ENVIRONMENTAL IMPACT ASSESSMENT

A PROPOSED SUBDIVISION OF LAND PART OF MONA AND PAPINE ESTATES AND GOLDSMITH VILLA, ST. ANDREW (CALLED MONA ESTATE, SECTION ONE)

HAJ HOUSING agency of JAMAICA LIMITED

Building Jamaica. One community at a time.

2011 June

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Presented to the:
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BACKGROUND

This project is a proposal of the Housing Agency of Jamaica Limited (HAJL). The Consultant was required to conduct and Environmental Impact Assessment (EIA) for a proposed residential subdivision in Mona Estates as a requirement for an Environmental Permit from the National Environment and Planning Agency (NEPA). In consideration of the zoning requirements, the developer proposes the development of only 11.8 hectares (29.2 acres) of its property, generally confining it to the west of the existing roadway. This effectively ensures that the rest of approximately 78.2 hectares (193.2 acres) remain for conservation and public open space (See Figure 1).

The subdivision would comprise primarily residential serviced lots (54) (see Appendix 16.6). The project falls within the Kingston and St. Andrew municipality to the southeast (Map 2.1). The proposed development site is sandwiched between the Long Mountain/Karachi Road to the east, the Long Mountain Country Club to the North, the Beverly Hills community to the west and the Pines of Karachi to the south. The location is on the western flank of the Long Mountain (or Wareika Hills).

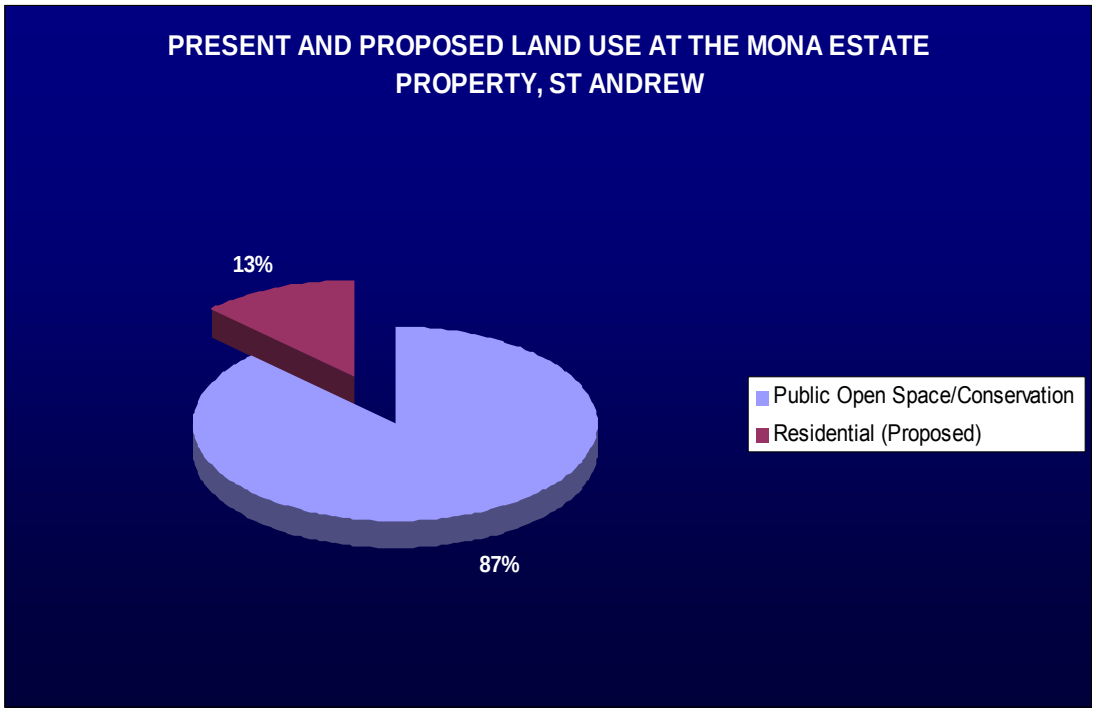


Figure 1: Present and proposed land use - Mona Estate

1. EXECUTIVE SUMMARY

Overview

1. The Mona Section 1 residential development is a project of HAJL. The proposed site is flanked by the middle-income residential developments of Pines of Karachi to the north and Long Mountain Country Club to the south. The upscale Beverly Hills is located to the west.

2. Essentially, the Kingston Metropolitan Area (KMA) is close to its threshold for residential development due to the virtual absence of large tracts of land to meet housing demand created by natural population increase, rural-urban drift and to satisfy the general backlog. The proposed Mona Section 1, therefore, is a Government of Jamaica response to alleviating the demand for housing solutions and these fifty-four (54) residential serviced lots are among the projected 9,800 to become available through the HAJL during the period 2010-2011.

3. The Mona Section 1 property is the only significant vacant property west of the Pines of Karachi to Long Mountain Road. The site lies along the northeastern slopes of the Long Mountain range although storm water generally flows towards an on site depression. The National Water Commission's (NWC) infrastructure that includes the Mona Reservoir and Treatment Plant, are located at the foot of these slopes.

4. This development will take place under the Housing Act, 1955. The Town and Country Planning Act, 1957 guides and controls development and, in essence, ensures sustainable land use, protects the land and physical environment from misuse and premature development. The proposed development site is zoned for public open space in the 1966 *Confirmed Kingston Development Order for Kingston* while in the emerging *Kingston and St. Andrew Development Order*, *2008,* the proposed zoning is public open space/conservation. The Natural Resources Conservation Authority Act, 1991 addresses the management of environmental risks of development activities.

5. The proposed Mona Section 1 development of 60 lots comprises residential 54 service lots with sizes ranging from 923 m² to 2,078 m². There are two access/egress proposed points off the Pines of Karachi to Long Mountain Road. These are located towards the north and south of subdivision. The NWC has confirmed the availability of potable water supply, which can be accessed through its supply main along the main road.

6. The site topography and geomorphic influences at Mona Section 1 provide the preferred option for the management of site drainage as the general north-east trending slopes direct drainage towards a 10- metre depression at the extreme north of the proposed development site.

7. Wastewater will be treated by connection to the NWC central sewage system. The site does not lend itself to direct connection by way of gravity feed to the existing sewer line; therefore, a lift station will be built to facilitate that connection.

Physical Resources

1. The proposed subdivision rises from the Limestone foothills near Karachi Avenue. Approximately 80% of the land mass exists on the slopes, which dip towards the west. Average slope gradient is 14^0 or 25%. Elevation of the site ranges from 200 to 260 metres above sea level. The proposed development site is underlain by two formations of the White Limestone Group. This formation is easily eroded by water and displays solution features as well.
2. Regionally, the proposed site is a part of the uplifted Wagwater Sequence which forms the prominent, structurally controlled Long Mountain, running southeast-northwest. A major fault zone is located approximately 500 metres west of the site at the base of the Long Mountain and borders the Liguanea alluvial fan. The proposed property is flanked by two other fault structures.
3. The Bonnygate Stony Loam under the Ministry of Agriculture's soil classification scheme underlies the proposed development. This soil type experiences very rapid internal drainage, which is characteristic of coarse-textured soils or some thin soils on steep slopes.
4. There is no perennial surface drainage system within the proposed development due to the intrinsic high permeability of the underlying limestone formations.
5. The groundwater resource has been tapped via the Beverly Hills, Long Mountain, Hampstead Road, Rennock Lodge and Rock Spring wells. These wells are used for domestic water supply by the NWC.
6. The high permeability of the regional limestone and the physical characteristics of the overlying soil unit make the limestone aquifer which these wells tap, highly susceptible to point source pollution from anthropogenic activities.

Risk Assessment

1. Three major hazards are expected to affect the site: hurricanes, earthquakes, and slope failure. The site is not flood prone and there is no anecdotal evidence of flooding in areas near the site.

2. The susceptibility of the proposed site is exacerbated primarily by its topographic elevations and the expected removal of trees for construction which otherwise act as natural wind buffers. This represents the lowest level of risk to the area proposed for development.

3. The project site itself is bounded to the east and west by mapped geological faults. The January 1993 earthquake affected areas within the vicinity of the proposed development and caused damage to the NWC's Filter Plant, ground cracks along the embankment road on the southwestern section of the Mona Reservoir and triggered a large rockslide in the limestone quarry located near the reservoir.

4. In general, the well-indurated, massive Newport and rubbly Walderston Limestones that dominate the site are very stable at steep angles. Only very willow soils occur atop the White Limestone Formations.

Biological Resources Assessment

1. The vegetation of the study area may be categorised as having predominantly two layers: (1) Emergent Trees and (2) Shrubs/Trees. Ecologically, the location is best described as a Degraded Dry Limestone Forrest.

2. Twenty eight (28) species of birds were observed and or recorded during the point count period or based on historical review. Of these, eleven (11) were Jamaican endemic species. Overall, the area has a very diverse bird community, and based on the survey, the study area supports no less than 39% of Jamaica's extant endemic bird species

3. Four (4) species of butterflies were identified from the study area. One species of moth and a dragonfly were observed. None of the butterfly species identified is considered threatened (Brown 1972, Garraway, 2005).

Landscape and Visual Impact Assessment

1. The context of the Project Site is Beverly Drive to the west, Wellington Drive and Old Hope Road to the north and Garden Boulevard to the east. There is a variety in the topography in the study are ranging from the flat landscape of Karachi Avenue and Mona Heights to the slopes of the proposed development area. The large areas of vegetation on the slopes within the Project Site are a major landscape resource.

2. The view from the site is towards the north and north east looking towards Mona, Mona Reservoir, Papine, Karachi, Hope Pastures, Jacks Hill, and the Blue Mountains. The developments in Karachi and Mona now view this property as a green hillside area with residential development to the west.

3. The Project Site is an area of dramatic contrast in the KMA. Therefore, landscape resources within, and adjacent to, the Project Site must be taken into account in the project design. The presence of the high quality landscape units constrains development.

4. The subdivision while it will alter the existing landscape and visual character of the site from a scrubby, rocky hillside slope into a residential use will conform to the existing residential character of the area.

Socio-economic Survey

1. The major concern associated with the proposed development is related to traffic congestion as expressed by 40% of the interviewees. Thirty per cent (30 %) of the residents interviewed had no concerns relating to the development; while the remaining 30% percent expressed concerns of environmental pollution and overcrowding among others.

2. Mona Road is an asphalted 2-lane road, which is consistent with its current use as a secondary road. Mona Road is a Class B road and services a number of residential

communities, which include the existing Mona Heights, Pines of Karachi, and Beverly Hills. The Mona Road converges with the Old Hope Road, a Class A main road.

3. Karachi Ave run west off Mona road and is classified as a Parish Council road that provides access to residents of Pines of Karachi and Beverly Hills.

Key survey results are shown below:

Daily traffic flow: 888 vehicles

am peak (7:00 - 8:00am): 141 vehicles

pm peak (4:30 - 5:30): 64 vehicles

4. It is projected that traffic at the Intersection: Mona Road (N)-Karachi Avenue-Mona Road (S) will increase from 20,273 (2010) to 26,354 in ten (10) years at a growth rate of 3%. Karachi Avenue, the main entrance point to the development is anticipated to generate approximately 1,021 vehicles per day (in 5 years) and 1,154 vehicles per day (in 10 years). Once the development is at complete build out it will generate approximately 55 vehicles during pm peak hour, which is less than one (1) vehicle per minute.

Environmental Impact, Mitigation and Management

1. The operation of the development will be monitored to ensure compliance with national environmental standards set by NEPA.

2. There is potential for slope movement, occurring as rockslides, along prominent fracture zones of the western slope. Impacts will invariably be generated, as access roads are cut and hard rocks are excavated. These impacts include:

- Noise nuisance, vibration and fugitive dust affecting adjacent communities, such as, the Long Mountain Country Club, Beverly Hills, and the Pines of Karachi.
- Increased vulnerability to slope failures of fractured rock along moderate to steep gradients.

