there were 47 public schools in the parish with the following breakdown:

- Public Infant Schools –8 (including infant departments in primary, Junior High and all-age schools).
- Primary and all-age schools-31
- Secondary including Junior High -8

There was no Technical High School, Agricultural, Community College or Teachers College in Trelawny.

Public schools accounted for 38 of the 47 schools found. An analysis of the data on these schools found that just over 60 % of these schools are operating above capacity while the remaining 40 % are below capacity. Details of the capacities of these schools, enrolment percentage attendance number of teachers and over-crowding index are provided in Table 18. below.

Table 18 Characteristics of schools serving the project area

School Code	School Name	Gender	School Organisation	Class	Locale	Percentage Attendance	Capacity
07045	Falmouth Infant	Co-ed.	Whole Day	II	Urban	78	240
07001	Albert Town Primary and Infant	Co-ed.	Whole Day	III	Urban	84	415
07040	Bounty Hall Primary	Co-ed.	Whole Day	I	Rural	86	255
07005	Clarke's Town Primary	Co-ed.	Whole Day	III	Urban	80	240
07006	Duanvale Primary	Co-ed.	Whole Day	II	Rural	88	315
07011	Freemans Hall Primary and Infant	Co-ed.	Whole Day	II	Rural	81	195
07013	Hampden Primary and Infant	Co-ed.	Whole Day	II	Rural	83	200
07014	Hastings Primary	Co-ed.	Whole Day	II	Rural	86	180
07039	Kinloss Primary	Co-ed.	Whole Day	I	Rural	88	185
07020	Spring Garden Primary and Infant	Co-ed.	Whole Day	II	Remote Rural	84	335
07023	Ulster Spring Primary	Co-ed.	Whole Day	II	Rural	86	230
07024	Unity Primary	Co-ed.	Whole Day	I	Rural	88	225
07026	Wakefield Primary	Co-ed.	Whole Day	III	Rural	92	500
07027	Waldensia Primary	Co-ed.	Whole Day	I	Remote Rural	87	380
07002	Alps All Age and Infant	Co-ed.	Whole Day	I	Rural	79	260
07004	Brampton All Age	Co-ed.	Whole Day	I	Remote Rural	82	135
07036	Daniel Town All Age	Co-ed.	Whole Day	I	Remote Rural	78	215
07007	Duncans All Age and Infant	Co-ed.	Shift	IV	Urban	83	395
07008	Falmouth All Age	Co-ed.	Shift	IV	Urban	89	690
07010	First Hill All Age	Co-ed.	Whole Day	III	Rural	85	385
07012	Granville All Age	Co-ed.	Whole Day	IV	Rural	84	710
07016	Refuge All Age	Co-ed.	Whole Day	I	Remote Rural	89	40

School Code	School Name	Gender	School Organisation	Class	Locale	Percentage Attendance	Capacity
07017	Rio Bueno All Age	Co-ed.	Whole Day	I	Rural	77	120
07018	Salt Marsh All Age	Co-ed.	Whole Day	II	Rural	86	200
07019	Sawyers All Age	Co-ed.	Whole Day	I	Rural	82	70
07021	Stewart Town All Age	Co-ed.	Whole Day	II	Rural	90	275
07022	Troy All Age	Co-ed.	Whole Day	III	Rural	80	260
07025	Wait-A-Bit All Age	Co-ed.	Whole Day	IV	Rural	86	380
07028	Warsop All Age	Co-ed.	Whole Day	V	Rural	86	695
07009	Wilson's Run All Age	Co-ed.	Whole Day	I	Remote Rural	79	145
07003	Bellevue Primary and Junior High	Co-ed.	Whole Day	I	Remote Rural	85	180
07015	Lowe River Primary & Junior High	Co-ed.	Whole Day	IV	Rural	80	720
07034	Albert Town High	Co-ed.	Shift	III	Urban	82	810
07042	Cedric Titus High	Co-ed.	Shift	III	Urban	82	480
07035	Muschett High	Co-ed.	Shift	III	Rural	90	810
07032	Westwood High	Girls	Whole Day	II	Rural	97	325
07041	William Knibb Memorial High	Co-ed.	Whole Day	III	Urban	95	910
07046	Holland High	Co-ed	Whole Day	III	Rural	85	1,300

source: MOE website - http://www.moec.gov.jm/schools_website/PROFILE2001-2002.htm

Total number of publio schools in parish	**38**
Number of school operating on shift basis	**5**
Number of school operating above capacity levels	**22**
Number of school operating below capacity levels	**16**

4.4.5 Health.

At the time of the study, there was one Type Three health centre and a Doctor's office in the community of Duncans/Kettering. However, there was one hospital and a Type IV health centre in Falmouth which is approximately 13 kilometers to the west of the study area.

4.4.5.1 Other Public services

There are three police stations serving the subject area and its immediate environs (Duncan, Clarkstown and Rio Bueno**).** It is reported that the police station in Duncans is in need of repairs and the construction of a new station is being planned.

The fire station serving the subject area is the Falmouth Fire Station which covers the entire parish of Trelawny. The station is equipped with only one of the two required units and has a staff compliment of 41 firefighters – 30 less than the required amount. The existing fire station is in disrepair and fire service is being housed in temporary facilities, a permanent location is being sought.

4.4.6 Housing [3]

The 2001 Jamaica Population Census shows some 1,969 dwellings in the study area with the following breakdown:

- 1,725 separate detached houses
- 33 attached houses
- 211 other units

Of the 1,969 dwellings, some 1,411 units were made of concrete while a total of 182 units were made of wood. Another 98 units were made of concrete with wood or brick. Freehold tenure dominates the land tenure arrangements with 58% being owned and 38% rented or leased.

Since the 2001 census the housing stock has improved significantly with the ongoing construction of new housing units under the Duncan's Hill housing development , a sub-component of the Amaterra project and supported by the National Housing Trust (NHT).

3 Data under this heading came mainly from the 2001 Population Census of Jamaica, disaggregated at the level of the Enumeration Districts (EDs) covering the communities within the 2 kilometers boundaries of the properties.

The majority of households (54%) have access to piped water while 42% get water for domestic use from standpipes and catchments. The National Water Commission (NWC) supplies some 90% of the domestic water. The vast majority of the households (81%) use Liquid Petroleum Gas (LPG) as fuel for cooking, while 17% use wood, kerosene or charcoal. The remaining 2% was not reported.

The survey of the squatter community on the property found that 64% of the residents reported that their reason for living on the property was either that they could not find a place to rent (41%) or that they could not afford to pay rent (23%). This suggests that there is a historic and existing shortage of affordable housing in the project area.

4.4.7 Waste Disposal.

The 2001 population census data also show that the majority of residents (57%) in the study area[4] have indoor sanitary facilities and 55.4% have water closets, fixed bath and shower. Most of the houses in the Duncans/Kettering communities have their own sewage disposal system-typically soak-away pits. Many of the households (48%) also have waste water pipes and sink facilities in their kitchen. The remaining households lacked these facilities. Regular weekly collection of solid waste is carried out by Western Parks and Market.

4.4.8 Community Fabric/Cohesion.

Outside of the church congregation not many other opportunities exist to foster community cohesiveness. Based on the socio-economic survey discussed above, there are limited opportunities for community interaction in any formal settings. Seventy-seven percent (79%) of the households surveyed reported that a community centre did not exist in their community. While 62% percent and 97% reported the absence of playing fields and recreational parks respectively.

Community cohesiveness was only notable in one organization which was the Fisherman's Cooperative operating on the fishing beach, this organization has approximately 150 members. No other community based organization or Non-governmental organization existed at the time of the survey. Only one community centre at Spicy hill was being development with support from

4 The Study area refers to all the communities within the 2 kilometers boundaries of the property.

the Jamaica Social Investment fund (JSIF). Discussions on the establishment of an organization for the elderly were also taking place among a few concerned members of one Community (Carey Park

4.4.9 Recreation & Tourism.

The tourism industry has had limited impact on the economy of Northern Trelawny (Falmouth and Duncans) when compared with Ocho Rios and Montego Bay. There has been some growth in the tourism industry in terms of rooms and employment mostly in the Falmouth area. The major resort developments include, Starfish Resort, Glistening Waters Inn and Marina, Braco Village Resort. Fisherman's Inn and a number of small guest houses in the town of Falmouth.

Within the 2 kilometers boundaries of the property, there are the Silver Sands and Duncans Bay resorts with Silver Sands having some 95 villas and Duncans Bay 75.

4.4.10 Cultural/Historical Properties.

Falmouth, which is some 13 kilometers from the site, has a large collection of Georgian Architecture and a recent project being developed by Heritage Trails has been working to protect, restore and renovate buildings and structures of architectural and historical significance. It is the view of the Honorable Custos of the parish, Roy Barrett, "that efforts in this project needs to be increased to use the cultural and historical aspects of the town for a niche in the tourism market". Specific historic sites in the area include, the ruins of Stewart Castle, the Slave Hospital in Orange Valley, and the caves in Windsor. It is also generally felt that the rich historic and cultural properties that are linked to the Town and the communities around the project area are virtually untapped, and that the Amaterra development could stimulate the development of these as tourist and educational attractions. In this regard, one of the important initiatives of Amaterra developers is the plan to manage the Stewart Castle site as a tourist attraction through a long-term lease arrangement with the National Heritage Trust.

The site is comprised of the ruins of a cut stone mansion that became known as Stewart Castle. According to the National Heritage Trust, the building was originally fortified for protection against attack and there are loopholes for the fire muskets placed strategically around the entire building.

4.4.11 Land Use.

4.4.11.1 Description of the Site

The subject lands are located along the northeast boundary of the parish of Trelawny. The property is bounded to the north by the Caribbean Sea and stretches along the coastline and goes inland for approximately 2.5 km.. Silver Sands Estate Resort, a tourist resort consisting of approximately 95 villas, bound the subject lands to the east. To the west of the property there is an abandoned industrial salt mining factory[5], Jamaica Salt Works. The residential communities of Stewart Castle, Carey Park, Duncan's Hill, Kettering and Duncan's Town Centre abut the southern boundary of the property. (See Map B in Appendix 6)

A squatter settlement consisting of 22 households is located on the southwest portion of the property. Along the eastern boundary of the property there is evidence of an inactive quarry mining operation. Local residents currently use the beach for recreational purposes. Several fishermen residing in the surrounding communities often use the site to access the fishing beach east of the property. Bird shooting which was done on the property in the past has been discontinued for some 5-6 years now as the Shooting Right held by the Trelawny Gun Club was taken away by the Amaterra developers. The remaining lands are vacant and are characterized by a variety of grass, shrubs, trees and open rock.

Within a two kilometers radius of the property there are the residential communities of Coral Springs, Spring, Stewart Castle, Carey Park, Duncan's Hill[6], Shawsmith Prospect, Simpson, Spicy Hill, Crawle, Windsor and Kettering. Within these communities there are 8 churches, 4 schools (3 basic and 1 all-age), 3 tourist accommodation resorts, several commercial shops, 3 public utilities sites, one doctor's office a health centre, one informal football field and one

5 The factory has been abandoned for over 30 years.
6 Duncan's Hill is an on-going residential development funded largely by the NHT.

library (see Table 19 below). The North Coast Highway runs along the southern section and bisects the property. The Derby Beach Fishing Village is to the northeast of the property and is used by over 100 fishermen.

Table 19 Land Use within a 2Km Radius of the Subject Land

Land Use Code	Land Use	No.	Comments
RES			
OFF	Offices		1 Doctor's Office
IND	Industrial		
INST	Institutional	2	1 Police Station, 1 Post Office, 1 Health Centre
PA	Public Assembly (place of worship)	8	1 Methodist, 1 Pentecostal, 1 Anglican, 1 Seven Days Adventist, 1 Baptist, Tabernacle, Shield of Faith,
EDU	Educational	4	3 Basic Schools & 1 All-age
REC	Recreational	1	Informal football field
RES/COM	Residential & Commercial Mixed Use	7	Mainly house shops attached to or operating from within the residence
RES/IND	Residential & Industrial Mixed Use	1	Carpentry and residential land use on site
RST	Resort	3	Silver Sands, Duncan's Bay,
U	Utilities	4	1 Cable & Wireless cell site, 1 JPS Co substation and two public water tank

4.4.11.2 Profile of the Squatter Community found on the property

A census of the squatter community found on the property was taken between April 13 - 18 2005. This revealed a total of 22 households and 89 residents. This translates to a household size of four persons per household. Approximately 50% of the residents are children (age 0 to Less than 18 years old). Some 50 % of the household heads reported marital status as single while 32% were reported to be in Common-law relationship. Only 14 % was said to be married. In

terms of the length of time residents were living at the site, Just about 77 % of the households reported to have been living on the property for 10 years and over.

The employment status of the residents at the time of the census shows that Just about 18% of the households was unemployed. Another 14% was reportedly self-employed.The most prevalent occupation was that of construction/builder accounting for another 18% of the household members. The other occupations found were similar to those found in the wider communities in the two km boundaries of the property (waitress, carpenter, domestic help/housekeeper, fisherman, day labourer, electrician merchandiser and maintenance). None of the residents fell in the professional occupational category.

All residents live in fairly well constructed houses, with construction material, for the most part, consisting of a combination of concrete and wood (ply-board) and zinc sheets. Only one dwelling was found to be fully constructed of concrete and zinc sheets. All of these houses were reportedly constructed and owned by the residents.

4.4.11.3 Development Planning

The Amaterra property falls outside of the Greater Falmouth Development Plan. However, the most recent Development Order for Trelawney, had zoned the general area, inclusive of this property for resort development. As at the time of the study therefore details of the development standards for the area were not available either from the Greater Falmouth Development Plan or the earlier Trelawny Development Order.