Site preparation and construction works should , therefore, be controlled and systematically done and the impacts of such monitored during those phases of the development.

3. Development of a site for residential purposes normally leads to a 1.5 to 2--fold increase in storm water runoff caused by increase in pavement structures such as paved roads, driveways and sidewalks, as well as. runoff from roofs of houses. If the drainage system for the site is undersized and there is frequent blockage due to rock/soil debris entering the system, flooding could occur on the site, and may also negatively impact the nearby Pines of Karachi community.

4. Field observations indicate that storm water flows downhill, along the main road, from the Long Mountain Country Club could impact the site negatively,

5. The natural depression on site will be used to deposit 80% of storm water generated from the catchment area. Excess water from the retention area will be conveyed via a 1500 mm wide x 1,200 mm deep drain (Appendix 16.4) across the main road to an existing drain in the Pines of Karachi to the west of the Mona Reservoir (see Plate 7.1& 7.2). This depression will also be a a point of percolation that will effectively recharge the local aquifer.

6. The direct impact of the proposed conversion to residential housing lots will be a 90 % loss in vegetative cover of the property. Future tree species may be expected to be comprised of non-native fruit trees and ornamentals. With this change in habitat structure and composition, the avi-fauna will also dramatically change in its species composition from a community with few endemic species and subspecies to a community comprised almost totally of non-endemic birds similar to those currently occupying the Open Woodland/Savannah and Residential sites. Replanting of some native species, such as, the palm that is prevalent on the slopes would reduce this impact.

7. The relatively small size of the subdivision means that the scale of the impacts will inevitably result in landscape and visual impacts that are not excessive. The primary ones are the loss of local natural vegetation west of the main road and the visual impacts to the residents in close proximity to the site.

8. The undeveloped land 78.2 hectares (193.2 acres) on the eastern side of the Long Mountain road will remain as open space.

9. Replanting of trees will reduce obtrusiveness of structures.

10. The Long Mountain Range has been home to several Taino settlements. Subsequently, the area formed part of the historic Mona Estate comprising 1,372 acres, which was established in the late 17th century. However, during the assessment, archaeological features and artifact assemblages observed were not considered significant to warrant a declaration for preservation.

11. Development Control purposes would dictate that the gentler gradients that occur to the north of the proposed subdivision should retain some of the natural vegetation. Clearing of land may result in soil erosion at this section of the property.

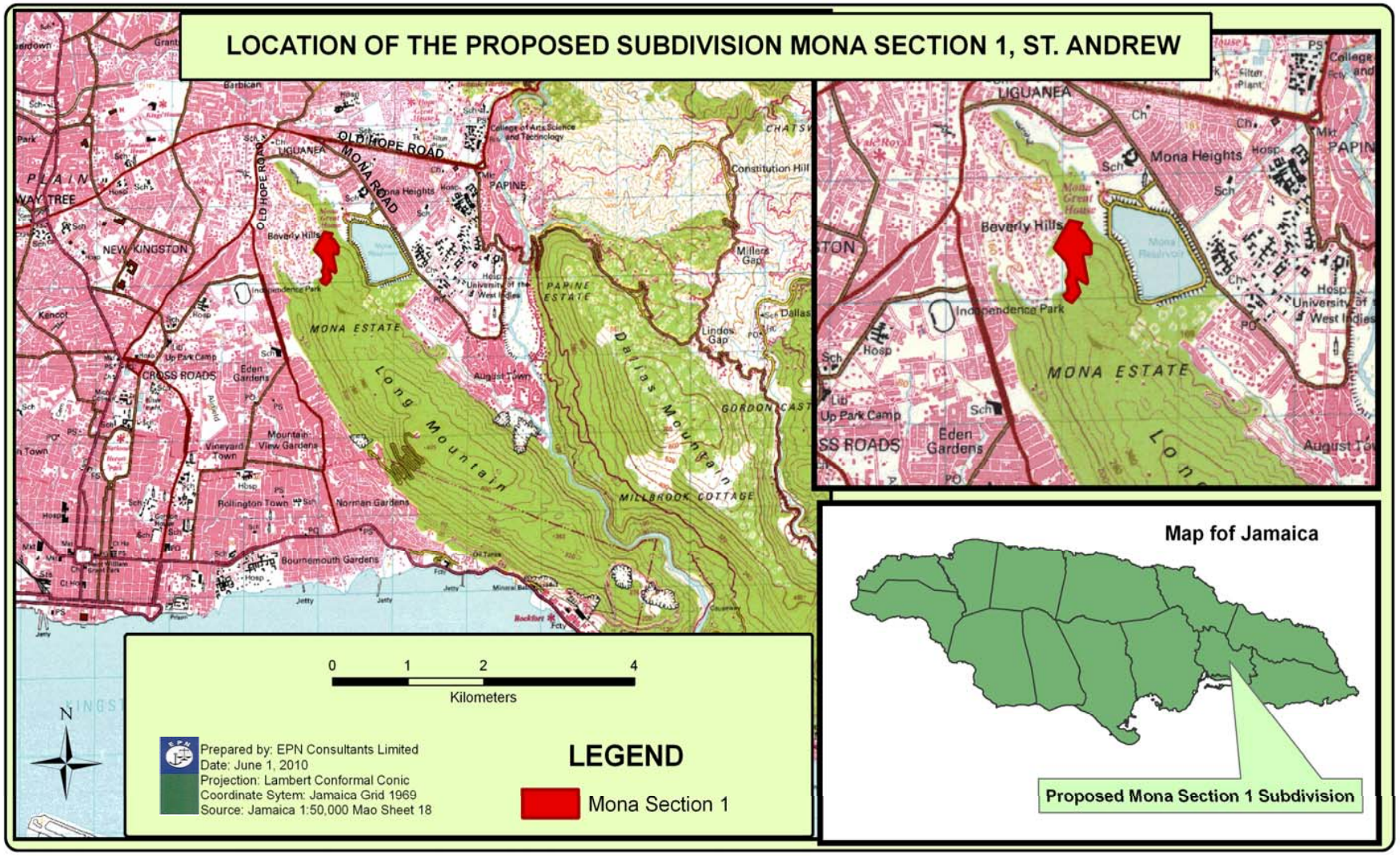
2. INTRODUCTION

2.1 OVERVIEW

The Long Mountain (or Wareika Hills) forms an imposing topographical feature within the Liguanea Plain as it runs for approximately 5 miles in a south east/north east direction. Despite its location, significance, and historical land uses, there is no clear and coherent land use plan for Long Mountain. The primary land uses on the ridge are public open space, conservation, residential and mining and quarrying (Caribbean Cement). Zoning for conservation/public open space uses stems from its well-documented attributes of biodiversity, archeological significance, a watershed area, and the location of a primary potable water source (the Mona Reservoir, towards the foot of its northeastern flanks and the Mona Treatments Plant).

Plate 2.1: Showing land uses surrounding the proposed Mona Section 1 property

The HAJL, as a Government of Jamaica (GoJ) Agency in fulfilling its mandate of providing housing solutions for the people of Jamaica intends to ensure its actions take into account today's needs, as well as, that of future generations. It supports Vision 2030 Jamaica National Plan in "preserving and renewing ecological capital" and the effort to "Integrate sustainability principles into land use planning and design."



Map 2.1: Showing location of the proposed Mona Section 1 development

The GoJ has been a major developer in the area commencing with the earliest middle income of Mona Heights housing scheme in the 1950's and Blue Castle for civil servants during the same period. More recently, the Pines of Karachi (1990's) which also targeted government employees and Long Mountain Club (2002), a joint venture project with GOJ were built. The last of the developments is Wellington Heights, which was subdivided in 1999.

The adjacent private subdivision, Bevely Hills, commenced development in 1939 on just over 100 acres (40.5 hectares) and was among the post-war suburb development by both government and the private sector. This subdivision was originally a part of the area known as De Tankerville. This scheme was subdivided by the private developer – Tankerville Properties Limited that later (1959) collaborated -ith Patrick Wilkinson Chung. The subdivision then comprised 248 lots and was one of the first of the upscale neighbourhoods to be developed. Based on observation, it appears that the original concept was to continue development into the site of the proposed subdivision, as the adjacent roadways such as Rutland Drive were never completed as cul-de-sacs. The present size of the development is about 230 acres.

2.2 METHODOLOGY

The National Environment and Planning Agency (NEPA) in following its framework for environmental permitting, in environmental scoping, established guidelines for preparing the Terms of Reference (TOR). These guidelines were augmented by discussions with project stakeholders, the specialist Environmental Impact Assessment professionals, and the relevant approval granting agencies. Team members conducted an exhaustive review of the possible impact-causing aspects of the project, the regulatory criteria controlling environmental aspects (development controls), and the status of valued environmental components (physical resource base of the project site and environs). Additionally, literature reviews on assessments of a similar nature and within the vicinity of the proposed development were used to strengthen the findings of baseline data collected.

The NEPA guidelines are as follows below:

1. An overall evaluation of the existing environmental conditions, values, and functions of the proposed development area.

2. A flora and fauna survey.

3. A detailed assessment of the present and proposed infrastructure for the subdivision to include but not be limited to roads and traffic, drainage, sewage treatment and disposal.

4. An assessment of hazard vulnerabilities of the site.

5. An assessment of the historical and cultural resources.

6. Landscape and visual assessment.

7. The effects of the development on the Mona Reservoir and the Mona Treatment Plant.

8. An assessment of slope stability.

9. A Socio-economic survey.

2.2.1 Physical Baseline

Baseline conditions at the proposed site were assessed following site visits, literature reviews, interviews and consultations based on the following:

- Meteorology (rainfall distribution, temperature/humidity, winds),
- Site topography (including discussion of terrain, landforms, surface drainage)
- Regional and site geology (including superficial bedrock, faults, cover, such as, soils)
- Hydrology (groundwater including regional groundwater, controls and water demand and supply issues)
- Multi-hazard assessment
- Maps and photographs will be included as necessary.

2.2.1.1 Noise Assessment

The noise level characteristics of the site were taken 2011 May 03 at one (1) location along the north eastern southern boundary at Lot 1 (close to the main road) on the property for the proposed residential subdivision at approximately 1:55 pm with the Amprobe Sound Level Meter. The instrument was set at low range (which is appropriate for measuring average sound levels) and slow response (for measuring stable noise) and function A (for general noise sound levels).

2.2.2 Site Ecology Baseline

The Mona Section 1 site was surveyed over a period of two (2) days, May 4 - 5, 2010. These surveys involved bird evening counts on May 4; and morning counts on May 5; and included other faunal and vegetation/habitat surveys during the specified dates. Evening surveys were conducted between the hours of 4:00 pm - 6:30 pm while morning (day) surveys were conducted 5: 30 am - 10:30 am.

2.2.2.1 Avifaunal Census

Two survey techniques were utilized in the determination of species composition. These were:

- Point Count Technique, with distance estimation
- Transect Technique, without distance estimation

A total of 4 point counts and 3 transects were completed, from which a species list of 21 species inclusive of migrant, resident and endemic birds, was generated. A further review was done to include species known to frequent the Long Mountain area from past surveys. This review increased the species list to 34 species

Other Faunal Surveys

Other faunal surveys were done, through basic direct observation of species within a randomly selected area. The use of burrows, nests, and tracks were also included to ensure a complete assessment of all the fauna.

2.2.2.2 Vegetation Assessment

In assessing trees, a Point-Centered Quarter (P.C.Q.) Method was used. In addition, detailed vegetation descriptions were done from (randomly) selected points. A species list of tree and plant species inclusive of all plant life forms, endemics, and native plants was generated.