4.5 Hydrogeology

For ***Basin1***, the drainage area is 7.7 square kilometers. The ***Project Area*** occupies 88% the Johnson sub-basin and 11% of the northern section of the Kettering sub-basin. The total flow through the area is comprised of the localize surface runoff over the Johnson and Kettering sub-basins and the combined flows of Retirement and Duncans to of the depression east of Carey Park, depicted as R260 in table 20. The magnitude of these flows for the 10-, 25- 50- and 100-year return periods are shown in the table.

The table also shows that the peak flows and runoff volumes for the post project scenario are significantly greater than the pre-project conditions in the Kettering and Johnson sub-basins. The Peak flows in the Johnson sub-basins will increase almost threefold with a doubling of the runoff volumes. The simulated peak discharges and runoff volumes should be used to review the adequacy of the existing drainage of the Silver Sands community and to revise the design if necessary.

The depression east of Carey Park serves as a natural detention pond for controlling the extent of flooding to the north. As shown in the table 20, the 10-yr peak flow at JR210 (which represent the combined flows of Duncans and retirement) of 6.7 m^3/sec is significantly smaller than the peak flows 0.42 m^3/sec at R260, representing the flow from the depression. This is the case for all the designated return periods and underscores the importance of the depression in attenuation flood flows. It is therefore reasonable to assume that proposed development should not be allowed to encroach the depression area.

Table 20 Results of Basin1 Hydrological Simulation

Hydrologic Element	Drainage Area (sq km)	Return Period							
		10-year		25-year		50-year		100-year	
		Peak Flow (m^3/sec)	Volume of Runoff (1000 m^3)	Peak Flow (cms)	Volume of Runoff (1000 m^3)	Peak Flow (cms)	Volume of Runoff (1000 m^3)	Peak Flow (cms)	Volume of Runoff (1000 m^3)
Basin1									
Retirement	1.211	3.5	32.56	5.6	53.166	3.43	82.439	11.20	105.66
Duncans_W	1.443	3.3	36.481	5.6	60.349	9.11	94.49	11.34	121.7
JR210	2.654	6.7	60.04	11.0	113.52	17.82	176.93	22.44	227.36
CareyParkE	0.494	1.4	11.729	2.4	19.664	4.06	31.095	5.02	40.245
Depression	3.18	0.42	39.22	0.82	74.9	1.46	131.0	2.03	178.21
R260	3.148	0.42	39.22	0.82	74.9	1.46	131.0	2.03	178.21
Kettering	4.013	6.6 (8.6)	107.9 (125.0)	11.1 (13.8)	176.18 (198.5)	17.56 (21.1)	273.19 (301.03)	22.15 (26.2)	350.15 (381.5)
JR70	7.161	12.9	188.66	21.8	309.36	34.68	481.21	43.58	617.76
R70	7.161	12.8	188.66	21.8	309.36	34.58	481.21	43.46	617.76
Johnson	0.53	0.86 (3.2)	10.47 (24.9)	1.6 (4.4)	18.249 (36.5)	2.65 (6.4)	29.691 (52.0)	3.39 (7.4)	38.974 (63.9)
Salt Pond	7.691	7.34 (16.6)	199.14	12.47	268.7	20.0	433.0	25.46	566.22

6.6 (8.6) ….. Pre and post project flows

For ***Basin2,*** the flows impacting the ***Project Area*** constitute flows through reach R30, generated from the southern section of the basin, and the flows generated over the Stewart1, WS Park and Clermont sub-basins. The Landuse change associated with the post project conditions (i.e. the development of 50% of Stewart1, 100% of WS_Park and 60% of Clermont sub-basins) will give rise to significant increases in the peak flows and runoff volumes over these sub-basin for the 10-, 25- 50- and 100-year return periods as shown below in table 21.

The peak discharges and runoff volumes should be used to review the existing drainage system and to inform the design of an adequate drainage for this section of the Project Area..

Table 21 Results of Basin2 Hydrological Simulation

Hydrologic Element	Drainage Area (sq km)	Return Period							
		10-year		25-year		50-year		100-year	
		Peak Flow (cms)	Volume of Runoff (1000 m^3)	Peak Flow (cms)	*Volume of* Runoff (1000 m^3)	Peak Flow (cms)	Volume of Runoff (1000 m^3)	Peak Flow (cms)	Volume of Runoff (1000 m^3)
Glamorgan	0.54	1.00	11.7	2.0	20.4	3.43	33.5	4.29	42.98
Simpson	0.391	0.11	2.37	0.39	5.88	0.94	11.78	1.34	16.47
JR190	0.931	1.05	14.1	2.32	26.2	4..28	45.31	5.53	59.46
R190	0.931	1.01	14.1	2.32	26.2	4.18	45.31	5.40	59.46
W_Refuge	0.67	1.51	18.4	2.81	30.6	4.55	48.5	5.57	61.12
E_Refuge	0.553	1.19	15.2	2.24	25.2	3.62	40.0	4.44	50.44
JR170	2.154	3.70	47.7	7.29	82.2	12.31	133.8	15.36	171.0
R170	2.154	3.70	47.7	7.29	82.2	12.31	133.8	15.36	171.0
Dry_Valley	1.99	3.92	54.7	7.45	90.8	12.07	144.0	14.84	181.5
Stewart2	0.386	1.51	17.4	2.40	26.2	3.51	38.5	4.11	47.9
JR140	4.53	9.02	119.7	17.0	199.1	27.68	316.3	34.06	399.5
R140	4.53	9.02	119.7	17.0	199.1	27.68	316.3	34.06	399.5
Stewart4	0.103	0.95	5.86	1.33	8.5	1.85	12.03	2.09	14.4
Carey_Park	1.562	1.88	31.4	3.98	55.7	6.92	92.7	8.80	119.5
JR130	6.195	10.9	157.0	21.1	263.3	34.7	421.1	43.0	533.4
R130	6.195	10.8	157.0	20.8	263.3	34.2	421.1	42.5	533.4
Stewart1	0.425	0.07 (1.0)	2.12 (13.1)	0.23 (1.78)	5.54 (21.2)	0.58 (2.81)	11.7 (33.1)	0.85 (3.42)	16.57 (41.36)
Stewart3	0.342	1.46	15.4	2.30	23.2	3.35	34.2	3.91	41.62
JR30	6.962	11.9	174.5	22.7	292.1	37.3	466.9	46.2	591.6
R30	6.962	11.6	175.5	22.1	292.1	36.3	466.9	45.0	591.6
WS_Park	1.295	1.83 (9.1)	31.7 (87.3)	3.54 (12.7)	53.9 (122.6)	5.91 (17.2)	86.9 (170.0)	7.40 (19.3)	110.5 (200.8)
Clermont	1.18	2.20 (4.33)	40.4 (62.1)	3.80 (6.70)	64.2 (91.3)	5.92 (9.55)	98.4 (131.0)	7.22 (11.1)	122.2 (157.9)
JR10	9.437	15.4	246.3	29.3	410.2	47.9	652.3	59.3	824.3
R10	9.437	15.4	246.3	29.3	410.2	47.9	652.3	59.3	824.3
Outlet	9.486	15.5 (22.0)	248.0 (336.3)	29.3 (38.0)	412.4 (524.0)	48.0 (58.6)	655.8 (792.4)	59.4 (71.0)	828.7 (979.6)

6.6 (8.6) **….. Pre and post project flows**

For ***Basin3,*** the sub-basins StewartBay2 and StewartBay3 are the ones that will significantly impact the ***Project Area.*** StewartBay1 is of insignificant size and is close to the sea. The Landuse change associated with the post project conditions (i.e. the 100% development of StewartBay2 and StewartBay3) will give rise to significant increases in the peak flows and runoff volumes over these sub-basin for the 10-, 25- 50- and 100-year return periods as shown below in table 22.

The peak discharges and runoff volumes should be used to inform the design of an adequate drainage for this section of the Project Area.

Table 22 Results of Basin2 Hydrological Simulation

Hydrologic Element	Drainage Area (sq km)	Return Period							
		10-year		25-year		50-year		100-year	
		Peak Flow (cms)	Volume of Runoff (1000 m^3)	Peak Flow (cms)	*Volume of* Runoff (1000 m^3)	Peak Flow (cms)	Volume of Runoff (1000 m^3)	Peak Flow (cms)	Volume of Runoff (1000 m^3)
StewartBay1	0.019	0.39 (0.36)	1.423 (1.28)	0.51 (0.47)	1.959 (1.80)	0.66 (0.63)	2.86 (2.48)	0.71 (0.68)	3.13 (2.95)
StewartBay2	0.33	1.13 (2.60)	13.79 (22.5)	1.86 (3.64)	22.40 (31.53)	2.76 (4.89)	39.28 (43.6)	3.26 (5.48)	38.56 (51.6)
StewartBay3	0.40	0.28 (0.99)	12.20 (26.8)	0.46 (1.40)	19.81 (31.6)	0.73 (1.94)	39.11 (52.0)	0.91 (2.24)	38.61 (61.5)
Sea	0.75	1.21 (2.82)	27.40 (50.51)	1.95 (3.97)	42.9 (70.9)	2.90 (5.39)	65.0 (98.1)	3.43 (6.10)	80.8 (116.2)

6.6 (8.6) **….. Pre and post project flows**

5.0 STAKEHOLDERS AND PUBLIC CONSULTATION

Discussions were held with an identified list of stakeholders. These included: the Member of Parliament for the area, the Custos of Trelawny, the president of the Chamber of Commerce, members of the management of the Parish Council, the NEPA representative for the area, a representative of the Beach Control Authority, and representatives of the Fisherman's Cooperative in the area. The Stakeholders consultations also covered the socio-economic survey of the residents (a purposive sample of 40 residents) of the adjoining communities. The interviewees were excited, as it was generally perceived that the development would benefit the Parish of Trelawny and the Duncans to Falmouth area in particular. The negative and positive impacts as perceived by these stakeholders are as discussed in Section 6.4 ..

6.0 ENVIRONMENTAL IMPACT ASSESSMENT

6.1 Environmental Chemistry Impacts

a) Present Impact

From baseline data collected it as well as field observations, coastal water quality as well as air quality in the vicinity of the proposed project site are good.

The **criteria air pollutants measured (PM_{10}, NO_2, and SO_2)** were all within or close to the NRCA ambient standards at the time of sampling. These results were in keeping with the absence of any industrial or development activity close to most of the monitoring sites. The highest value which was determined for Stewart Castle is likely due to the fact that the sampler was located near to a denuded area. The other significant level which was determined at Silver Sands quite likely reflects the fact that some land clearing had been done in this vicinity.

The Nitrate level in **ground water** 0f 3.6mg/l was well below the drinking water standard of 10mg/l. Phosphate level was similar to that determined in coastal water. These levels in addition to the absence of faecal coliform indicated that ground water was not contaminated by sewage. The high conductivity however indicated significant sea water intrusion. The level of salinity detected suggests that this water would be classified as Class 4 irrigation water. Use of this class

of water for irrigation could lead to accumulation of salt in soils and sensitive plants would have difficulty obtaining stands. It should be noted that sampling was carried out during a relatively dry spell when the ground water level was low. This could change significantly during a wet period.

The presence of faecal coliform at Jacob Taylor Beach suggests that there is the possibility of a local source of sewage contamination. The fact that the level is well below the interim standard for recreation waters suggests that the problem is not yet significant. The levels of nutrients (nitrate and phosphate) determined at the coastal sites though within the interim standards are close to the upper limit suggesting that any increase in these levels may lead to conditions which do not favour coral reef growth.

From the short term monitoring carried it impact from noise at the residential/ rural sites monitored was minimal and associated mainly with the intermittent movement of vehicles. Background values (no human activity) were typical of literature values for quiet surroundings falling well below the lowest level in the US Dept of Labour regulations for permissible noise exposures.

Levels encountered at sites close to the highway impacted much more frequently by traffic and by highway construction activities nevertheless had maximum noise levels around 10% lower than the lowest level in the US Dept of Labour regulations for permissible noise exposures.

b) Projected Impact

The proposed development will involve activities that could lead to changes in coastal water quality as well as air quality.

Changes to local air quality issues could be associated mainly with the movement of heavy duty equipment in the area and earth moving activities. As with all land conversion operations there could be significant generation of fugitive dust/particulate matter. The generation of noxious gases from traffic is expected to be minimal especially given the location.

Changes to coastal water quality could be associated with changes in the run off characteristics of the area and the use of fertilisers to maintain landscaped areas. Changes could also be due to the possible discharge of treated/untreated sewage. Increased fresh water run off as well as increased nutrient input could lead to disturbing of the ecological balance and deterioration in conditions necessary for coral reef growth. This could lead to the proliferation of nuisance species of marine organisms at the expense of coral growth.

The **noise** readings obtained for Stewart Castle near the North Coast Highway and Duncans Hills are typical of the impact from regular flow of traffic (heavy and light-duty vehicles). These values should give a good indication of the type of sound levels that can be expected during the construction phase of the project. Given the nature of the proposed development, impact during the operational phase is not expected to be significant at a distance of 30m from construction activity. Based on spot measurements conducted, it is unlikely that average noise levels would be greater than around 60db with peak levels of not more than 80db at a distance of around 30m.

6.2 Ecological Impacts

The most significant impacts to the area as a result of this development are considered to be:

1) Siting of permanent buildings, temporary construction camps and materials storage areas that would reduce existing habitat for resident, migratory and endemic bird species as well as endemic species of plants and insects which presently serve as food for the birds.

2) Transportation of building materials through the area resulting in dust, fuel emissions and noise which can impact the natural flora & fauna esp. nesting birds. Increased noise levels and movement of people may also affect the willingness of particular species to feed or rear young in the area.

3) Paving and surfacing of roads and community areas; the laying of pipes for water and sewage would necessitate vegetation clearance on a large scale and cause direct as well as indirect loss of vegetation. Loss of vegetative cover will change drainage patterns and increase the base levels of water runoff from the site. This could also reduce the stability of steep slopes and expose thin

soil layers / patches to erosion with consequent loss of topsoil as well as the facilitation of unwanted flora and fauna.

4) Solid waste generated during construction could become a health hazard by the facilitation of undesirable species. Storage onsite prior to final disposal is a factor to be considered since abnormal weather conditions might distribute these products to other unsuitable areas.

5) During the post construction/occupancy period, solid wastes will also be of concern for reasons similar to those given above.

6) There is the potential for improperly maintained drainage systems to create areas of localised flooding and thereby periodically generate nuisance species of animals e.g. mosquitoes.

Ecological investigations of terrestrial flora and fauna indicate that other than the Jamaican Yellow Snake, no plant or animal species of unique or protected status are to be found on this property which might be significantly impacted by the proposed development. Of those species which likely to suffer negative impact, mitigative measures have been proposed to compensate which could actually enhance both the environment for avifaunal species and its subsequent use by stakeholders in the area.

The nearshore marine environment supports several small scattered seagrass beds, accompanying populations of urchins (*Tripneustes* and *Diadema* spp.) and small patches of coral (heads). The long term impact on these marine flora or fauna by the placement of groynes, excavated bays or pier structures is likely to be low. However, due to the already impacted and depressed state of the fish and coral populations in the area it is recommended that significant efforts be made to maintain and even facilitate the spread of existing local populations of flora and fauna.

6.3 Coastal Dynamics Impacts

In some areas (marked: on map C in Appendix 6) some excavation of the nearshore bedrock is proposed in order to re-establish a suitable beach-profile. The technique employed for excavation will rely mainly on the use of a hydraulic rock-hammer attached to a standard

excavator. In some cases a pipeline-trench digging machine will be utilized to accurately control the configuration of the coves.

In two of the cases however, because of the existing wave-refraction patterns and beach profiles already lend themselves to enhancement, shore connected groynes will be utilized to anchor and stabilize the coastline. These will be situated nearer the western end of the property and are shown on map C in Appendix 6. In this area waves approach the coast at an acute angle and sand transport is predominantly to the west. The groyne at the western boundary will therefore accrete sand on its eastern side, while the rocky nature of the coast further west will prevent erosion.

The groyne by the beach park (near A3) will act as a shore-connected breakwater and accrete sand on its western side by wave refraction. No erosion to the adjacent areas will result from the installation of this structure.

In some areas (marked:) some excavation of the nearshore bedrock is required in order to re-establish a suitable beach-profile.

6.4 Socioeconomic Impacts

6.4.1 Positive Impacts

The people of Trelawny on the whole welcome the development as they see it as the answer to their dream for the development of the area. From a commercial standpoint, there was general consensus among the stakeholders that the development would have a number of positive impacts on the immediate communities (2-5 kilometers) and even on the town of Falmouth approximately 13 kilometers away. In fact there is great anticipation among stakeholder that this development will be consistent and supportive of the Greater Falmouth Development Plan, which was prepared in 1998. In commenting on the proposed development, the president of the Trelawny Chamber of Commerce and Industry- Mr. Dennis Seivwright, wrote " I think this will be a welcoming development and will impact positively on the economy of the parish and to Duncans in particular".

Some of the positive impacts envisioned include:

e. **Employment:**

Infrastructure Stage. It is estimated that based on the planned cost of infrastructure of some US$50,000,000. The estimated labour cost is approximately US$2,000,000 per year spread over the next five years. With an average per job expenditure of approximately US$8,000 per year, about 250 new jobs will be created per year in the infrastructural development stage of the project.

The building works stage will see a total expenditure of US$800,000,000 over a twelve year period. This works out to an average US$65,000,000 per year. Based on this expenditure, it is estimated that some 2,500 jobs/year will be created in this phase of the project . This will bring the total number of jobs over the 12 year period of construction to some 30,000.

The Operational stage: A total number of 2000 hotel/resort rooms are being planned for the project as well as 2200 villa lots. Current projection is that there will be at least one new job created per room. Assuming one bedroom per villa This will give a total of at least 4,200 jobs per year as at full development of the project .

f. When connected to Harmony Cove and Oyster Bay/Glistening Waters, the development will enhance visitor arrival in the area and will add significantly to the attraction of the whole Silver Sands/Falmouth/ Duncan's area.

g. Significant enhancement of Job creation and employment opportunities as well as increased demand and market for the products produced by the pool of self-employed persons including fishermen in the project area.

h. The project area now suffers from an acute shortage of water linked to problems with their domestic water supply, which comes from the Charles Town system through the NWC. Although many households now have a piped water system in their homes, the water source through the NWC is inconsistent and unreliable. As a result residents of the area depend mostly on trucked water to fill public tanks or private household's containers. The trucked sources of water are also unreliable

and expensive. The residents over the years have therefore grown accustomed to water woes. The project will impact positively on the water situation in the area, as the Amaterra developers will co-finance a major water supply scheme to the tune of US$ 7.83. Million of a total cost of US$25.0 Million with the NWC. The project will receive one million gallons of water per day from this water scheme under the co-financing arrangement with arrangement with the NWC.

e. The developments planned for the Parish of Trelawny, including the Amaterra development, should give support to the development of the eco-tourism potential of the nearby attractions such as the Phosphorescent Lagoon at Glistening Waters, The crocodile farm in the swamp, and rafting on the Martha Brae River. These attractions now provide employment and income for many residents of the area. For example in 1998, the Rafting on the Martha Brae attraction employed at least 80 raft captains. Additionally, a number of craft vendors sell their craft at the raft stand and along the rafting route.

f. The Project also plans to manage the Stewart Castle historic/heritage site as a tourism attraction through a long-term lease of the site from the National Heritage Trust.

g. There is general consensus among the various stakeholders, including the Trelawney Chamber of Commerce, that the development will bring significant improvements to the physical infrastructure and amenities as well as the commercial activities in the Study area. This view is supported by the following aspects of the Amaterra development as planned:

- The creation of a new town centre including, business park, convenience stores, warehousing, gas station and plaza. This will provide a commercial hub that will mitigate much of the negative impacts associated with the new north coast highway given that this highway by-passes the existing urban centres of Rio Bueno, Duncans and Falmouth.
- The Amaterra developers have also set aside lands for the construction of community centre, church and school in the study area as well as Administrative and municipal buildings including police and fire stations.

- The fishermen in particular were happy as they saw more potential for selling fish and lobster although they can barely cope with the present demand .
- Improved transportation and access to the area and the hotels is envisioned.
- It is also generally felt that the development will stimulate and even hasten the ongoing development of the Falmouth area.

6.4.2 Negative Impacts

The major negative impacts envisioned from the development as perceived by the stakeholders are as discussed below.

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i) The development will bring further pressure on the already strained infrastructure and amenities of the study area.

j) There is a concern about some 22 households that are currently located on the property. The group of squatters was taken to court and has been served with Court Orders to vacate the property. The developers have so far evicted three of those who were served court orders, in order to proceed with some development/maintenance activities on the property.

k) Restricted access to the beaches by the Fishermen when going to sea will negatively affect their fishing business.

l) The fishermen envision destruction of fish breeding grounds and turtle nesting areas.

m) Pollution of the environment through dynamite blasting.

n) The fishermen felt that the development will prohibit them from rearing their animals and for conducting other agricultural activities thus impacting negatively on their livelihood.

o) Increase in crime and violence in the area, as it would have many persons outside the area coming in to do business there.

p) Generally the fishermen felt powerless to stop any development that would adversely affect their livelihood.

6.5 Hydrogeological Impacts

The entire study area has a drainage area of approximately 18.0 square kilometres (4,448 acres) and constitutes three distinct sub-basins of areas 7.7, 9.5 and 0,8 square kilometres (1903, 2422 and 185 acres). Field reconnaissance confirmed no perennial stream in the area; however each sub-basin is characterized by well defined drainage networks for discharging flood flows. The impermeable nature of the geologic strata of the area would make it vulnerable to floods of the higher return period rainfall.

The flooding impacts associated with the development are as follows;

iv) The ***Basin1*** area that is designated for project development will experience significant increase in peak flows and runoff volumes and may pose a flooding threat to the existing community at Silversands.

v) Flooding of the north of the ***Basin1*** area will be aggravated if the depression east of Carey Park that serves as a natural detention pond for controlling the extent of flooding is encroached by the proposed project development area.

vi) For ***Basin2*** and ***Basin3,*** the proposed project development will also give rise to significant increase in peak flows and runoff volumes. These however should not have any negative flood impact on the environs but may create problems for the development area itself.

7.0 ASSESSMENT OF ALTERNATIVES TO PROJECT

7.1 Alternative 1: Without Project Scenario

The without project scenario from a socioeconomic perspective would mean that the use of the site continues in a marginal manner with substantial underutilisation of resources. This alternative was the least favourable.

7.2 Alternative 2: With Project Scenario

The with project scenario contributes toward a national goal to expand the opportunities for Tourism Development, add to housing stock, provide for a diversified recreational product with heritage components, and a foreign exchange earner. According to the parish of Trelawny Development Order, 1980 the parish has potential for resort development and, New Falmouth,

Silver Sands and Rio Bueno were proposed locations for expansion. The Amaterra development site lies between New Falmouth and Rio Bueno and is one of the boundaries of Silver Sands. The property therefore falls well within the areas proposed for resort development by the Development Order. The Development Order also identified and documented a large number of historic sites, historic buildings and national monuments in the general area including the site for the Amaterra development project.

Located about midway between the two major tourist/resort centres (Montego Bay and Ocho Rios) on the north coast, the Amaterra property can be said to lie in the heart of the tourism belt. The developers' proposals for the property features an integrated development with a strong tourism component, comprising some 2,000 hotel rooms, 2,200 villa lots, an 18 hole golf course, bathing beaches, commercial and housing developments as well as a number of attractions. This development would also be compatible with the existing and future planned land uses. The developers have already started the Duncans Hill housing scheme which to date has provided 550 lots out of a proposed 900 planned for primary and middle income housing. Significant forward and backward linkages associated with the local sourcing of construction material and employment opportunities during construction would be created. Other advantages include the maintenance of open space areas via the golf course and woodlands.

The discussion of alternative options for the development of this property is based on the Economic and Social Survey of Jamaica (ESSJ), 2004. This document identifies the major productive sectors in the Jamaican economy as:

- Agriculture
- Mining and Quarrying
- Manufacturing
- Construction and Installation and
- Miscellaneous Services under which the tourism sub-sector falls.

The "Construction and Installation" and "Miscellaneous Services" sectors are both involved in the "With Project" Alternative, hence subsequent discussion will be based on the alternatives pf Agriculture, Mining and Quarrying and Manufacturing.

7.3 Alternative 3 : Agriculture

The size of the Amaterra Development property (some 870 acres) would suggest agriculture as a logical option for the development of this property. However, the land capability, the soils and the climate of the area are not suited to the development of viable agricultural enterprises. The area suffers from low rainfall while its physical characteristics in terms of soil types and land capability classifications are serious constraints to agricultural production. Agriculture is therefore not considered to be a viable development option for this property.

7.4 Alternative 4: Mining and Quarrying

The land-use information shows that the site consists mainly of limestone shrub forest with limited opportunity for mining and quarrying. In addition, the areas zoned for Bauxite and Conservation (BC) under the parish of Trelawny Development Order, 1980, fall well outside the site for development under the Amaterra Development Project. For these main reasons, Mining and Quarrying are not options that could be considered for this site.

7.5 Alternative 5: Manufacturing

Manufacturing is not a strong competitor for the Amaterra Development site for the following main reasons:

- Small and medium scale manufacturing which is typical of the Jamaican economy is an intensive activity requiring much less land that that which is being proposed for the Amaterra Development.
- The area is not readily accessible to cheap sources of raw material and labour which are the main prerequisites for viable and competitive manufacturing businesses.

From the foregoing discussion, it can be seen that alternatives to the proposed Amaterra Development are constrained not only by the Trelawny Development Order but by the geographic location, the climate (especially rainfall), land capability and soil type.

8.0 RECOMMENDED MITIGATION AND MONITORING

8.1 Environmental Chemistry

A mitigation plan to minimise impact of the development on air and water quality should focus on minimising the impact of fugitive dust on the surrounding communities as well as taking steps to minimise impact on coastal water quality. This could include but not necessarily be restricted to the following:

- Regular sprinkling of haul roads and other sources of probable fugitive dust near to communities/receptor sites.
- Covering of basement material of marl, gravel etc to limit dust generation.
- Create a sod farm to provide material for the fairways and greens. The suggested sequence of activities for course development should be land clearance, basement preparation, and sod placement. All these steps should be carried out at a specific location before commencement of work at another site. This would limit the areas of the course construction exposed to the effect of wind, which could generate dust.
- Monitoring of coastal water quality during and after construction to track any changes in levels of nutrients, TSS and bacteria.
- Monitoring of ground water quality over the long term to determine suitability for use as irrigation water without leading to build up of salt in soil.
- The allocation of adequate land area to allow containment of surface run off to allow recycling especially for irrigation. Containment areas should be adequately lined to prevent seepage into the aquifer.
- Monitoring of the development to ensure compliance and the early identification of negative trends

8.2 Ecology

3. Increase the size of green / natural forest areas with appropriate siting so as to be as close as possible to existing areas favoured by current avifauna.

4. Temporary storage of solid waste on-site in a manner that will resist pollution of adjacent areas until it can be transported to an approved dump site.

4. A specific search and capture operation for snakes should be carried out in areas designated for clearing of vegetation either for golf course, building, construction or access purposes to allow for translocation of these specimens to other /remaining green areas.

5. The footprint areas for the proposed shoreline structures (inclusive of a 5m buffer zone) should be carefully examined immediately before the commencement of construction for the purpose of identifying the presence of any corals, urchins or growing margins of seagrass beds and relocating them to suitable sites nearby.