2.2.3 Socio – Economic Impact Assessment Methods

Data to support the Social Impact Assessment (SIA) were collected through primary and secondary data sources and with Geographic Information Systems (GIS):

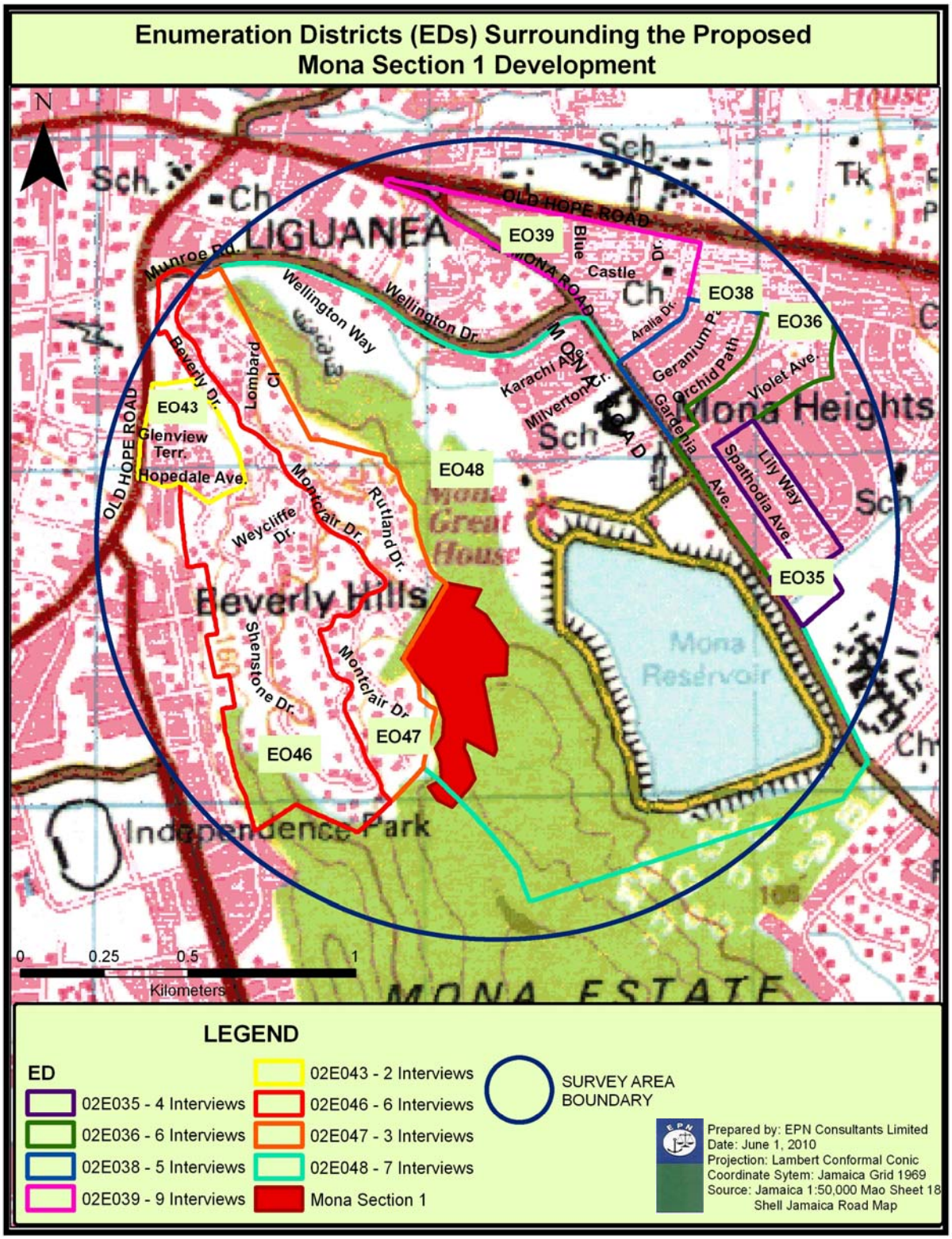
1. Primary data through:

- reconnaissance of the site and adjacent areas
- interviews with and socio–economic survey among local stakeholders
- telephone interviews with personnel of relevant government agencies and service providers
- Data from 12 hour peak traffic count conducted on 2009 March 30 at the T Junction Mona Road/Karachi Avenue, the primary access road to the site of the proposed development.

2.2.3.1 Socio-economic Survey

The socio-economic survey was conducted in 42 households (see Table 2.1) on 2010 May 8 & 12 via face-to-face interviews with persons over the age of 18 years. The survey instrument was a questionnaire consisting of 15 open-ended and closed-ended questions (see Appendix 16.8). The key points of the survey will be alluded to in the socio-economic impact section of the document while the overall findings also presented in Appendix 16.8. The survey was conducted in the Enumeration District (ED) within which the site falls, as well as, neighbouring communities, which ll within an approximately 1.5 km radius of the property. Map 2.2 displays the eight (8) EDs, within which the survey was conducted.

The sample size per ED was determined using the quota sampling method.



Map 2.2: Enumeration Districts within which the socio-economic survey was conducted.

Table 2.1: The number of households per Enumeration Districts

ED CODE AND LOCATION	POPULATION	FREQUENCY
East 035 Mona Heights	373	4
East 036 Mona Heights	591	6
East 038 Mona Heights	473	5
East 039 Mona Heights	902	9
East 046 Beverly Hills	663	6
East 047 Beverly Hills	316	3
East 048 Pines of Karachi	717	7
East 043 Glenview Terrace/Hopedale Avenue	230	2
Total	**3,665**	**42**

The steps taken to determine the number of surveys per ED are as follows:

1. Find the population within EDs located between .75 and 1.5 km from the proposed site

2. Find approximately 1 percent of the population in each ED (see Table 2.1).

Secondary data was obtained through:

- Analysis of National Population 1991 and 2001 Census Data

- Documentary research of information from government institutions, such as, the National Environment and Planning Agency (NEPA), Ministry of Education and Youth,), the Statistical Institute of Jamaica (STATIN), the National Works Agency (NWA), the Water Resources Authority (WRA) and the Office of Disater Preparedness and Emergency Management (ODPEM).

3. The use of Geographic Information System (GIS)

- Review of the 2001 Population Census, based on Enumeration District and Traffic Count data sets.

2.2.3.2 Landscape and Visual Assessment

The methodology for undertaking the landscape and visual impact assessment is in general accordance the requirements of the National Environment and Planning Agency.

The approach to the Landscape and Visual Impacts is as follows:

- landscape impact assessment will assess the source and magnitude of developmental effects on the existing landscape elements, character and quality in the context of the site and its environs; and,

- visual impact assessment will assess the source and magnitude of effects caused by the proposed development on the existing views, visual amenity, character, and quality of the visually sensitive receptors within the context of the site and its environs.

Landscape Impacts

The assessment of the potential impacts of a proposed scheme on the existing landscape comprises:

- baseline survey; and,
- potential landscape and visual impacts assessment

A baseline survey of the existing landscape character and quality will be undertaken from site and desktop surveys. Landscape elements considered include:

- local topography
- vegetation extent and type;
- built form
- patterns of settlement
- land use
- prominent water feature
- archaeological and cultural identity.

The assessment of the potential landscape impacts of the proposals will result from:

- identification of the sources of impact, and their significance and their magnitude
- the landscape character and its quality

Visual Impacts

The baseline survey of all views towards the proposals is undertaken by identifying:

- The visual envelope or visual zone within which the proposed development may be contained either wholly or partially with in views.
- The sensitivity of each receptor group and how their views are influenced by their location relative to the subdivision are considered. These include views from residences and open spaces.

2.2.3.3 Archaeological/historical/cultural Assessment

The Jamaica National Heritage Trust (JNHT) through a detailed site assessment assessed the cultural environment in its historical context. This led to the determination of the historical and cultural value of the location.

3 . POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

This development will take place under the Housing Act, 1955. Under the Act, the Ministry of Water and Housing has the power to override the Town and Country Planning Act, (Law 42 of 1957). The Town and Country Planning Act guides and controls development and, in essence, ensures sustainable land use, protects the land and physical environment from misuse and premature development. The vehicle through which these objectives are met is the Development Order, which may be framed out of a Development Plan. However, Development Orders are not prepared for all areas. These Orders are prepared by the Town and Country Planning Authority (TCPA) (a body established under the Act) in consultation with the Local Planning Authority (Parish Councils & Kingston and St. Andrew Corporation (KSAC)). The TCPA can "call in" an area for which a Development Order has been prepared. This includes the *Kingston Development Order, 1966* that sets zoning requirements for the development of land in the parishes of Kingston and St. Andrew. The proposed development site is zoned for public open space in the 1966 *Confirmed Kingston Development Order for Kingston* while in the emerging *Kingston and St. Andrew Development Order*, *2008,* the proposed zoning is public open space/conservation.

However, in order that the development might proceed, an Environmental Permit from the NEPA is mandatory under the Natural Resources Conservation (Permits and Licences) Regulations, 1996. These Regulations stipulate the grant of permits for activities in prescribed areas as outlined in section 9 of the Natural Resources Conservation Authority (NRCA) Act, 1991. This addresses the management of environmental risks of development activities. The process is shown in Figure 3.1 below.

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

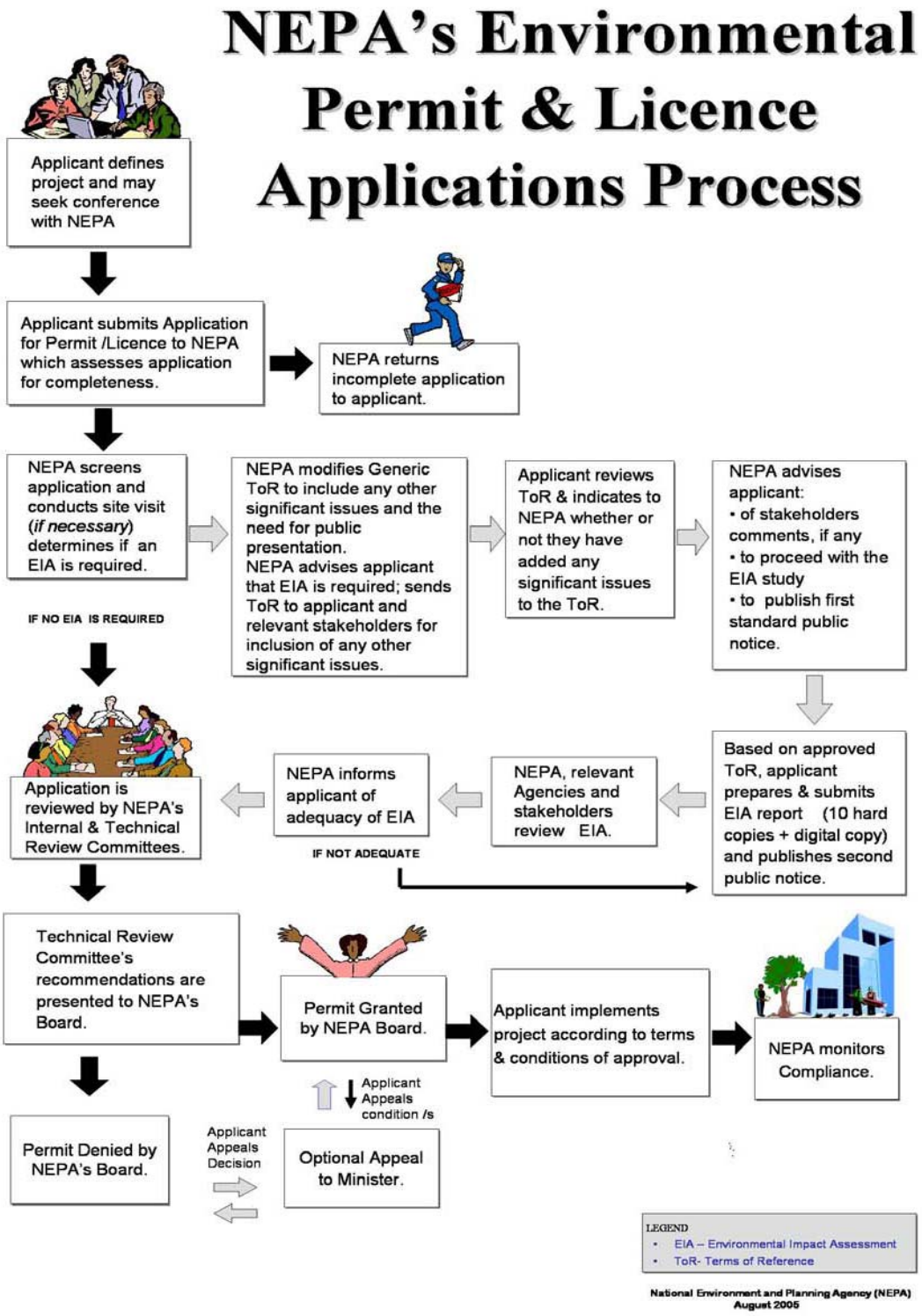


Figure 3.1: NEPA's flow chart for the Environmental Permit and Licences process.