8.3 Socio-economics

The main mitigation measures as they relate to the socioeconomic assessment are as discussed below:

a) An important mitigation measure arising from the socio-economic assessment relates to the residents now squatting on the property. Notwithstanding the fact that the squatters have been ordered by the courts to vacate the property, the developers have identified the nearby Steelfield Housing Development Project as a possible option for the squatters and have initiated discussions on the matter with the sitting member of parliament for the area as well as with the project authorities- the National Housing Corporation (NHDC). The Steelfield Housing Development Project is one of the Government's low income housing projects being implemented by the National Housing Development Corporation (NHDC). Lots are currently being offered for sale. This initiative could provide the squatters an option for relocation and hence reduce tensions, animosities, dislocation and trauma that could arise from the forced but legal eviction.

b) The involvement of community leaders in the detail planning and implementation of the planned facilities could serve to mitigate the feared isolation, exclusion and possibly alienation of the local residents by the upscale development aspects of the project. Additionally, the existing shopkeepers and other small business entities may be invited to become business owners in the new town centre being planned as part of the development.

c) Coordination of all the development projects to maximize the impacts on the area, rather than duplicating offerings etc.

d) A monitoring plan would need to be devised to be implemented at the construction and operational phases of the project, to ensure adherence to recommendations made to mitigate negative impact factors.

e) With respect to the negative impact of the development on the physical infrastructure and amenities of the study area, various steps are either planned or in progress to reduce these impacts. These include:

i) A major water supply scheme (Martha Brae/Duncans Water Supply) is being undertaken by the NWC at a cost of US$25 million. The Developers will co-finance this to the tune of US$7.83 million. This will not only mitigate the impact of the development on the existing water supply system, but will bring substantial improvements to the existing system, which as discussed above is currently under severe stress.

ii) The North Coast Highway, which bisects the property, will significantly improve access and transportation to the area.

iii) The Falmouth hospital has recently been upgraded and is now 2007 compliant

iv) School places have recently been significantly increased with the addition of three new schools in the area.

v) The fire service and police Command centre in Falmouth have been significantly strengthened while plans are in place to upgrade the existing police station in Duncans. The Amaterra developers have set aside lands for the construction of these municipal facilities.

vi) It is planned that the possible construction component will conform to the Georgian architecture that characterizes the historic buildings in the Greater Falmouth area.

8.4 Hydrogeology

v) The ***Basin1*** drainage network that is to be designed should be dimensioned based on the simulated flows in table 19 for Johnson, Kettering and R260. At least the 50-year return period flows should be considered. The culvert at location 5 should be re-assessed to determine its adequacy to discharge flows of Kettering and from the depression for the 50- and 100-year event.

vi) Only open space development e.g. golf course or lawns should be allowed in the depression area of ***Basin1***.

vii) For ***Basin2*** the drainage network should be dimensioned based on the simulated flows in tables 20 for at least the 50-yr return period. The relevant one would be the flows through reach R30, generated from the southern section of the basin, and the flows from the Stewart1, WS Park and Clermont sub-basins.

viii) For ***Basin3,*** the entire area will be developed and hence all the peak flow and runoff volumes over the entire basin should be considered.

8.5 Mitigation Costs.

The main costs here would be in the area of mitigation of Air Quality, Water Quality and Ecological Impacts. In this section only crude estimates for mitigation costs are presented as these costs would be part of the contractors contract sum.

Plans for the development already include provisions for a sod farm so the costing for this is not included here. In mitigation of Air Quality impacts, the major cost elements would relate to the deployment of sprinkler trucks and other dust control methods such as tarpaulins and would vary drastically depending on the stage of the construction. This could cost approximately J$5,000.00 to $8,000.00 per day. Monitoring of coastal and ground water quality would cost between J$60,000 and J$180,000 per month, depending on the frequency required by NEPA.

In the mitigation of Ecology impacts, the selection of appropriate green areas would be incorporated in the detailed planning for the development. The cost of the search and capture of the snakes and the examination of the footprint of the coastal work would vary depending on the final design, but could cost between J$120,000 and J$200,000.

The costs for the suggested Socio Economics and Hydrology mitigation would not be additional to the base cost for the development as they require only that these factors be taken into account during the detail planning stages.

8.6 Monitoring Programme and Management Plan.

A draft monitoring Programme for this project is located in Appendix 2.

A draft management Plan for the development is located in Appendix 4.

9.0 LEGISLATIVE AND REGULATORY FRAMEWORK

9.1 Responsible Authorities

The responsibility for regulating and facilitating environmentally sound development lies with several authorities. The principal agency responsible for environmental matters is the National Environment and Planning Agency (NEPA) of the Ministry of Environment and Housing. This agency administers the Natural Resources Conservation Authority Act (1991), which allows the Authority, the Board to which NEPA reports, to request an environmental impact assessment in addition to the requirements of the Permit and Licensing System for development or construction considered likely to have an adverse effect on the environment. Failure or refusal to submit the documents is an offence under the law.

The Environmental Health Division (ECD) of the Ministry of Health administers the Public Health Regulations (1976) under which air, soil and water pollution control standards are established and monitored. A full application for approval of sewage treatment plans may be made to the EHD, which will input into the detailed application to be approved by the NRCA before authorizing any development. The EHD and local planning authorities monitor

construction work to ensure that all development restrictions and requirements are properly adhered to.

In addition, there are Parish Acts and guidelines of local significance, including the Local Improvements Act (1944). However, whereas general approval under the Parish Councils Act is needed for building permits, the UDC Act supersedes all other legislation in the UDC designated areas. The construction of all buildings must comply with the Building Code. The Ministry of Environment and Housing (developed by ASCEND, 1996) and the Town Planning Department have manuals which provide guidelines and planning standards for housing developments. The national planning enforcement authority is the Town and Country Planning Authority (TCPA) which is now part of the NEPA.

9.2 Planning and Environmental Legislation

Natural Resources Conservation Authority (NRCA) Act

The Natural Resource Conservation Authority (NRCA) Act allows the Authority to request an environmental impact assessment for development or construction considered likely to have an adverse effect on the environment. A permit is required from the NRCA for the undertaking of any activity within certain prescribed categories. A permit to operate is required by any new development, construction or modification of any works enabling the discharge of trade or sewage effluent into the environment under Sections 9, 10 and 12 of the NRCA act. This Legislation referred to includes:

- The NRCA (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order.
- The NRCA (Permit and Licence) (Forms, Processing and Fees) Regulations

Failure or refusal to submit the required documentation shall constitute an offence. In general, planning permission must first be sought from the NRCA. The NRCA Act is currently administered by the National Environment and Planning Agency (NEPA).

Public Health Act (Air, Soil, and Water Regulations)

The Public Health Act (1974) specifies that persons responsible for any construction, repair or alteration and grit removal facilities, treatment ponds, sludge handling and disposal, and outfalls. It also deals with issues such as emergency power facilities, fencing and appropriate signage around the treatment ponds.

The Watershed Protection Act

The Watershed Protection Act (1963) was enacted to provide protection for watersheds and adjoining areas and by that means promote the conservation of water resources. The Amaterra development is located within the Martha Brae Watershed Management Unit, one such designated watershed area. The Watershed Protection Commission, established by the Act, can make relevant regulations restricting the planting of crops, the felling an destruction of trees, and the clearing of vegetation within watershed areas.

The Town and Country Planning Act

The TCPA formulates and coordinates strategic plans for area development in the form of Development Orders consistent with the Town and Country Planning Act (1975). This act is now administered by NEPA, and the NRCA board functions as the Town and Country Planning Authority

The Housing Act

The Housing Act (1973) requires that any proposal for the subdivision of land and the construction of houses thereon be accompanied by a plan of the area inclusive of, but not restrictive to, the following:

- the manner in which it is intended that the area shall be laid out, in particular, the land intended to be used for the provision respectively of houses, roads and open spaces for public and commercial purposes;
- the approximate area of the land;
- the approximate number and nature of the houses and other buildings to be provides;
- the average number of houses to be constructed per acre;
- particulars relating to water supply, drainage and sewage disposal.

The Beach Control Act

The Beach Control Act (1956) states that no person shall be deemed to have any rights in or over the foreshore of the island or the floor of the sea and all rights over the foreshore of the island and the floor of the sea are declared to be vested in the Crown. Additionally, no person shall encroach on or use, or permit any encroachment on or use of, the foreshore or the floor of the sea for any public purpose or for or in connection with any trade or business, or commercial enterprise without a licence granted under this Act. This act is administered by NEPA.

The Tourist Board Act

This Act states that no person shall operate or maintain any tourism enterprise unless such person is the holder of a licence.

Other Significant Legislation and Policies

Other significant legislation includes the Tree Preservation Order which provides for the protection of all trees from destruction or mutilation of any kind, except with the express permission of the local planning authority. The Wildlife Protection Act (1981), and the Forestry Act (1983) are also relevant to the proposed undertaking.

National Land Policy (1996)

This policy establishes the framework to enhance the efficient planning, management, development and use of land. It is comprehensive in order to achieve complementary and compatible development which is in harmony with economic and socio-cultural factors.

Chapter 3 of the National Land Policy includes rural development and the protection of watershed and fragile areas, exploitation of mineral resources, and crop and livestock production.

Section 3.5.2 (Tourism) states that Government has adopted policies to:

#1. Improve physical planning and infrastructure development in resort areas;

#6. Ensure the preservation and or development as well as access by all to public open spaces and recreational areas.

Section 4.2.2 (Land Access) states that Government will seek to:

#1. Reduce the incidence of squatting by eviction, relocation, regularization and upgrading of infrastructure where necessary;

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APPENDIX

Appendix 1 – Terms Of Reference

Appendix 2 – Monitoring Plan

Appendix 3 – Ecology

Appendix 4 – Environmental Management Plan

Appendix 5 - Impact Matrices

Appendix 6 – Maps

Appendix 7 - Sewage Treatment

Appendix 8 – Socio Economics

Appendix 9 – Correspondence

Appendix 10 – Project Personnel

APPENDIX 1 - TERMS OF REFERENCE

The Strategic Environmental Impact Assessment should:

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

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

Task #1. Description of the Project

Provide a comprehensive description of the project, noting areas to be reserved for construction and landscaping, areas to be preserved in their existing state as well as activities and features which will introduce risks or generate impact (negative and positive) on the environment. This should involve the use of maps, site plans, aerial photographs and other graphic aids and images, as appropriate, and include information on location, general layout and size, as well as pre-construction, construction, and post construction plans. For projects to be done on a phased basis it is expected that all phases be clearly defined, relevant time schedules provided and phased maps, diagrams and appropriate visual aids be included.

Task #2. Description of the Environment

This task involves the generation of baseline data which is to be used to describe the study area as follows:

i) physical environment

ii) biological environment

iii) socio-economic and cultural constraints.

It is expected that methodologies employed to obtain baseline and other data be clearly detailed.

Baseline data should include:

(A) Physical

i) A detailed description of the existing **geology** and **hydrology.** Special emphasis should be placed on storm water run-off, drainage patterns, effect on groundwater and availability of potable water. Any slope stability issues that could arise should be thoroughly explored.

ii) **Water quality** of any existing wells, rivers, ponds, streams or coastal waters in the vicinity of the development. Quality Indicators should include but not necessarily be limited to nitrates, phosphates, faecal coliform, and suspended solids. The potential for pollution and/or contamination of sediment due to the lavish use of fertilisers in golf courses should be evaluated.

iii) Climatic conditions and air quality in the area of influence including particulate emissions from stationary or mobile sources, NO_x, SO_x, wind speed and direction, precipitation, relative humidity and ambient temperatures

iv) Coastal Dynamics should be evaluated by means of an Oceanographic study, which should evaluate the impact of coastline modification and the associated implications of these modifications on shoreline stability and longshore drift. The movement of nearshore currents and the implications

for transport of storm water and other waste waters, if any, from the proposed site should also be reviewed.

v) Noise levels of undeveloped site and the ambient noise in the area of influence.

vi) Obvious sources of pollution existing and extent of contamination.

vii) Availability of solid waste management facilities.

(B) Biological

Present a detailed description of the flora and fauna (terrestrial and aquatic) of the area, with special emphasis on rare, endemic, protected or endangered species. Migratory species should also be considered. There may be the need to incorporate micro-organisms to obtain an accurate baseline assessment. Generally, species dependence, niche specificity, community structure and diversity ought to be considered.

(C) Socio-economic & cultural

Present and projected population; present and proposed land use; planned development activities, issues relating to squatting and relocation, community structure, employment, distribution of income, goods and services; recreation; public health and safety; cultural peculiarities, aspirations and attitudes should be explored. The historical importance of the area should also be examined. While this analysis is being conducted, it is expected that an assessment of public perception of the proposed development be conducted. This assessment may vary with community structure and may take multiple forms such as public meetings or questionnaires.

An issue of priority for golf courses is the contamination of sediment and adjacent water bodies via fertilizers and colour sprays/dyes to maintain the green. Special consideration should be given to the type of fertilizer and the frequency of use.

Task #3. Legislative and Regulatory Considerations

Outline the pertinent regulations and standards governing environmental quality, safety and health, protection of sensitive areas, protection of endangered species, siting and land use control

at the national and local levels. The examination of the legislation should include at minimum, legislation such as the NRCA Act, the Wildlife Protection Act, the Town and Country Planning Act, legislation and policies from the Forestry Department, Building Codes and Standards, Development Orders and Plans and the appropriate international convention/protocol/treaty where applicable.

Task #4. Identification of Potential Impacts

Identify the major environmental and public health issues of concern and indicate their relative importance to the design of the subdivision. Identify potential impacts as they relate to, (but are not restricted by) the following:

- change in drainage pattern
- flooding potential
- landscape impacts of excavation and construction
- loss of natural features, habitats and species by construction and operation
- pollution of potable, coastal, surface and ground water
- Air pollution
- potential impacts from climate change
- capacity and design parameters of proposed sewage treatment facility.
- socio-economic and cultural impacts.
- risk assessment
- noise

Issues such as Coastline stability, coral reef, mangrove and wetland, seagrass impacts, unique coastal environments, nutrient loading in coastal waters and impact on coastal commercial fishing should be examined.

Distinguish between significant positive and negative impacts, direct and indirect, long term and immediate impacts. Identify avoidable as well as irreversible impacts. Characterize the extent and quality of the available data, explaining significant information deficiencies and any

uncertainties associated with the predictions of impacts. A major environmental issue is determined after examining the impact (positive and negative) on the environment and having the negative impact significantly outweigh the positive. It is also determined by the number and magnitude of mitigation strategies which need to be employed to reduce the risk(s) introduced to the environment. Project activities and impacts should be represented in matrix form with separate matrices for pre and post mitigation scenarios.

Task #5. Mitigation

Prepare guidelines for avoiding, as far as possible, any adverse impacts due to proposed usage of the site and utilising of existing environmental attributes for optimum development. Quantify and assign financial and economic values to mitigation methods.

Task #6. - Monitoring

Design a plan to monitor implementation of mitigatory or compensatory measures and project impacts during construction and operation of the facility. An Environmental Management Plan for the long term operations of the site should also be prepared.

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

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

The Monitoring report should also include, at minimum:

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

Task #7. Project Alternatives

All viable alternatives to the proposed development will be thoroughly reviewed. This will include the "no-action alternative". This review should incorporate the use history of the overall area in which the site is located and previous uses of the site itself and should also take into consideration, *inter alia*, alternatives in site layout and design, land clearing practices, water resources and supply, transportation networks and waste disposal. Refer to NEPA guidelines for EIA preparation.

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

APPENDIX 2

DRAFT MONITORING PLAN

DRAFT MONITORING PLAN

1.0 SCOPE OF STUDY AND METHODOLOGY

The monitoring programme is designed to ensure that the requirements of the Permit granted by the NEPA are met. Monitoring and mitigation of impacts during the implementation of the project will also require co-ordinated scheduling of activities between Amaterra Ltd. and the consultants, as well as regular reports required by the NEPA. Water quality and ecological parameters that may be affected by construction and operation of the development will be monitored with the necessary fieldwork component to provide the data as needed.

Field observations and measurements will be correlated simultaneously with weather prevailing conditions, so that any change in weather can be compensated for, and unwanted impacts can be avoided. In order to abide by the terms of the Permit set by the authorities, and certify satisfactory completion of the project, it will be necessary to perform the following:

a. **The monitoring of water and air quality parameters**, specifically, Turbidity, Total Suspended Solids (TSS), and Dissolved Oxygen (DO) during the implementation and post construction phases of the project as well as PM10. Samples will be collected at various locations (approved by the NEPA) twice during the first week of operation, weekly and then at fortnightly, depending on the nature of the activities being carried out at the time Monitoring will be carried out more frequently as required if the results of initial monitoring suggest that there is a potential threat to the environment.

b. **Random photographs** will be taken at regular intervals to determine whether the project is being carried out according to the stipulations of the Permit.

c. **A suite of ecological observations** would be required to observe any changes in the composition of marine, benthic and terrestrial flora and fauna (See Appendix). If required, as above, monitoring will be carried out more frequently if the results of initial monitoring suggest that there is a potential threat to the environment.

d. Final monitoring will be carried out at least three weeks after the works are complete.

2.0 OUTPUT

The information from the monitoring exercise will be used by the consultant to guide Amaterra regarding the efficacy of the mitigation measures being implemented. Any changes required to enhance the effectiveness of existing mitigation actions would then be recommended. Monitoring reports will contain the results of water quality and ecological examinations, as well as photographic monitoring carried out, in the period preceding the report, as well as recommendations for action, if required, for improving the construction process from an Environmental perspective. Data will be presented in both tabular and spatial form on maps prepared for this purpose. The maps will carry background, average and current data on each site of monitoring as well as coordinates. Monitoring reports would be produced according to the following schedule, in hard copy and electronic format:

1. Monitoring Report No. 1 - within one week following commencement of construction.
2. Monitoring Reports No. 2 - onwards - within one week following the monitoring period (fortnightly or monthly) as determined, unless there is an unforeseen situation which could negatively affect the environment.
3. Post Project Monitoring will take place three weeks after the works are complete and the Final Monitoring Report will be submitted within week four after completion of the post project monitoring.

Depending on the length of the construction process, the NEPA may require monitoring reports on a schedule different from the intervals proposed.

3.0 STUDY PERSONNEL

The study team:

Mr Paul Carroll MSc. will carry out water and air quality monitoring,

Mr Peter Gayle BSc. will carry out the Ecological monitoring.

Mr Donovan Rose MSc. will supervise operations and co-ordinate report preparation.

Ms Janette Manning will be research assistant.

4.0 WATER QUALITY MONITORING

4.1 Background

This plan is developed to satisfy the water quality monitoring component of the Amaterra Construction project at the Ocean Pointe Resort Development. The water quality component is required to evaluate impacts on critical parameters as a result of the proposed construction. In order to evaluate immediate and short term effects of the project, the monitoring plan will be carried out in two parts as follows:

- Water quality monitoring during construction
- Post development monitoring

Rationale for Selection of Water Quality Indicators

Our experience in this area has allowed us to determine that parameters of significance to the monitoring programme are **Total Suspended Solids** (**TSS), Turbidity, Biological Oxygen Demand** (**BOD)**, and **Dissolved Oxygen** (**DO).**

4.2 Methodology

Initial sampling will be carried out prior to the commencement of construction, to compare current conditions with data previously collected in order to confirm the baseline water quality for comparison with data collected during the project. Sampling will be carried out twice during the first week of construction. If the results are satisfactory, then sampling will be done weekly thereafter. As the project progresses there may be the request to change the frequency to fortnightly. Sampling will be increased to three times per week if a potential threat to the environment is identified.

At least six sampling stations will be established to enable comparison with data collected for the targeting areas slated for development ·and the closest sensitive area(s) potentially affected by the development.

4.2.1 Sample Collection

Surface and sub-surface water samples will be collected at all sites established using a Van Dorn sampler or similar device. Sampling will be carried out on several occasions during the development project as follows: Twice in the first week after commencement of infrastructure construction and then weekly thereafter. Final monitoring will be three weeks after completion of the project.

4.2.2 Sample Analysis

Laboratory analyses will be carried out by local facilities in accordance with Standard Methods for the Analysis of Water and Wastewater to determine levels of TSS and BOD. Dissolved Oxygen (DO) will be determined in situ using portable instrumentation.

Total Suspended Solids will be determined by filtration and gravimetry.

Biological oxygen demand (BOD) will be determined by the bottle dilution method.

Dissolved oxygen (DO), will be determined using the YSI Model 51B Oxygen meter, and Model 5739 Field Probe. The probe uses a Clark-type gas permeable membrane that covers polarographic electrode sensors. The system has a built in thermistor for temperature compensation, and temperature measurement. Measurement range of the instrument is 0-15mg/l, and accuracy is better than .2mg/l when calibrated within +/- 5^{o}C of actual sample temperature. Readability is better than 0.1mg/l.

ENVIRONMENTAL MONITORING

OF

THE DEVELOPMENT OF THE HALF WAY TREE TRANSPORTATION CENTRE

June 2005

Submitted by:

TECHNOLOGICAL AND ENVIRONMENTAL MANAGEMENT NETWORK LIMITED

5.0 AIR QUALITY MONITORING

5.1 Background

The air quality monitoring component of the Amaterra Construction project, Ocean Pointe Resort Development, is required to evaluate impacts as a result of the proposed construction on the immediate air shed surrounding the project site. Based on the type of development proposed it is considered that there may be measurable impact to air quality and noise levels during the

construction phase. This impact will result from earth moving and the operation of heavy-duty vehicles and construction equipment.

5.2 Scope of Study And Methodology

The monitoring programme is designed to satisfy typical requirements of Permits granted by NEPA for this type of development. Monitoring and mitigation of impacts during the implementation of the project will require co-ordinated scheduling of activities between the developers and the consultants, as well as regular reports required by NEPA. Air quality will be monitored with by conducting the necessary field exercises studies to provide generate the data as neededon PM_{10} to ensure compliance with NEPA standards for ambient air quality. Background measurements performed for the EIA indicate ambient PM_{10} levels well below both the 24hr and annual national standards shown in Table1.

Table 1. National Ambient Air Quality Standards - Jamaica

Pollutant	Averaging time	Standard (Maximum concentration) $\mu g/m^3$
[a]Total Suspended Particulate Matter (TSP)	Annual 24 h	60 150
[b]PM_{10}	Annual 24 h	50 150
[c]Sulphur Dioxide	Annual 24 h 1 h	80 Primary; 60 secondary 365 Primary; 280 Secondary 700
Carbon Monoxide	8 h 1 h	10,000 40,000
Nitrogen Dioxide	Annual	100

Field observations and measurements will be simultaneously correlated with weather conditions, so that any change in weather can be compensated for, and unwanted impacts avoided. To satisfactorily complete this project, it will be necessary to perform the following:

a. Monitoring of construction water quality parameters, specifically, Turbidity, Total Suspended Solids (TSS), and Dissolved Oxygen (DO) during the implementation and postsite activities to include but not necessarily limited to, stockpiling of construction materials, waste disposal and environmental impact mitigation.

b. Deployment of adevelopment phases of the project. ir quality sSamplerscollected at no less than two locations (approved by NEPA) around the proposed dredgedevelopment site in order to monitor PM_{10} every sixth day in accordance with the Hi Volume sampling regime. , construction and spoil deposition sites, twice during the first week of operation and then at least weekly, depending on the nature of the dredging (See Appendix). Monitoring will be carried out more frequently as required if the results of initial monitoring suggest that there is a potential threat to the environment.

c. Monitoring of noise at no less than two sites weekly. Noise measurements would be co-ordinated with the monitoring of PM_{10}.

d. Monitoring of air quality at least three weeks after the works are complete.Soundings will determine if there is any breech of the berms or retention mechanisms and if any sedimentation extends beyond the retention areas. In this instance waste material will likely be confined to the plume of suspended particles which will result from deposition of fill material at the coastline.

The berms and retention mechanisms used to retain this material will be physically monitored for effectiveness.Aerial monitoring will be carried out on at least three occasions (1) at the beginning of monitoring, (2) Midway through the Project, and (3) at the end of the development works. Aerial photographs will be taken on the day of monitoring if appropriate at orientations along the 4 main cardinal points (North, South, East and West) at intervals. This monitoring will cover all aspects of the development and shall ensure that each subject of interest is fully captured. It is expected that aerial monitoring will be carried out monthly (depending on the nature of the work being carried on at the time). Random photographs will also be taken from the land and sea.

Methods to be used are summarised in Table 2.

Table 2: Methods To Be Used for Air Quality & Noise

Parameter	Method	Test Data
PM_{10}	MiniVol Sampler	$>13\mu g/m^3$
Noise	CSL-328 Integrating Octave Band SL Meter	Freq Range (3.5Hz – 70KHz)

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6.0 ECOLOGY MONITORING

6. 1. Background

The ecology component of the monitoring of the Ocean Pointe development calls for the evaluation of the impacts of the proposed construction on the overall flora and fauna of the area of influence of the project. The general objective will be to inspect, assess and characterise specific areas of the marine and terrestrial environment examined prior to, during; and immediately after the construction activities to be carried out.

The location of indicator species would be such as to render them directly or indirectly impacted by the development. Acute impacts resulting from the project will be evaluated by habitat monitoring during the construction and by post project monitoring.

6.2 Rationale for Selection of Ecological Parameters

Particular emphasis will be placed on possible impacts to near shore mangrove stands, coral reefs, seagrass beds as well as other flora and fauna that may be affected (fall within the predetermined area of influence). The parameters considered to be relevant indicators for the assessment of significant impacts to the ecosystems include

I. the areal coverage and productivity of mangroves (leaf litter), seagrasses (rate of shoot growth) that occupy the immediate shoreline or inhabit the bay
II. the amount of coral cover and species diversity of corals found on nearshore reefs
III. the spatial distribution and density of herbivores (urchins and fishes) existing on nearshore reefs
IV. the amount of suspended solids and freshwater levels to be found in inshore waters

6.3 Methodology

An examination of the ecology of the area of influence of the project will be carried out at sites previously established to define baseline conditions before construction commences. Sampling will then be carried out initially, at two week intervals. Maintenance of or deviations from the status quo regarding the parameters being investigated would determine whether or not the sampling period would be increased or decreased.

At least six sampling stations will be established in concert with the water quality monitoring stations if possible or appropriate so as to allow comparison with data collected from the ecological assessments made in previous studies

6.4 Sample Collection & Analysis

Sampling of ~~the~~ reef habitat component species will be carried out by direct visual count (for urchins and fishes) and the use of transects of appropriate length which are video tapings of the substrate for later analysis (random dot matrix analysis) in the laboratory - as appropriate – to determine substrate composition and species diversity. Suspended ~~S~~ediment in the nearshore water column will be measured with appropriately sized and positioned sediment samplers while light levels will be evaluated with the aid of a secchi disc and light meter to determine the initial calibration values for each parameter. This will result in the eventual elimination of the need to collect this data with sediment traps and facilitate the use of digital equipment that can be deployed for remote collection (light meters) or provide immediate readings (secchi disc)

Initial sampling exercises are expected to occur at the commencement of the project; two weeks after commencement then at two or four week intervals as appropriate. Final monitoring will be three weeks after completion.