Table 3.1: Relevant Regulatory Authorities

REGULATORY AUTHORITIES	DESCRIPTION
The National Environment and Planning Agency	Under the Natural Resources Authority Act and the Permits and Licenses Regulations of 1996, NEPA is responsible for environmental protection on the island. In discharging its responsibilities, NEPA is not only responsible for the environmental protection but also manages the nation's natural resources and enforces the environmental and development planning laws. Its functions include ensuring that developments are undertaken within its environmental guidelines by requiring Environmental Impact Assessments, reviewing proposed developments, and granting permits and licences. Besides the NRCA Act, NEPA monitors and enforces laws and regulations such as The Beach Control Act, The Watershed Protection Act, and the Wildlife Protection Act.
The Town and Country Planning Authority	This development falls under the Town and Country Planning Act of 1958 (amended 1993 and 1999) and the Local Improvements Act of 1944. The guidelines of the Westmoreland Parish Confirmed Development Order (1982) should generally be adhered to. These statutes control the development and subdivision of land. In such cases, normal procedures for building and development applications would be pursued by being channeled through the Westmoreland Parish Council and NEPA respectively.
The Ministry of Health	The Environmental Health Unit (EHU) of the Ministry of Health (MOH) is the agency responsible for the approval of the proposed sewage treatment and disposal system and setting the discharge limits and pollution control. The EHU would be responsible for reviewing the designs of the sewage treatment plant and the development plan for the cemetery.
The National Works Agency	Under the Ministry of Transportation and Works, NWA is responsible for reviewing the proposed development plan and ensuring that the drainage and road design meet the required standard. In essence, this means that the NWA will have to ensure that the surface drainage/storm war runoff generated from the site is effectively intercepted and disposed of and that the design for proposed main entrance road to the cemetery is safe.
National Water Commission	The NWC is responsible for potable water supply and sewerage services and will review the sewage disposal and water supply plans for the project and determine whether they should be approved.
Water Resources Authority	This government Agency is responsible for monitoring and ensuring the proper use of the surface and ground water resources of the island. The WRA is usually asked to review proposals for the development of a cemetery.
The Kingston and St. Andrew Corporation (KSAC)	The KSAC is the local planning authority and has responsibility for the provision, management, and regulation of certain public services including public health services, fire protection, abattoirs, cemeteries, street cleaning, parks and play fields and markets. The Parish Council is also responsible for solid waste disposal, however, Western Parks and Markets manages this. The Parish Council will give permission to construct the cemetery if the building plans meet the required standard.
Office of the Prime Minister (Local Government Division)	This ministry has responsibility for coordinating the functions of the local authorities such as the Parish Councils and the NSWMA.
National Land Agency	This government agency has the responsibility of managing all information as it relates to land (services) and would verify land ownership by the project proponent.
Urban Development Corporation	This government agency is responsible for urbanization in rural areas and would serve to ensure that the proposed development is sustainable.
Jamaica National Heritage Trust	This agency is responsible for the preservation of monuments, art, botanical, and animal life, and anything designated as protected national heritage for the benefit of the island.
Office of Disaster Preparedness and Emergency Management	This Government agency's overarching responsibility is disaster risk reduction through its hazard preparedness and mitigation measures.

Table 3.2: Relevant Regulatory Legislations

RELEVANT LEGISLATIONS	DESCRIPTION
The Natural Resources Conservation Authority (NRCA) Act, 1991	The NRCA Act (1991) is the overriding legislation governing environmental management in Jamaica. It requires that all new developments (or expansion of existing projects) which involve the sub-division of ten (10) or more lots be subject to EIA. The regulations require that fifteen (15) copies of the EIA Report be submitted to the Authority for review. Therefore, a preliminary review period of ten (10) days is required to determine whether additional information is needed. After the initial review, the process can take up to ninety (90) days for approval. If on review and evaluation of the EIA the required criteria are met, a permit is granted. In the event that the EIA is not approved, there is provision for an appeal to be made to the Minister. Specifically, the relevant section(s) under the Act that addresses the proposed project are: Section 10: Empowers the Authority to request EIAs for the construction of any enterprise of a prescribed category. Section 12: Addresses the potential for contamination of ground water by trade effluent and sewage. Section 15: Addresses the implementation of stop orders and fines associated with the pollution of water resources. Section 16: Authorizes the government to intervene in order to prevent the contamination of ground water. Section 17: Addresses the authority of the government to request in writing, any information pertaining to the: - performance of the facility - quantity and condition of the effluent discharged - the area affected by the discharge of effluent.
Natural Resources Conservation (Permits and License) Regulation, 1996	▪ Water treatment facilities including sewage and industrial wastewater require permits. ▪ Regulation 8 sets out the application process for obtaining a license to discharge pollutants ▪ Regulation 9 empowers the NRCA to require owners for operators of existing facilities to upgrade their facilities to the "current standards applicable to new facilities" within a specified time

RELEVANT LEGISLATIONS	DESCRIPTION
The Watershed Protection Act, 1963	This Act governs the activities operating within the island's watersheds, as well as protects these areas. The watershed designated under this Act is the Deans Valley River Watershed Management Unit.
The Public Health Act, 1974	This Act falls under the ambit of the MOH. Provisions are also made under this Act for the activities of the Environmental Health Unit (EHU), a division of the MOH. The EHU has no direct legislative jurisdiction, but works through the Public Health Act to monitor and control pollution from point sources. The Central Health Committee would administer action against any breaches of this Act. In addition, there are various sections of this legislative instrument that govern and protect the health of the public. Relevant sections under the Public Health Act of 1985 are: Section 7 - (1) A local Board may from time to time, and shall if directed by the Minister to do so, make regulations relating to nuisances and, Section 14 - (1) The Minister may make regulations generally for carrying out the provisions and purposes of this Act, and in particular, subject to Section 7 but without prejudice to the generality of the foregoing, may make regulations in relation to air, soil, and water pollution.
The National Solid Waste Management Act, 2001	The Regulatory Agency, NSWMA will be responsible for the implementation of the National Solid Waste Management Act. In Part II Section 4-1 the Authority shall – (a) Take all such steps as are necessary for the effective management of solid waste in Jamaica in order to safeguard public health, ensure that waste is collected, stored transported, recycled, reused or disposed of, in an environmentally sound manner and promote safety standards in relation to such waste;" In Section 23 – (i) Every person who: a. Operates or propose to operate a solid waste disposal facility: b. Provides or proposes to provide solid waste collection or transfer service; or c. Otherwise manages solid waste, "Shall apply in the prescribed form and manner to the authority for the appropriate licence." Part V Section 42 – (i) 7. The Authority may provide the occupier of any premises, on his request, with receptacles to be used for: a. Compostable waste which is to be recycled b. Non - compostable waste which is to be recycled; or c. Waste which is not to be recycled" Subject to subsection (4), the Authority may, in relation to a request for receptacles: a. Where possible, provide them free of charge; or b. Provide them at such cost, and on such terms as to payment, as may be agreed with the occupier. Part VII Section 45 - Every person who - a. Disposes of solid waste in any area or in any manner not approved by the authority; b. Operate a solid waste disposal facility, provide solid waste collection or transfer service or otherwise manages solid waste, without a valid licence or operating certificate under this Act or any regulation hereunder; commits an offence and shall be liable on summary conviction before a Resident Magistrate to a fine not exceeding one million dollars or to imprisonment for a term not exceeding nine months or to both such fine and imprisonment. The NSWMA is the public authority responsible for solid waste management in Jamaica, under the National Solid Waste Management Act, 2001. This includes provision for environmentally sound waste collection, transportation, re-use and recycling, and the establishment of a licensing system for operators of solid waste management facilities and collection systems. The permit issued to the applicant

RELEVANT LEGISLATIONS	DESCRIPTION
	stipulated that the developer had the responsibility to dispose solid waste from the facility at an NSWMA approved disposal site.
The Wildlife Protection Act , 1945	The Wildlife Protection Act of 1945 is administered by NEPA and provides regulation for the protection and conservation of animals, birds, and fishes.
Jamaica National Heritage Trust Act, 1985	The Jamaica National Heritage Trust Act of 1985 established the Jamaica National Heritage Trust (JNHT). The trust's functions include the following responsibilities: • To promote the preservation monuments and anything designated as protected national heritage for the benefit of the land; • To carry out such development, as it considers necessary for the preservation of any national monuments or anything designated as protected national heritage; • To record any precious objects or works of art to be preserved and to identify and record any species of botanical or animal life to be protected. Section 17 further states that it is an offence for any individual to: • Willfully deface, damage or destroy any national monuments or protected national heritage or to deface, damage destroy, conceal or remove any mark affixed to a national monument or protected national heritage; • Alter any national monuments or mark without the written permission of the Trust; • Remove or cause to be removed any national monument or protected national heritage to a place outside Jamaica.
Town and Country Planning Act, 1958	The Town and Country Development (Westmoreland) Confirmed Development Order, 1982 falls under this Act and guides physical development in the Parish. Section 5 of the Town and Country Planning Act authorizes the Town and Country Planning Authority to prepare, after consultation with any local authority, the provisional development orders required for any land in the urban or rural areas, so as to control the development of land in the prescribed area. In this manner, the Authority will be able to coordinate the development of roads and public services, conserve, and develop the resources in the area. Any person may, under Section 6 of the Act, object to any development order on the grounds that it is: • impractical and unnecessary; • against the interests of the economic welfare of the locality. However, if the Minister is satisfied that the implementation of the provisional development order is likely to be in the public interest, he may, under Section 7 (2) of the Act, confirm it with or without modification by publishing a notice in the Gazette. Section 8 of the Act also gives the Minister the authority to amend a confirmed development order. Section 10 of the Act states that a development order must include: • clearly defined details of the area to be developed; • regulations regarding the development of the land in the area specified; • formal granting of permission for the development of land in the area. If the provisions of section 9A of the Natural Resources Conservation Authority (NRCA) Act apply to the development, the application can only be approved by the Planning Authority after the NRCA has granted a permit for the development. (Section 11 (1A). The Authority may impose a "tree preservation order" under Section 25 of the Act if it considers it important to make provision for the preservation of trees and woodlands in the area of the development.
Town and Communities Act, 1843	The Town and Communities Act of 1843 govern the code of conduct in communities.

RELEVANT LEGISLATIONS	DESCRIPTION
The Local Improvements Act	The subdivision of land throughout Jamaica is regulated under this Act. The Act stipulates that all subdivision of land for building or sale throughout Jamaica require the permission of the local planning authority of the parish in which the land is located. The Act requires that the comments of the Chief Technical Director be obtained prior to the applicant being notified of the Parish Council's decision. By virtue of an amendment in 1959, the expert advice of the Government Town Planner is also required by the local authority prior to notification of applicants.
The Clean Air Act, 1964	The Central Health Committee regulates air emissions of any noxious or offensive gases and dust from a premise. This Act lists seven categories of dust and noxious gases, including air emissions from the following works: alumina, cement, lime, sulphur from petroleum processing, gypsum, and sugar factories. With the exception of cement that will be used in the construction phase of this development, the project does not include any of these activities in its construction or operational phase.
The Noise Abatement Act, 1997	The Noise Abatement Act, 1997 is the main legislation for the control of noise in Jamaica. Section 3 of this Act prohibits persons in private or public places from operating amplification devices in such a way that could cause a nuisance to persons in the vicinity.
The Water Resources Act, 1995	The Water Resources Authority (WRA) administers the Water Resources Act 1995, which regulates the allocation and preservation of water resources in Jamaica.

Table 3.3: Relevant International Agreements, Conventions& Standards

INTERNATIONAL STANDARDS, AGREEMENTS & CONVENTIONS	DESCRIPTION
Agenda 21	This is an international programme developed at the United Nations Conference on the Environment and Development, which provides proposals for the work on sustainable development on all areas of society. This programme, however, is not legally binding.
Convention on Biological Diversity	This convention is concerned with the protection and sustainable use of the world's biological diversity and equitable sharing of the benefits arising from the sustainable use of heritable resources.
Rio's Forest Principles	This document promotes sustainable forest management. The Intergovernmental Forum on Forests (IFF) implements the forest principles. Similar to Agenda 21, this document is not legally binding.
Habitat Agenda	This programme promotes sustainable development in urban areas and contains a global action plan for the sustainable development of cities.
United Nations Convention on Combating Diversification (UNCCD)	**United Nations Convention to Combat Desertification (UNCCD)** was adopted in Paris on **June 17, 1994** and was entered into force on **December 26, 1996** ninety days after the fiftieth ratification was received**.** Presently, **UNCCD** membership stands at 194. The **UNCCD** is the only internationally recognized legally binding instrument that addresses the problem of land degradation in dry land rural area. UNCCD is a direct result of the United Nations Conference on Environment and Development (UNCED), which took place in Rio in 1992, sometimes known as the earth summit and it one of efforts at securing sustainable development.

4. PUBLIC PARTICIPATION AND CONSULTATION

4.1 THE PUBLIC PARTICIPATION PROCESS

Public Consultation is an integral part of the EIA process as it ensures that the views (on the proposed development) of the local community members and stakeholders are heard and taken into account. The public consultation included telephone conversations with selected stakeholders in the Kingston and St. Andrew (Table 4.1) and a survey conducted in communities within approximately 1,5 km radius of the proposed site location. There have been ongoing discussions of the proposal in the print and voice media and some of these discussions are summarized in Appendix 16.8.

4.1.1 Interviews

Face to face, interviews were conducted with individuals who either lived in adjacent communities or who are stakeholders in the development process. Not everyone was willing to have his opinion recorded while some would but wished to conceal their identities. Then there are those who did not fall into any of those groups as shown in Table 4.1. Generally, comments focused on the need to ensure sustainability of the proposed project.

Table 4.1: List of selected stakeholders and their comments on the proposed development

CONTACTS	COMMENTS	DATE
Eistein McLean Agricultural Extension Officer/ Resident of Pines of Karachi	All for it once an EIA is done that addresses the issues raised by the BHCABS.	2011 April 10
Newton Ramdial Resident- Long Mountain Country Club	There is a great need for housing accommodation in the corporate area. However, due diligence must be followed in all areas of the EIA and by all affiliated agencies to minimize or mitigate against potential threats associated with the development.	2011 April 10
Chris Harty Engineer/ Resident of Mona Heights	In support of the development once, proper protocols have been observed. Great attempts being made to provide housing accommodation for an increasing population that brings with it its own challenges; despite the disingenuous attitude displayed by some people. A point worth making is that people are not willing to build up so we have to build out, as there is a notion that people need yard space, thus, green spaces are being threatened.	2011 April 10
Lecturer/ Resident of Pines of Karachi (Does not wish to have name disclosed)	I have no problem with the proposed development as provision is being made for individuals to become homeowners. However, the site proposed for development I believe, threatens the preservation of a natural setting. This I hope will be properly assessed by the relevant agencies. Additionally, I am of the view that the sale of the units may ultimately be used to decide on how some of the issues will be addressed, for example, the sewerage management method.	2011 April 10
Medical Doctor Resident of Beverly Hills (Does not wish to have name	Development is progress. Attempts are made to provide stable and safe houses for individuals. However, there is potential destruction of the existing ecosystem and leaching of	2011 April 21

CONTACTS	COMMENTS	DATE
disclosed)	contaminants into the water underground. Personally, I believe one of the 'biggest' threats to residents in the existing communities is poor maintenance of the sewerage system if and when the problem occurs.	
Phyllis Weller Retired/ Mona Great House	The main concern was "Can the services support a new development?"	2011 May 30

Source: Telephone and face-to-face interviews

4.1.2 Socio-economic Survey

The survey sought to provide a qualitative assessment through those to be directly impacted by the proposal. Those interviewed fell within a wide a range of income groups and they included the educator, attorney at law, businessman, engineer, accountant, media personnel and the retiree.

The findings of the survey are presented in Appendix 16.8, however, the responses to two (2) of the questions are summarized in Tables 4.2 & 4.3 below. As shown in Table 4.2, the main concern expressed was traffic congestion (40%). A significant number of persons (30%) had no concerns.

Table 4.3 shows that 57% of those interviewed agree with the proposal for the residential subdivision while one-third (33%) indicated that the area should remain in its present form (a green area).

Table 4.2: What would be your main concern in the event of the construction of the proposed housing development?

RESPONSES				
Traffic congestion	**environmental pollution**	**overcrowding**	**none**	**other**
40%	10%	10%	30%	10%

Table 4.3: What would you recommend for the proposed housing development site?

RESPONSES				
Housing	**Green Area/Remain as is**	**Shops**	**Community Centre**	**Not Sure**
57%	33%	2%	5%	2%

4.1.3 Overview of public discussion

As shown in Appendix 16.8 there has been controversy associated with past and present development proposals in the area. There were several issues surrounding the development of the Long Mountain Country Club, as expressed by primarily the Karachi and Beverly Hills communities and Environmentalists. In summary the main talking points were:

1. Access road to the Long Mountain Country Club. Neither the Karachi Avenue nor Beverly Hills residents wanted access through their community.
2. Whether the Long Mountain Country Club had proposed the construction of its own permanent access road.
3. The solid and sewage waste disposal and their impact on the Pines of Karachi residents.

With respect to the HAJL proposal the discussions have included:

1. The Long Mounatin is the watershed area for the Mona Dam (This was denied by the NWC)
2. Discharge of additional storm water in the drainage channel could erode the lower slopes facing the reservoir
3. Sewage from the proposed development entering the Mona reservoir
4. The need to assess the potential impact of the proposal with respect to the reservoir and the the potable water supply, wild life and solid waste.

5. COMPREHENSIVE DESCRIPTION OF PROPOSED PROJECT

5.1 THE PROPONENT

This proposed residential subdivision is a project of the GoJ through being proposed through HAJL as indicated above. The Agency has the direct responsibility for all phases of the project cycle. HAJL will be responsible for the planning, design, construction/implementation, marketing and sales of the proposed serviced lots.

5.2 PROJECT CONCEPT AND DESCRIPTION

5.1.1 The Project Proposal

The proposed sixty-lot subdivision comprises the following as shown in Appendix 16.6 and the land budget in Table 5.1:

Residential Lots – 54 serviced lots with sizes ranging from 923 m² to 2,078 m².

Recreation Area - an adjacent area zoned for the new community (1 lot).

Open space and Retention Area - area reserved for the retention of 80% of site's storm water runoff and open space (1 lot)). An additional adjacent area - but to the north is also zoned for open space.

Landscaped Area - open spaces, recreational area, verges, and roadways.

Physical Infrastructure – allocations for sewerage and drainage easements (9). Existing and proposed potable water tanks (3 lots).

On site roads – reserved roads (4) and service road (1).

Access road – the main access road to the property leading from the Class B main road.

Table 5.1: Showing Land Budget for the proposed Mona Section 1 development

LAND USE	TOTAL	AREA (M²)
Residential	54 lots	59,195.210
Physical Infrastructure:		
Potable water tanks	3 lots	4, 011.690
Reserved Roads	4	7,710.410
Service Road	1	3,965.810
Sewer & Drainage Easement	9	5,063.790
Open space and retention	1 lot	6,510.495
Open Space	-	6,935.340
Recreational area	1 lot	22,777.703
Existing Telecom Operation	1 lot	1,871.688
TOTAL		**118,042.136**

5.1.2 Justification for Site

This site was chosen based on four (4) main considerations:

- The site is government owned
- The site is accessible
- The site is located adjacent to existing communities and despite questions on issues of environmental sustainability and carrying capacity, tradeoffs can be been considered
- The development would breach Development Order guidelines but these can be addressed in the tradeoffs mentioned in #3.

5.1.2 Socio-economic Integration

The developer of the proposed site envisages an environmentally sound development that assist in the remedy of the shortfall in housing solutions within the KMA. Socially, the proposed development would help to arrest the backlog in new housing solutions in the KMA; economically, the opportunities for employment will arise for contractors, construction workers, business opportunities for suppliers of construction equipment and materials and players in the real estate market. Economic benefits that would accrue to the developer would further strengthen its ability to be a primary public sector developer of housing solutions.

5.2 PROJECT INFRASTRUCTURE

5.2.1 Roads, Transportation, Traffic

There are two proposed access/egress points off the Pines of Karachi to Long Mountain Road, located towards the north and south. The internal road network is influenced by the existing contours of the hilly terrain and comprises three (3) reserved roads and two (2) service roads. Typical road carriageway will be approximately 7.9 meters with minimum 2-metre wide sidewalk reservations on either side.

5.2.2 Potable Water

The NWC has confirmed the availability of water supply that can be accessed through its supply main along the main road. However, the erection of a 60,000 gallon capacity water tank has been requested and this is to be built at the same location as the two (2) tanks that serve the existing Beverly Hills and Long Mountain Country Club communities. Design calculation for the supply system is included in Appendix 16.4.

5.2.3 Electricity/Telephone

The Jamaica Public Service Company Limited (JPS Co.) will likely provide electricity to households who do not opt to install a renewable energy systems (solar and wind).

LIME and FLOW offer landline telephone service. Cellular service is available in the area from Digicel, LIME, and Claró.

5.2.4 Drainage

The site topography and geomorphic influences at Mona Section 1 influence the management of site drainage as the general north-east trending slopes direct drainage towards a 10-metre depression at the extreme north of the development (Runoff does not flow in the direction of the Mona Reservoir as shown in Figure 6.3). The retention area has been designed to accommodate 1:100 year rainfall events as shown in Appendix 16.4. This a green infrastructure feature of the project design as approximately 80 % of the storm water from the catchment area will be deposited in that depression.

Where the capacity of the depression is exceeded during more extreme rainfall events, an overflow drain that will route the excess storm water to existing structures in the Pines of Karachi, is planned (Appendix 16.4) .

5.2.5 Waste Disposal

i. Solid Waste Disposal

Solid waste from the site would be disposed of at the Riverton City Solid Waste Disposal Site. The removal of solid waste from the Mona Section 1 development would be the responsibility of the National Solid Waste Management Authority (NSWMA).

As it relates to construction waste, it is expected that private trucks will be hired by individual lot owners to remove construction and other debris from the site as the demand arises.

ii. Sewage

Wastewater treatment will by the NWC system. All raw sewage will be collected and disposed of by the central NWC system when it is directed to the existing NWC Karachi sewage pump station. A dissipating hole is located adjacent to the proposed development site, however, the site does not lend itself to direct connection by way of gravity feed to the existing sewer line, therefore; a lift station will be built to facilitate that connection.