Random aerial photography re. influence of project on the overall environment will take place at monthly intervals.

APPENDIX 3

ECOLOGY

APPENDIX 3 – ECOLOGY

Table #1 Vegetation Species List

Scientific Name	Common Name	DAFOR
Bursera simarouba	Red Birch	
Thespecia populaea	Sea side mahoe	D
Yucca filamentosa	Adam's needle	D
Samanea saman	Gaungo	D
Melicoccus bijugatus	Guinep	A
Ipomoea pes-caprae	Railroad vine	A
Croton punctatus	Beach croton	A
Hernandia catapifolia	Water mahoe	A
Trichilia hirta	Wild Mahagony	A
	Devil's potato	A
	Devil's horse whip	A
Cenchrus incertus	Sand spur	A
Distichlis spicata	Salt grass	A
Ficus aurea	Strangler fig	A
Bromelia ceae	Ping wing	A
Croton punctatus	Beach croton	A
Avicennia germinans	Black mangrove	A
Cocoloba uvilera	Sea grape	A
Smilax auriculata	Smilax	A
Bromeliaceae sp.	Ping wing	A
Annona muricata	Soursop	F
Magnifera indica	Mango	F
Quercus agrifolia	Coast live oak	F
Philadendrons	Wicca cocoa	F
Cordia balata		F
Haematoxylum	Logwood	F
Neptunia pubescens	Sensitive Plant	F
Brya ebenus	West Indian ebony	F
Pithecellobium arborum	Wild tamarind	F
Prosopis juliflora	Cashaw macca	F
	Common purple orchids	F
Lobelia		F
Mellotonia graphalodes	Sea lavender	F
Conocarpus erectus	Button wood	F

Pricasma excelsa	Guinep	F
Cactus triangules	Spider cactus	F
Krugiodendron ferrun	Black iron wood	F
Avicennia gernuinaus	Black Mangrove	F
Cocoloba uvilera	Sea grape	F
Acacia spp.		F
Chrysophyllum cainito	Star apple	F
Rochefortia acanthophora	Greenheart Ebony	F
Terminalia catappa	Almond	F
Tamarindus indica	Tamarind	F
Cephalocerus swartzii	Columnar Cacti	F
Bromeliales (Family)	Tank Bromeliad	F
Croton linearis	Wild Rosemary	F
Sida spp.	Broomweed	O
Guzmania	Strapleaf air plant	O
Bursera simarruba	Gumbo limbo / Red Birch	O
	Purple orchid	O
Comocladia pinatifdia	Maiden plum	O
Caesalpinia bondue	Nicker bean	O
Eugenia foetide	Spanish stopper	O
Hermandia catalipifolia	Water mahoe	O
Unida paniculata	Sea oats	O
Asplenium tricomanes	Maidenhair spleenworth	O
Stenocereus hystrix	Dildo pear	O
Epidendrons	Wicka cocoa	O
Chamaclirium	Fair wand	O
Bursera simaruba	Gumbo limbo	O
Metopium toxiferum	Poison wood	O
	Pepper-elder	O
Trichilia hirta	Wild mahagoney	O
(*epiphyte sp.)*	Tillandsia	O
Sagittaria	Arrow head	O
Nectandra coriaca	Sweet wood	O
Nectandra coriacea	Lance wood	O
Epiphyte sp	Vriesea	O
Rubiaceae sp.	Wild coffee	O
Schinus terebinthifolius	Brazillian pepper	O
Caesalpinia bondue	Nickerbean	O

	Devil's potato	O
Picrasma excelse	Bitter-wood	O
Thuinax parviflora	Thatch	O
Canaralia rosea	Bay bean	O
Cecropia peltata	Trumpet tree	O
Chamaelirium	Fair wand	O
Epidemdrums	Wicca cocoa	O
Cedrela odorata	Cedar	O
	Pepper- elder	O
Piscidia piscupula	Dog wood	O
Cactus triangulares	Spider Cactus	O
Comocladia pinatifdia	Maiden plum	O
Ficus aurea	Strangler fig	O
Metopium toxiferum	Poison wood	O
Bursera simaruba	Gumbo limbo	O
Albezia lebbeck	Woman tongue tree	O
Cenchous incertus	Sand spur	O
Distichlis spicata	Salt grass	O
Schinus terebinthifolius	Brazillian Pepper	O
Sagittaria	Arrow heads	O
Xerophyllum tenax	Bear Grass	O
Ficus aurea	Strangler fig	O
Sephalocereus swartzii		O
Detura stramonium (Solanaceae)	Devil's trumpet	O
Asplenium Tricomanes	Maiden hair spleenworth	O
Sporobolus virginicus	Sand runner	O
Spartina pateus	Grass	O
C*rescentia cujete*	Calabash	O
Coccoloba spp.		O
Bourreria spp.		O
Comocladia spp.		O
	Noni	O
Orchidales (Family)	Wild Orchids	O
Rhoeo spp.		O
L*eucaena eucocephola*	Lead tree	R
Cyperus esculentus	Chufa	R
	Strap leaved air plant	R
Kaugiodendrum fereum	Black iron wood	R
	Pepper elder	R

Piscidia piscula	Dogwood	R
Cyperus esculentus	Chufa	R
Sabal palmetto	Cabbage palm	R
Mallotonia graphalodes	Sea lavender	R
Brosimum alicastrum	Breadnut	R
Casuarina equisetifolia	Australian Pine	R
Cresentia cujete	Calabash	R
	Spider lilly	R
Sagittaria sp.	Arrowheads	R
Stenocereus hystrix	Dildo pear	R
Cissus sicyoides		R
Metopium toxiferum	Poison wood	R

Table #2 – Avifauna

Shore Birds Observed	
Magnificent Frigatebird	*Fregata magnificens*
Cattle Egret	*Bubulcus ibis*
Wilson's Plover	*Charadrius wilsonia*
Black – necked Stilt	*Himantopus mexicanus*
Land Birds Observed	
Residents	
Turkey Vulture	*Carthartes aura*
American Kestrel	*Falco sparverius*
White-crowned Pigeon	*Columba leucocephala*
Zenaida Dove	*Zenaida aurita*
Mourning Dove	*Zenaida macroura*
Common Ground Dove	*Columbina passerina*
Caribbean Dove	*Leptotila jamaicensis*
Olive Throated Parakeet	*Aratinga nana*
Mangrove Cuckoo	*Coccyzus minor*
Smooth – Billed Ani	*Crotophaga ani*
Greater Antillean Elaenia	*Elaenia fallax*
Stolid Flycatcher	*Myiarchus stolidus*
Loggerhead Kingbird	*Tyrannus caudifasciatus*
Northern Mockingbird	*Mimus polyglottos*
Bananaquit	*Coereba flaveola*
Black – Faced Grassquit	*Tiaris bicolor*
Jamaican Oriole	*Icterus leucopteryx*
Endemics	

Yellow - Billed Parrot	*Amazona collaria*
Red – Billed Streamertail	*Trochilus polytmus*
Jamaican Woodpecker	*Melanerpes radiolatus*
Jamaican Vireo	*Vireo modestus*
Jamaican Crow	*Corvus jamaicensis*
Jamaican Mango	*Anthrocothorax mango*
Yellow – Shouldered Grassquit	*Loxipasser anoxanthus*
Migrants (Summer)	
Gray Kingbird	*Tyrannus dominicensis*
Black – Whiskered Vireo	*Vireo altiloquus*

Table #3 - Trees Utilized By Observed Species

Tree Species	Bird Species	Purpose / Use
Acacia spp**.**	*Black – Whiskered Vireo*	*Nesting*
Bauhinia divaricata	*Jamaican Mango, Bananaquit, Red – Billed Streamertail, Vervain Hummingbird*	*Feeding*
Bursera simarouba	*Jamaican Oriole, Yellow – Shouldered Grassquit, Jamaican Vireo*	*Feeding*
Coccoloba spp.	*Caribbean Dove*	*Feeding*
Croton linearis	*Vervain Hummingbird*	*Feeding*
Comocladia spp.	*White – Crowned Pigeon*	*Feeding*
Guazuma ulmifolia	*Olive Throated Parakeet*	*Feeding*
Magnifera indica	*Northern Mockingbird, Vervain Hummingbird, Red – Billed Streamertail, Jamaican Mango*	*Nesting*
Samanea saman	*American Kestrel*	*Nesting*

APPENDIX 4

ENVIRONMENTAL MANAGEMENT PLAN

Environmental Management Plan

The Environmental Management Plan (EMP) defines a process wherein the developers of the Resort Development will:

1) Establish its commitment to improving the environment
2) Review its activities and identify those that have a significant impact on the environment.
3) Put programmes in place to eliminate or reduce these impacts.

The Products of the EMP will be:

- Specific targets and actions to reduce the impact of the resort's activities on the environment;
- The establishment of a system of monitoring the activities of the resort identified above.
- A data base, preferably digital of the Resort's activities and data collected to track the effect of the management programme
- Increase the awareness and knowledge of the staff at all levels of the environmental impacts of the decisions and activities that they undertake, and of the standards requited by NEPA.
- Placing a caveat on purchasers of lots in the development requiring their commitment to the management plan.
- A communications programme to encourage environmental stewardship among the resorts residents and businesses.

The outcome of the EMP will be an improvement of the environment in and around the resort.

APPENDIX 5

IMPACT MATRIX

SIGNIFICANCE OF WEIGHTINGS USED IN IMPACT MATRIX

+10	Positive, Long term, New, Very significant, Direct
+8	Indirect, Positive, Very significant, New, Long term
+6	Positive, Direct, Short term, Very significant, Incremental
+4	Indirect, Positive, Short term, Very significant, Incremental
+2	Positive, Direct/Indirect, Insignificant, Short term, Incremental
0	
	Indirect, Negative, Short term, Incremental, Insignificant, Mitigable
-2	Indirect, Negative, Short term, Very significant, Mitigable, Incremental
-4	Direct, Negative, Long term, Very significant, Mitigable, Incremental
-6	Indirect, Negative, Long term, Very significant, New, Unmitigable
-8	Direct, Negative, Long term, Very significant, New, Unmitigable
-10	

IMPACTS MATRIX

Factor	Indicator	Type	Extent	Magnitude	Mitigative Measures	Comments	Weight
Ecological - during construction	Loss of terrestrial habitat for resident, migratory and endemic bird species as well as endemic species of plants and insects which presently serve as food for the birds	Negative, Direct	Long Term	Significant	Relocation of, or building around larger trees. Replanting useful or fruit bearing vegetation in buffer zone around area to replenish lost units and increase local biodiversity Access roads should be paved and routed as far away from existing tree lines as possible	Habitat being lost would be important ecologically since existing vegetation is relatively sparse on the existing limestone substrate. Carry out additional bird / habitat studies to better identify specific areas favoured by resident, migratory or nesting birds.	- 3
	Departure of birds that would normally feed or nest in area due to increased noise, dust & fuel emission levels from human activity, transportation	Negative, Direct	Short Term	Significant	Temporary berms used to contain any rainwater forming during this period	Proper vehicle maintenance would also minimize dust & fuel emissions problem	- 2
	Loss of vegetation from construction activities facilitating soil erosion during heavy rain on unprotected, excavated or compacted areas	Negative, Indirect	Short Term	Insignificant	Rapid replanting of defoliated areas as appropriate. Increase the size of green / natural forest areas with appropriate siting so as to be as close as possible ot existing areas favoured by current avifauna.	Runoff to be directed to holding ponds for later use as irrigation water	- 1
- post construction	Loss of vegetation alters natural drainage patterns facilitating unwanted flora & fauna	Negative, Direct	Short Term	Very Significant	Careful monitoring and maintenance of drains especially during heavy rain events	Development of emergency plan to contain or reroute excess water during heavy rain events – as appropriate	- 3
	Contamination of ground surface water bodies or local flora & fauna by spillage of waste petrochemicals or hazardous wastes	Negative, Direct	Long Term	Significant	Record existing drainage pattern prior to start of construction. Use of temporary berms to prevent excess runoff entering or leaving immediate vicinity of ground surface water bodies	Possibility of impact to local hydrologic regime	- 4

IMPACT MATRIX
ENVIRONMENTAL CHEMISTRY
OCEAN
POINT

PRE-MITIGATION

INDICATOR	I TYPE	M EXTENT	P MAGNITUDE	A MITIGATIVE MEASURES	C COMMENTS	T WEIGHT
COASTAL WATER QUALITY:						
Organic Pollution Indicators:						
BOD	NEG	LONG TERM	SIGNIFICANT		DUE TO SEWAGE DISCHARGE	-6
Nitrogen	NEG	LONG TERM	SIGNIFICANT		DUE TO SEWAGE DISCHARGE	-6
Pesticides	NEG	LONG TERM	SIGNIFICANT		USE IN MAINTENANCE OF LANDSCAPE	-6
TSS	NEG	SHORT TERM	SIGNIFICANT		DUE TO SEWAGE DISCHARGE	-6
Oil and Grease	NEG	LONG TERM	SIGNIFICANT		DEPOSITION OF OIL CONTAMINATED SOIL	-6
Coliform	NEG	LONG TERM	SIGNIFICANT		MAINLY FROM SEWAGE	-4
D.O.	NEG	LONG TERM	SIGNIFICANT		DUE TO HIGH LEVEL OF BOD IN SEWAGE	-6