All sewer pipes with gradients over 22 % will be encased in concrete protection. Details of the sewerage system is included in Appendix 16.4.

5.2.6 Spoils

Materials required for filling areas such, as low points, in the road profile, would be sourced from materials excavated from the site if found suitable. Surplus material would be incorporated into the landscape architecture for the project.

5.2.7 Construction Materials

Basic construction materials such as, sand, cement, marl and blocks should be obtained from legitimate sources at the closest proximity to the site. This would have the effect of reducing transportation costs and the use of energy (petrol) and the emission of green

house gases (ghg). As far as possible, other required materials will be sourced locally. Imported goods will be used where it is essential or unavoidable.

5.2.8 Landscaping

A **Open Space**

Open space zoning will be in accordance with the requirements of the Local Planning Authority and NEPA. The proposed open space will comprise outdoor facilities intended to cater for children's play space, local sitting out areas and shade structures. However, the recreation area as proposed is isolated from the subdivision by the main road leading to the Long Mountain Country Club. It would have been best integrated into the subdivision - somewhere in the centre where access to it would have been easier and safer. The park should, however, be developed with proper facilities including a playground for both adults and children.

Safety concerns with respect to the safe access for children and adults to the park should be addressed with a footbridge or some other appropriate safety solution such as a designated individual to assist children across and or a pedestrian crossing.

B Roadside Landscape Design

A landscaped area (tree corridor) of up to - thirty feet (9.1 metres) wide will be developed along the undeveloped eastern side of the Long Mountain Road that can also be used as a safe jogging trail for the community. This will also create a well-defined green corridor, softening the visual harshness of that side of the road. This corridor would link with the recreational area to be developed.

C Aesthetics

The lots are approximately ¼ of an acre (1,012 sq. m). The required building coverage should be maintained to ensure enough land would remains to do proper landscaping that would facilitate the percolation of stormwater thus reducing runoff . Owing to the fact that the land is very rocky, topsoil will be needed for landscaping. The planting of palm trees that thrive in this type of environment should be encouraged to soften the subdivision's visual impact making the buildings as visually recessive and unobtrusive as possible. This would be in addition to any trees that were marked for preservation.

5.2.9 Other Comments on the Project Design

5.2.9.1 The Influence of Site Topography

The site consists of rough/undulating hills; hence, the slopes vary greatly. The steepest slopes that are found in the centre of the property fall in the range 1: 1 to 1: 4. The subdivision design, however, has addressed this by the orientation of the lots and the use the flatter areas for roadways. The northern and southern sections of the property have gentler/flatter slopes (1:8 – 1:10) which are more conducive to housing and infrastructure development. The terrain has forced the design into three enclaves, however, workable but costly.

5.2.9.2 Project Design and Drainage

The proposed development site collects storm water from Beverly Hills housing development via two adjoining roadways which may affect a few lots at the lower level or northern section of the site.

The site in general exhibits rapid run off at all points and generally drains south to north mostly by a network of short earth drains flowing in a northerly direction, however, at varying angles. The rate of run off is expected to increase during and after construction. Nevertheless, the possibility of the complete flooding of any area on the site is negligible/extremely low.

6. DESCRIPTION OF THE EXISTING ENVIRONMENT

6.1 PHYSICAL

6.1.1 Climate and Air Quality

Jamaica experiences what is described as a bimodal rainfall pattern, which consists of two peak periods, with higher values of rainfall (May to June & September to November) and corresponding periods of lower rainfall amounts. The Island's primary peak is in October, while the secondary peak in is May. Jamaica experiences the lowest rainfall levels during the period February to March and the month of July.

i. Precipitation

The mean total annual rainfall for the Norman Manley International Airport station is 733 mm (Table 6.1) Highest rainfall values are in the months occur during September to November. The dry season lasts from December to April, with a secondary rainfall maximum occurring in May.

Table 6.1. Norman Manley International Airport Climatic Data (1992 - 2002)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Max Temp. (C)	31.0	30.9	31.1	31.7	32.0	32.8	33.4	33.0	32.8	32.4	32.0	31.4
Highest Max.	32.8	32.7	32.6	33.0	33.6	34.4	35.1	34.9	34.7	34.3	34.0	33.2
Min Temp. (C)	22.6	22.6	23.1	23.9	24.9	26.0	25.8	25.6	25.5	25.0	24.2	23.2
Lowest Min.	20.7	20.5	20.7	21.5	23.4	23.7	23.7	23.5	23.3	23.0	22.1	21.3
Mean Daily Temp. (C)	26.8	26.7	27.1	27.8	28.5	29.5	29.6	29.3	29.2	28.7	28.1	27.3
Rainfall (mm)	29.7	25.7	22.3	24.3	73.0	51.2	31.7	63.8	147.0	103.5	120.6	40.0
No. of raindays	6	5	6	5	8	5	5	7	9	8	6	5
Rel. Hum.- 7am (%)	81	81	80	77	76	76	75	77	79	80	81	82
Rel. Hum.- 1pm (%)	63	64	63	63	67	65	63	67	68	68	66	63
Mean Sunshine (Hrs.)	8.3	8.4	8.5	9.0	8.0	8.2	8.2	8.0	7.4	7.7	7.5	7.8
Thunder (Days)	0	1	0	0	3	3	7	7	11	8	3	1
Evaporation (mm)	8.5	9.0	11.2	11.8	11.5	12.4	11.9	11.9	9.9	8.5	9.1	8.4

Source: Metrological Service of Jamaica

ii. Temperature and Humidity

Temperature data for the Mona area unavailable; however, data from the monitoring station at the Norman Manley International Airport (NMIA) indicate that between December and April mean daily temperatures are below 28°C. During these cooler months, mean minimum temperatures range between 22.6 degrees and 23.9 degrees for the same period. Conversely, mean daily temperatures are highest between May and October (with a high during the summer month of July).

Based on Jamaica's location, the Island can receive a maximum of 13.2 hours (in June) of sunshine with a minimum of 11.0 hours (December). Data from the Meteorological Services indicates that Kingston & St. Andrew receive a maximum of 8.6 hours and a minimum of 3.1 hours of sunshine.

Relative humidity varies with elevation and, as such, humidity within Kingston & St. Andrew varies with location. Based on data obtained at the NMIA, humidity for Kingston ranges from 73 - 80 % in the mornings (7:00 am) and 60 - 68% in afternoons (1:00 pm), humidity in St. Andrew, on the other hand, ranges from 80 - 88% in the morning to 64 - 90% in the afternoon.

III. Winds

Winds in the area predominantly blow from the north and northeast. This is reflective of the effects of the northeast trades that incidentally tend to be strongest during the cooler months of the year, for example, higher wind speeds (>16 kph) occur between December and mid February, when they are strongest along with the effects of winter storm fronts from the north. The period July to mid-November generally marks a period of relatively calmer conditions.

6.1.2 Geomorphologic Landscape

6.1.2.1 Stratigraphy

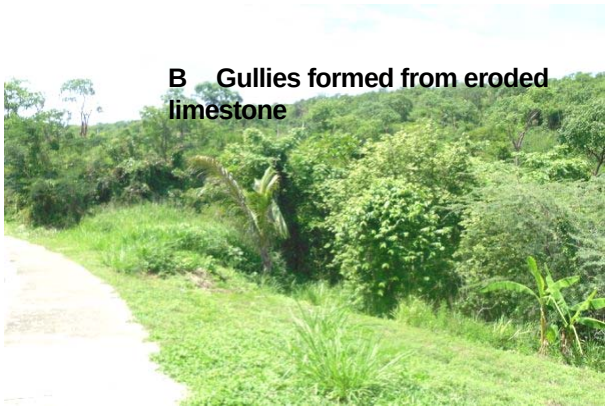
The proposed development is underlain by two formations of the White Limestone Group. The majority of the property from the central regions to the southern portions is underlain by the Newport White Limestone. The Newport Formation is described as bioclastic, micritic rock with limestone clasts more than 2 mm in diameter. In some localities the Newport Limestone is partially recrystallised. Field observations of the project site show variations of this formation from a massive rock type to a more honeycombed structure which is evidence of solution activities (Plate 6.1 A and B). Checks with the Mines and Geology Division confirmed no evidence of sinkholes or caves on this or adjacent properties.

6.1.2.2 Topography

The proposed subdivision rises from the limestone foothills near Karachi, then moderately steepens and eventually grades into a plateau at its highest point in the vicinity of the Long Mountain Country Club. Approximately 80% of the land mass exists on the slopes which dip towards the west. Average slope gradient is 14^0 or 25%. Elevation of the site ranges from 200 to 260 metres above sea level. The topography of the area is strongly influenced by the well-known limestone karst development. The land is thickly vegetated and the pattern of growth of such vegetation highlights the gully pathways in some areas (Plates 6.2 A and B).

The northern tip is underlain by the Walderston Brown's Town White Limestone Formation which conformably underlies the Newport Formation. Gibraltar-Bonnygate Formation is described as a chalky and nodular. This formation is easily eroded by water and displays solution features as well. Figure 6.1 below shows the geological setting of the proposed site.

Plates 6.1 A and B: Honeycombed White Limestone



Plates 6.2 A and B: Gully Pathways

6.1.3 Geology

6.1.3.2 Geologic Structure

Regionally, the proposed site is a part of the uplifted Wagwater Sequence which forms the prominent, structurally controlled Long Mountain, running southeast-northwest. A major fault zone is located approximately 500 metres west of the site at the base of the Long Mountain and borders the Liguanea alluvial fan. The proposed property is flanked by two other fault structures. One such system runs along the northern tip and trends northwest-southeast. The other structure runs along the southern and central sections, trending northeast-southwest. Both rock formations exhibit numerous fractures and brecciation from these fault structures.

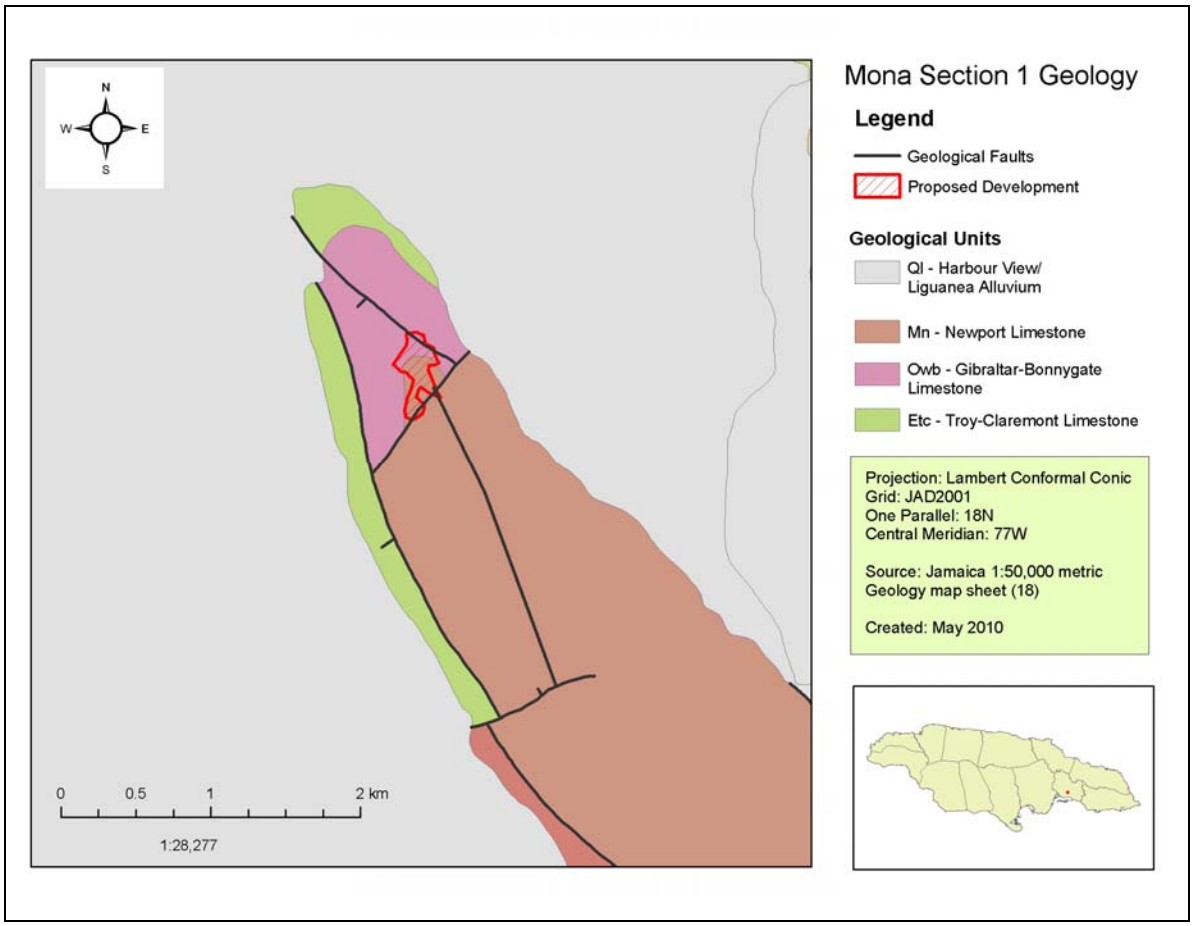


Figure 6.1: Geology of Mona Section 1 Proposed Property

6.1.4 Seismology

This site is located within the eastern section of the island which, seismically, is the most active and is still undergoing geotectonic uplift. Historical evidence shows that the Wagwater Trough is earthquake prone since the primary faults are considered to be seismically active (Ahmad, 1993).