Inorganic Pollution Indicators:					
Phosphate	NEG	LONG TERM	SIGNIFICANT	FROM FERTILISERS USED IN MAINTENANCE OF LANDSCAPE	-6
Nitrate	NEG	LONG TERM	SIGNIFICANT	DUE TO BREAK DOWN OF SEWAGE, AND USE OF FERTILISERS	-6
Salinity	NEG	LONG TERM	SIGNIFICANT	REDUCED SALINITY OF COASTAL WATER DUE TO INCREASED FRESH WATER RUN OFF	-6
TSS	NEG	LONG TERM	SIGNIFICANT	DUE TO SEWAGE DISCHARGE, EROSION.	-6
GROUND WATER QUALITY					
Organic Pollution Indicators:					
BOD	NEG	LONG TERM	SIGNIFICANT	DISCHARGE OF SEWAGE TO AQUIFER,	-6
Nitrogen	NEG	LONG TERM	SIGNIFICANT	DISCHARGE OF SEWAGE TO AQUIFER, SEEPAGE OF NUTRIENT RICH IRRIGATION RETURN WATER	-6

Pesticides	NONE	NA	NA	USE OF PESTICIDES IN MAINTENANCE OF LANDSCAPED AREAS, SEEPAGE OF NUTRIENT RICH IRRIGATION RETURN WATER	0
TSS	NEG	LONG TERM	SIGNIFICANT	DISCHARGE OF SEWAGE TO AQUIFER, SEEPAGE OF NUTRIENT RICH IRRIGATION RETURN WATER	-6
Coliform	NEG	LONG TERM	SIGNIFICANT	DISCHARGE OF SEWAGE TO AQUIFER, SEEPAGE OF NUTRIENT RICH IRRIGATION RETURN WATER	-4
D.O.	NEG	LONG TERM	SIGNIFICANT	DUE TO HIGH LEVEL OF BOD IN SEWAGE	-6
Inorganic Pollution Indicators:					
Phosphate	NEG	LONG TERM	SIGNIFICANT	SEEPAGE OF NUTRIENT RICH IRRIGATION RETURN WATER	-6

Nitrate	NEG	LONG TERM	SIGNIFICANT	DISCHARGE OF SEWAGE TO AQUIFER, SEEPAGE OF NUTRIENT RICH IRRIGATION RETURN WATER	-6
Salinity	NEG	LONG TERM	SIGNIFICANT	ABSTRACTION OF GROUND WATER	-6
Conductivity	NEG	LONG TERM	SIGNIFICANT	ABSTRACTION OF GROUND WATER	-6
TSS	NEG	LONG TERM	SIGNIFICANT	DISCHARGE OF SEWAGE TO AQUIFER	-6
AIR QUA.LITY					
SOX	NONE				
NOX	NONE				
CO	NONE				
CO2	NONE				
PM10	NEG	SHORT TERM	SIGNIFICANT	LAND CLEARING, VEHICLE MOVEMENT ON HAUL ROADS	-4
NOISE	NEG	SHORT TERM	SIGNIFICANT	VEHICLE MOVEMENT THROUGH COMMUNITY, HORNS, DEFECTIVE VEHICLES, EXHAUST NOISE	-4

POST-MITIGATION

COASTAL WATER QUALITY

Organic Pollution Indicators:

BOD	NEG	SHORT TERM	INSIGNIFICANT	TREATMENT OF SEWAGE TO ENSURE COMPLIANCE WITH TRADE EFF. STDS.		0
Nitrogen	NEG	SHORT TERM	INSIGNIFICANT	TREATMENT OF SEWAGE TO ENSURE COMPLIANCE WITH TRADE EFF. STDS., CONTAINMENT OF SURFACE RUN OFF	OVERFLOW MAY OCCUR IN EXTREME EVENTS	-2
Pesticides	NONE	NA	NA	CONTAINMENT OF SURFACE RUN OFF AND IRRIGATION RETURN WATER	OVERFLOW MAY OCCUR IN EXTREME EVENTS	-2
TSS	NEG	SHORT TERM	INSIGNIFICANT	CONTAINMENT OF SURFACE RUN OFF AND TREATMENT OF SEWAGE TO ENSURE COMPLIANCE WITH TRADE EFF. STDS	OVERFLOW MAY OCCUR IN EXTREME EVENTS	-2

Coliform	NONE			TREATMENT OF SEWAGE TO ENSURE COMPLIANCE WITH TRADE EFF. STDS.		0
D.O.	NONE			TREATMENT OF SEWAGE TO ENSURE COMPLIANCE WITH TRADE EFF. STDS.,		0

Inorganic Pollution Indicators:

Phosphate	NEG	SHORT TERM	INSIGNIFICANT	CONTAINMENT OF SURFACE RUN OFF	OVERFLOW MAY OCCUR IN EXTREME EVENTS	-2
Nitrate	NEG	SHORT TERM	INSIGNIFICANT	TREATMENT OF SEWAGE TO ENSURE COMPLIANCE WITH TRADE EFF. STDS., CONTAINMENT OF SURFACE RUN OFF	OVERFLOW MAY OCCUR IN EXTREME EVENTS	-2
Salinity	NEG	SHORT TERM	INSIGNIFICANT	CONTAINMENT OF SURFACE RUN OFF	OVERFLOW MAY OCCUR IN EXTREME EVENTS	-2
Conductivity	NEG	SHORT TERM	INSIGNIFICANT	CONTAINMENT OF SURFACE RUN OFF	OVERFLOW MAY OCCUR IN EXTREME EVENTS	-2
TSS	NEG	SHORT TERM	INSIGNIFICANT	CONTAINMENT OF SURFACE RUN OFF	OVERFLOW MAY OCCUR IN EXTREME EVENTS	-2

GROUND WATER QUALITY

Organic Pollution Indicators:

BOD	NONE	USE OF APPROPRIATE LINER IN CONTAINMENT AREA	0
Nitrogen	NONE		0
Pesticides	NONE	USE OF APPROPRIATE LINER IN CONTAINMENT AREA	0
TSS	NONE	USE OF APPROPRIATE LINER IN CONTAINMENT AREA	0
Coliform	NONE	USE OF APPROPRIATE LINER IN CONTAINMENT AREA	0

Inorganic Pollution Indicators:

Phosphate	NONE	USE OF APPROPRIATE LINER IN CONTAINMENT AREA	0
Nitrate	NONE	USE OF APPROPRIATE LINER IN CONTAINMENT AREA	0
Conductivity	NONE	AVOID USE OF GROUND WATER FOR IRRIGATION	0

TSS	NONE			USE OF APPROPRIATE LINER IN CONTAINMENT AREA	0
AIR QUA.LITY					
SOX	NONE				
NOX	NONE				
CO	NONE				
CO2	NONE				
	NEG	SHORT TERM	INSIGNIFICANT	SPRINKLING OF HAUL ROADS AND OTHER AREAS AS APPROPRIATE TO MINIMISE DUST	-2
PM10				HAZARD	
NOISE	NEG	SHORT TERM	INSIGNIFICANT	REGULATION OF TRAFFIC , PLANNING OF ROUTES, USE OF ONLY VEHICLES SATISFYING TRAFFIC REGS.	-2

SOCIO-ECONOMIC IMPACT MATRIX

INDICATOR	I	M	P	A	C	T
	TYPE	EXTENT	MAGNITUDE	MITIGATIVE MEASURES	COMMENTS	WEIGHT
Economic/ Employment	Positive, Direct, New	Short to Long-term	Very significant	Local residents with the required skills should be given first preference for new jobs.	The vast majority of some 400 (15% of the labour force) unemployed residents are expected to benefit from new jobs being created by the development. The multiplier and A trickle down effects will result in an overall increase in the levels of living of the residents.	**+7**
Infrastructure (Water Supply & Transportation)	Positive, Direct, New	Short-term to Long-term	Very Significant	Improvement to existing infrastructure should be undertaken in conjunction with the development.	The developers will be co-financing a major water supply scheme to the tune of US$ 7.83 of the US$25 million needed. The development will also serve to hasten and in some instance act as an impetus for further development in the area.	**+3**
Cultural/Historical Properties	Positive, Direct	Long-term	Significant	N/A	As part of the plan the developers will seek to manage the Stewart Castle historic/heritage site as a tourism attraction through a long-term lease of the site from the National Heritage Trust	**+4**
Social Cohesion	N/A	N/A	N/A		The development will bring about interaction between the guests and the local residents through the buying and selling of goods and services.	**0**

INDICATOR	I	M	P	A	C	T
	TYPE	EXTENT	MAGNITUDE	MITIGATIVE MEASURES	COMMENTS	WEIGHT
Social Displacement	Negative	Long-term	mitigable	Alternate location for squatters will have to be sought to ensure amicable relocation.	The existing squatters will be put in-touch with the Operation Pride project which currently exists in the area. Through this programme the squatters will be able to own their own house and land.	**-4**
Housing	Positive	Long-term, direct	Significant	N/A	The development plan includes some 850 low income housing lots under NHT funding plus middle and upper income apartment and town houses.	**+7**
Fishing Activities	Positive	Long-term	Very Significant	N/A	There will be an increase in demand for fishermen catch, both from the guests staying in the new guest houses as well as from the hotel itself.	**+7**
National/Regional	Positive	Long-term, cumulative,	Very significant	N/A	The development will increase visitor arrivals to the area bring foreign exchange.	**+7**
Total						**+25**