Earthquake sources in the Blue Mountain region are within 8 km radius of the project site. This coupled with the presence of faults and fracture zones in the project area make the area susceptible to experiencing the effects of moderate to severe earthquake events. Slope movement and landslides are common across the Hope River and into the Long Mountain area.

Although loose boulders have been observed, the Mines and Geology Division of the Ministry of Industry, Technology, Energy and Commerce have described the slope stability as generally good. The presumed bearing capacity was estimated between 1000 to 4000 KN/m^3. Earthquakes and other manmade disturbances from construction may result in differential settlement and collapse of large cavities.

6.1.5 Soils

6.1.5.1 Physical Properties

The proposed development is underlain by the Bonnygate Stony Loam (See Figure 6.2) under the Ministry of Agriculture's soil classification scheme. Field observations show that the soil is deposited as surficial material atop the limestone bedrock and in some instances may be found within pockets of the bedrock (Plate 6.3). The root limit to the bedrock for such soils is generally within 2.54 to 30.48 centimetres (1 to 12 inches). The Bonnygate stony loam has a high erosional capacity resulting in thin layers on steeply sloping areas. This soil type experiences very rapid internal drainage which is characteristic of coarse-textured soils or some thin soils in steep slope. As such, this soil type tends to be only saturated during and just after heavy rain. Surplus water is removed very rapidly with no mottling.

6.1.5.2 Chemical Properties

The pH classification for the Bonnygate Stony Loam is mildly alkaline which suggests a pH value in the region of 7.5. Natural fertility in nitrogen and potassium is generally low while that of phosphorous is moderate.

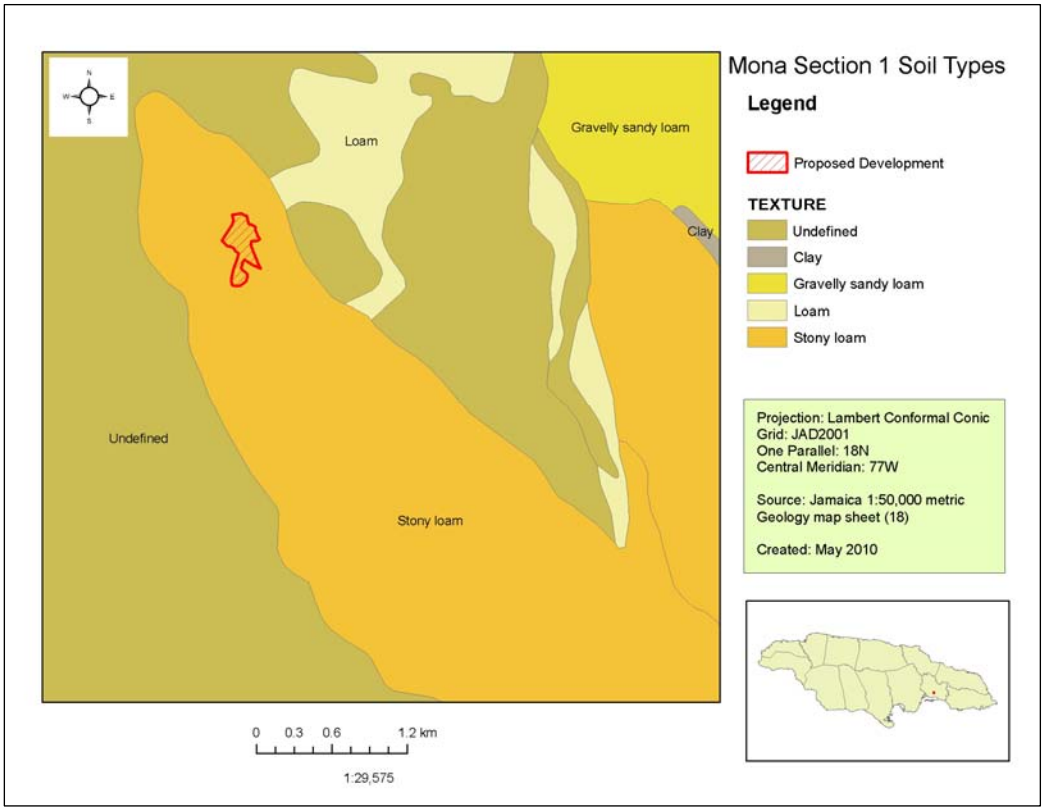


Figure 6.2: Mona Section 1 Soil Type

Plate 6.3: Limestone infilled with Bonnygate Stony Loam Soil

6.1.6 Hydrology

The Project Site falls within the Hope River Watershed Management Unit within the Kingston Hydrologic Basin. The physiography of the land can be expected to play an important role in the development of drainage. The major controls on the development of drainage type (surface or subsurface) include lithological variations, regional slopes, bedding and joint patterns, and faulting. Figure 6.4 below shows the hydrostratigraphy of the site.

6.1.6.1 Surface Drainage

The site generally slopes to the north east direction (Figure 6.3) with significant drainage paths towards a 10m depression towards the extreme north of the propose subdivision development There is no perennial surface drainage system within the proposed development due to the intrinsic high permeability of the underlying limestone formations. The steeply dipping area has been dissected by extensive faulting resulting in seasonal gullies and rills that channel runoff during rainfall events. It is anticipated that the construction of impermeable surfaces, such as, roads at this proposed development will decrease the exposed land surface available for natural infiltration resulting in a subsequent increase in the storm water runoff. Based on field observation

it would appear that the only artificial drainage features along the access road to the Long Mountain Country Club are kerb and gutter and grilled inlets across the main road (Plates 6.4 A and B).

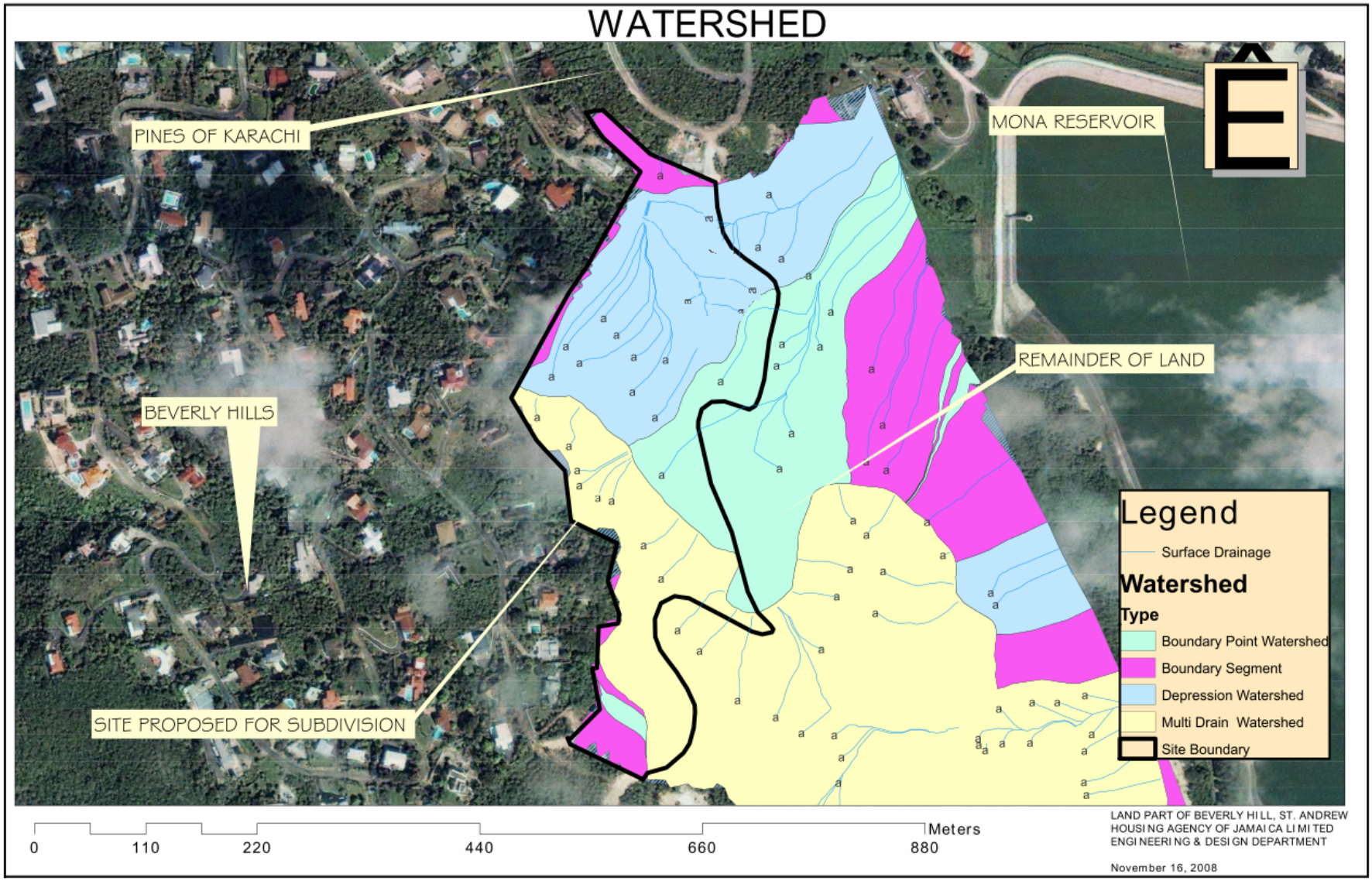


Figure 6.3: Showing watershed area and the northeasterndirection of drainage flows on the property


Plates 6.4 A and B: Spillway and grilled cross drain along the access road


Plates 6.5A & B: Earth drain at the foot of Long Mountain that redirects stormwater away from the NWC facilities

As shown in Plates 6.5A & B storm water runoff down the eastern slopes of the Long Mountain is captured by an approximately 1.5 metre deep earth drain that effectively redirects runoff away from the Mona Water Treatment Plant and the Mona Reservoir.

Storm Water Runoff Estimation

Design for the drainage structures for storm water run-off for the sub-catchment area is estimated using the Rational Method. This is expressed using the formulae where:

$$q = 0.278 * C * I * A$$

Where: Q- Peak runoff (discharge)

C- Dimensionless runoff coefficient based upon degree of imperviousness and infiltration capacity of

the drainage surface

C= 0.33↔0.77 →Use *C=0.5 for post-development*
C=0.33 for predevelopment

A- Drainage or tributary area of the terrain.