APPENDIX 6

MAPS

Map A: AMATERRA Project Area

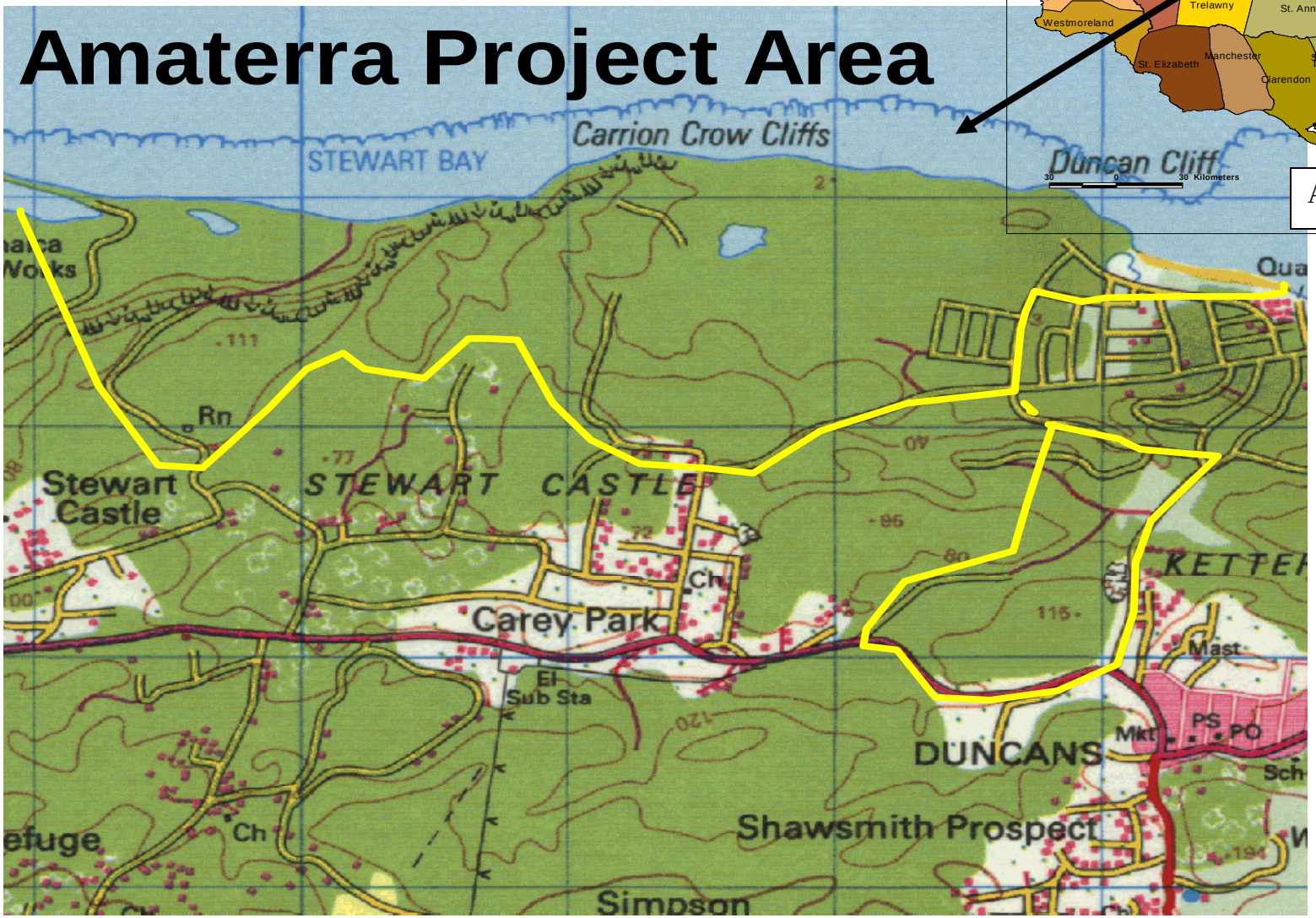
Map B: Land Use map

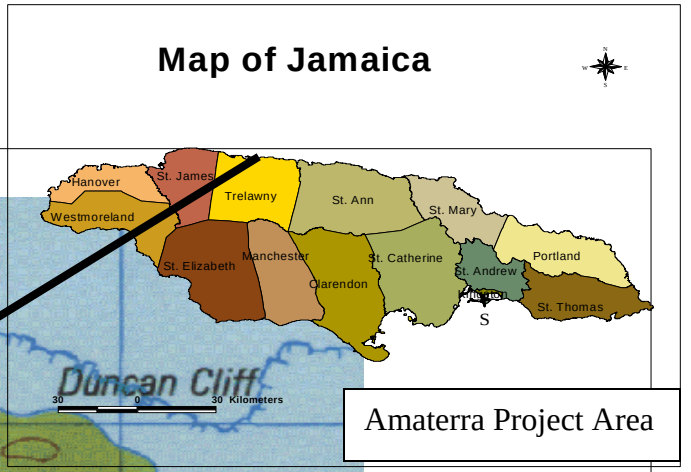
Map C: Coastal Modifications

Map D: Environmental Chemistry Monitoring Stations

Map E: Layout of Resort Development

Appendix 6. Map A - Location of Amaterra Project Area



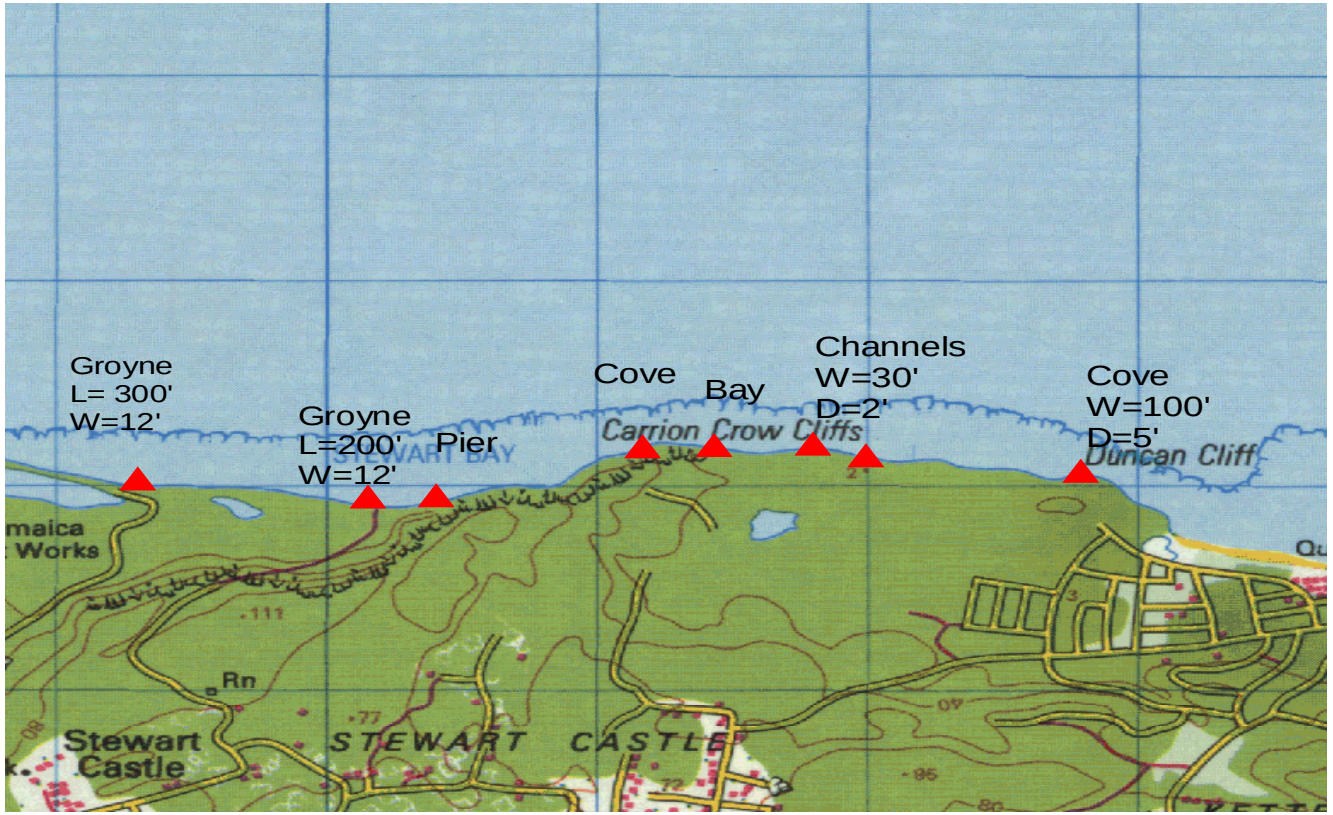


KEY

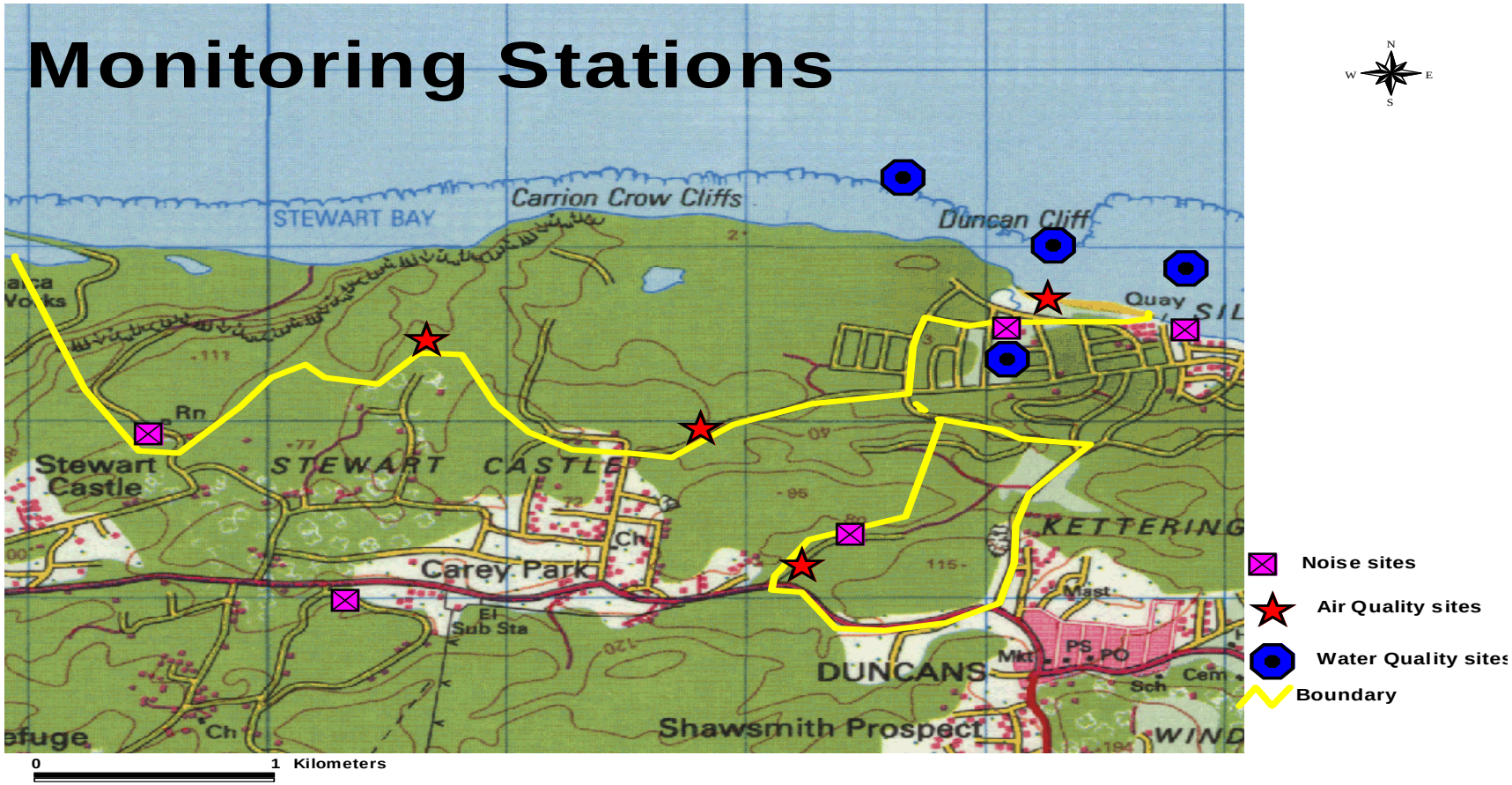
Boundary

Appendix 6: Map C - Coastal Modifications

Coastal Modifications



Appendix 6: - Map D – Monitoring Stations for Air Quality, Water Quality and Noise



APPENDIX 7

SEWAGE TREATMENT

APPENDIX 8

SOCIO ECONOMICS

A) Stakeholders List
B) SIA Questionnaire
C) Squatter Settlement Questionnaire

Stakeholders List

Discussions were held with an identified list of stakeholders. These included:

- the Member of Parliament for the area,
- the Custos of Trelawny,
- the president of the Chamber of Commerce,
- members of the management of the Parish Council,
- the NEPA representative for the area,
- Representative of the Beach Control Authority, and
- Representatives of the Fisherman's Cooperative in the area.
- The Stakeholders consultations also covered the socio-economic survey of the residents (a purposive sample of 40 residents) of the adjoining communities within the study area.
- the Trelawny Gun Club
- the Ocean Point developers

Questionnaire

1. Name of Community _____

2. Name of Respondent _____

3. Address _____

4. Respondents Gender: male ------- Female _____

5. Respondents Highest Level of education:

Pre-primary_____
Primary _____
All-age _____
Secondary/High School _____
Vocational/High School _____
College Certificate _____
Other Post Secondary Certificate _____
University Degree _____

6. Respondent's Occupation
Professional _____
Technical _____
Unskilled Labourer_____
Farmer _____
Fisherman_____
Domestic Helper _____
Shop Keeper_____
Housewife_____
Driver _____
Taxi/bus/ truck Operator _____
Tour Operator/Tour guide _____
Other small business Operator_____
Other (specify)_____

7. Are you aware of the Ocean Point Development that is being planned nearby?
Yes _____ No_____
If yes
8 . Do you know the boundaries of the Ocean View Property
Yes _____ No _____
If yes,

9. Can you describe the boundaries?

East _____
West _____
North _____
South _____

9. List at least some of the things that you are aware of that are being planned for the property?

1._____
2. _____
3. _____
4. _____
5 _____

10. Do you now use the property in anyway?

Yes _____ No _____

If yes,

11, Please explain

_____
_____
_____

12 Do you think the development on the property will affect you and your community in anyway (good or bad)?

Yes _____No _____
If Yes,

13 Please explain:

good _____
_____
_____

bad _____
_____
_____

13 . What is the size of your Household by gender and occupation?

H/hold member	Gender	Age-group	Occupation	Employment status	Highest level of Educational attainment
#1 (Head)					
#2					
#3					
#4					
#6					
#7					
#8					
#9					
#10					

Code for age group: **1** = 0-5, **2**= 6-10, **3**= 11-18, **4**= 19- 29, **5** = 30 45, **6**= 46- 60 **7**= 61 plus

Code for Employment Status: **1**= Employed full-time **2**= Employed Part-time **3=** Self-employed
4= Unemployed

14 How would you rank the following community amenities:

Amenitie/Utilities	Excellent	Very Good	Good,	Poor	Very Poor	Non-existent
Roads						
Water supply						
Electricity						
Telephone						
Waste disposal /Toilet facilites						
Community Centre						
Playing Field						
Recreational park						
Public beach						
Transportation						
School						
Health centre /Clinic						

15. What is presently your main means of transportation?
Bus ____ Mini-bus ____ Route Taxi___ Other Taxi _____Other (specify)_____

16. What would you say are the three most pressing problems facing your community at this time.

1. _____
2. _____
3. _____

Name of Interviewer _____
Date of Interview _____

Comments : _____

OCEAN POINTE SETTLEMENT SURVEY

1. Name of respondent: _____

2. Are you the head of the household?
   (a) Yes _____
   (b) No _____

3. In what age group do you fall?
   (a) < 18 _____ (b) 18 - < 40 _____
   (c) 40 - < 60 _____ (d) 60 and over _____

4. Gender:
   (a) male ____
   (b) female ____

5. What is your current relationship status?
   (a) Married ____ (d) Separated ____
   (b) Divorced ____ (e) Widowed ____
   (c) Single _____ (f) Common-law_____

6. How many years have you lived in the community?
   (a) Less than 6 months _____ (d) 5 years to less than 7 yrs _____
   (b) 6 months to less than 1 yr _____ (e) 7 years to less than 10 yrs _____
   (c) 1 year to less than 5 years _____ (f) 10 years and over _____

7. Do you work away from your community?
   (a) Yes _____
   (b) No _____

8. Number of persons living in the household: _____
   (a) How many adults? _____
   (b) How many are under the age of 18 years?_____

9. Household Information

Household Member	Occupation	Employed		Unemployed
		F/T	**P/T**	
Respondent				

10. What type of construction material is the house you live in made of?

Roof:

(a) concrete _____
(b) wood ____
(c) galvanize zinc _____
(d) tatch _____
(e) Other (specify) _____

Walls:

(f) concrete ___
(g) Wood/board _____
(h) Other(specify) ____

11. Do you own your house?

(a) Yes _____
(b) No _____

12. What is your status on the property?

(a) Own _____
(b) Rent _____
(c) Lease _____
(d) Other (specify) _____

13. What is your main source of domestic water supply?

(b) Piped _____
(c) Spring/river/sea _____
(d) Community stand pipe _____
(e) Community Tank _____

(f) Private tank _____ (g) Other: Specify _____

14. What type of toilet facilities do you have?

(a) Water closet _____

(b) Pit latrine _____

(c) Other: specify _____

15. What is your main fuel used for cooking?

(a) Bottled gas _____ (d) Wood _____

(b) Kerosene _____ (e) Electricity _____

(c) Charcoal _____ (f) Other specify: _____

16. Why did you/ your household decide to live on this site?

Reasons for living on this site

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

17. Do you expect any changes to your current place of residence?

(a) Yes _____

(b) No _____

18. Do you have any current plans to relocate?

(a) Yes _____

(b) No _____

Date: _____

Name of Interviewer: _____

Appendix 9

Correspondence

a) Letter from National Water Commission re water Supply for the development

Appendix 10

Project Personnel

Donovan Rose MSc. Project Manager
Paul M. Carroll MSc. Environmental Chemistry
Conrad Smikle BSc. Socio Economics
Garth Lampart BSc Hydrogeology
Janette Manning M.Phil (Pending) Research Assistant