I- Rainfall intensity lasting for a critical duration or concentration time (*tc*) and corresponding to return period (*T*)

For the design of drainage structures the rainfall intensity (I) was determined for return periods 25, 50 and 100 years. The peak discharge for the return periods are shown in Appendix 16.4.

6.1.2.2 Groundwater Hydrology

The dominant, perennial drainage within the Project Area is underground. The Gibraltar-Bonnygate and Newport Limestone Formations have been classified as an

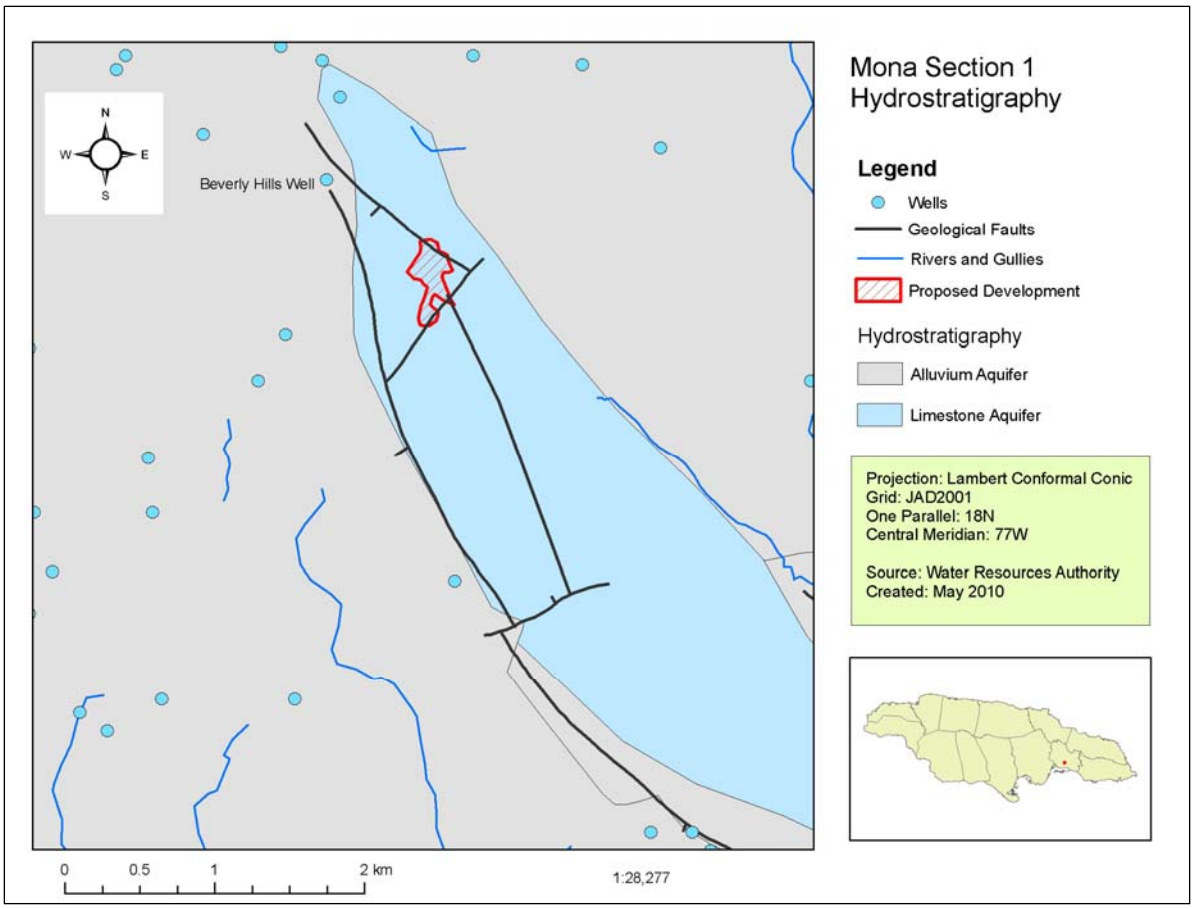


Figure 6.4: Hydrostratigraphy of Mona Section 1 Proposed Property

aquifer due to their relatively high permeability, which will support significant groundwater storage and movement under normal hydrologic conditions. The White

Limestone is considered to possess both primary porosity and secondary permeability. The primary porosity comes from the intrinsic properties of the rock material and its pore formation. Secondary porosity is associated with jointing, fracturing and faulting which the geological processes are acting on the rocks after their formation. The Limestone Aquifer exists under unconfined conditions with majority of the bare bedrock available for direct recharge. The area of dominant recharge is the upland area of the Long Mountain. Recharge is mainly from precipitation, which infiltrates the subsurface through caverns and exposed fissures in the limestone.

Depth to groundwater is approximately 103 metres below ground level (185 metres above sea level) as indicated by the nearest well at Beverley Hills. Regional groundwater flow essentially, follows along gradients of hydraulic head to the south in this section of the basin.

6.1.7 Water Resources Development Potential

The groundwater resource has been tapped via the Beverly Hills, Long Mountain, Hampstead Road, Rennock Lodge and Rock Spring wells. These wells have been used for domestic water supply by the NWC. It is expected that in excess of 5 million gallons per day be collectively abstracted from these wells. The high permeability of the regional limestone and the physical characteristics of the overlying soil unit make the limestone aquifer, which these wells tap, highly susceptible to point source pollution from anthropogenic activities as illustrated in Figure 6.5 in the case of the Bevely Hills well.

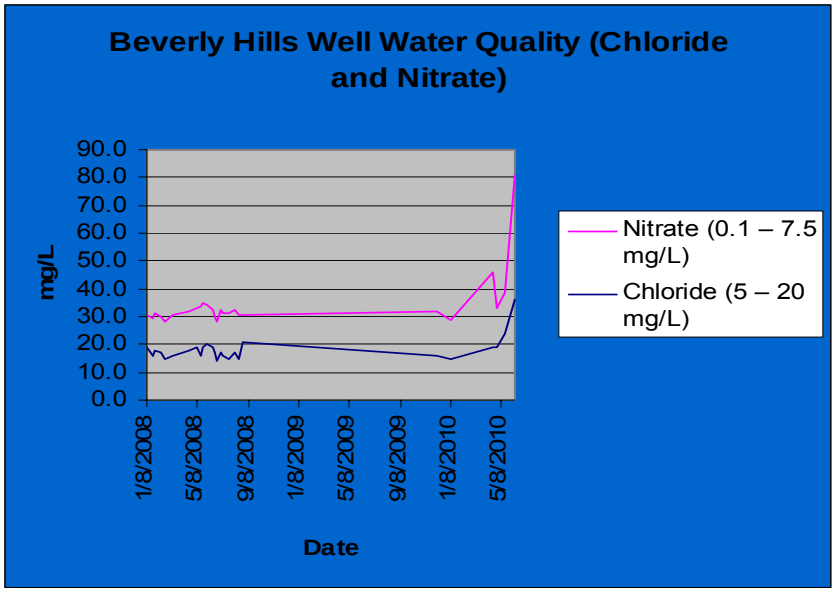


Figure 6.5: Showing high nitrate level in the Beverly Hills well

6.1.8 Air Quality

Ambient Noise Level

Ambient noise level is a measure of the sound pressure levels in an area. The noise level characteristics of the site were taken 2011 May 03 at one (1) location along the north eastern southern boundary at Lot 1 (close to the main road) at approximately 1:55 pm with a Amprobe Sound Level Meter. The instrument was set at low range (which is appropriate for measuring average sound levels) and slow response (for measuring stable noise) and function A (for general noise sound levels). The noise levels recorded within the guidelines set by NEPA (see Table 6.2 below).

Table 6.2: Noise Level Mona Section 1, St. Andrew, 2011 May 03

TIME	NOISE LEVEL dB(A)	AVERAGE NOISE LEVEL dB(A)	NEPA AMBIENT NOISE LEVEL STANDARD Db(A)
1:55 pm	52.5 50.4 48.8. 48.3 52.9	50.6	70

6.2 NATURAL HAZARDS

6.2.1 Multi Hazards and Risk Assessment

Natural hazard vulnerability for the area is based on the physical condition of the site, baseline hazard/susceptibility for the area, as well as, historical events, which have affected the project site and its environs in the past and regional experience (Figure 6.6). While some scientific data on natural hazards is available, this is found to be inadequate in most instances. An assessment of the vulnerability is therefore mainly based on the physical characteristics of the site and surrounding areas and historical events that have affected the area.

The main natural and geological hazards considered in this section are earthquakes, hurricanes, slope failure, soil erosion, land subsidence, and flooding.

6.2.1.1 Earthquake

The physical vulnerability of the site is evaluated against impacts from its geological situation (regional and local) and the extent of weathering at the site (thickness of alluvium overburden). There is a positive correlation between the proximity to geological faults and the impacts caused from earthquakes. An earthquake density map of the Caribbean (Figure 6.7) reproduced from the United States Geological Service (USGS) website: (http://earthquake.usgs.gov/regional/world/caribbean/density.php) indicates that on average Jamaica experiences less than one (1) earthquake of magnitude 5 and greater (per year). The earthquake risk is influenced by major transform boundaries associated with the Gonave micro-plate of the northwestern Caribbean. Jamaica itself is traversed by a number of geological faults that feature Quaternary left-lateral offsets. In southeastern Jamaica, there is the Plantain Garden fault that runs into the Yallahs, Blue Mountain,

Wagwater, and Silver Hill faults, which together control the tectonics of the Blue Mountain block. The project site itself is bounded to the east and west by mapped geological faults. The general area lies within the seismically active Wagwater Belt. This is was alluded to by Dr. Katherine Ellins in the *Jamaica Observer* newspaper of 2010 July 30 when she opined

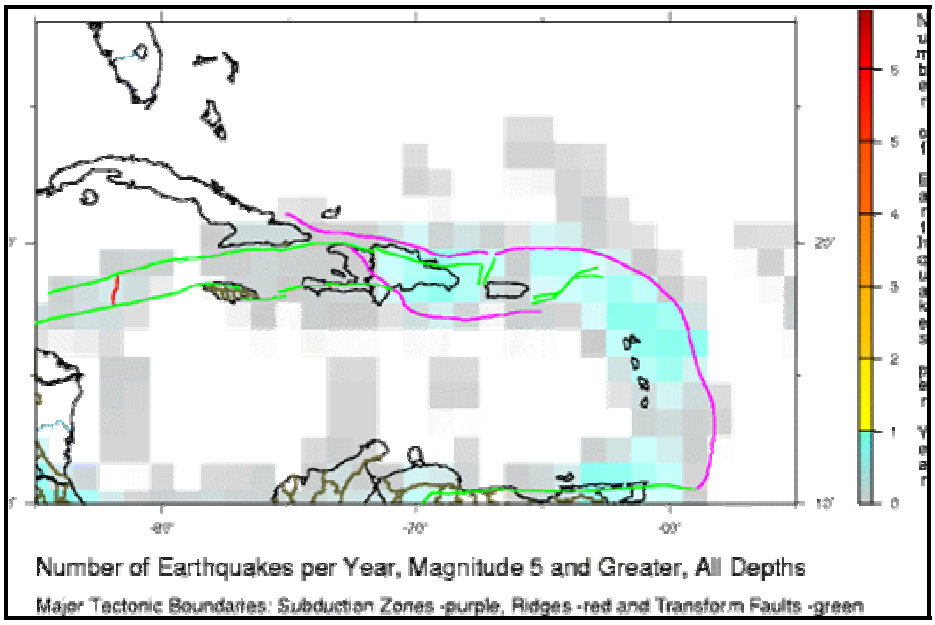


Figure 6.6: Earthquake Frequency in the Caribbean

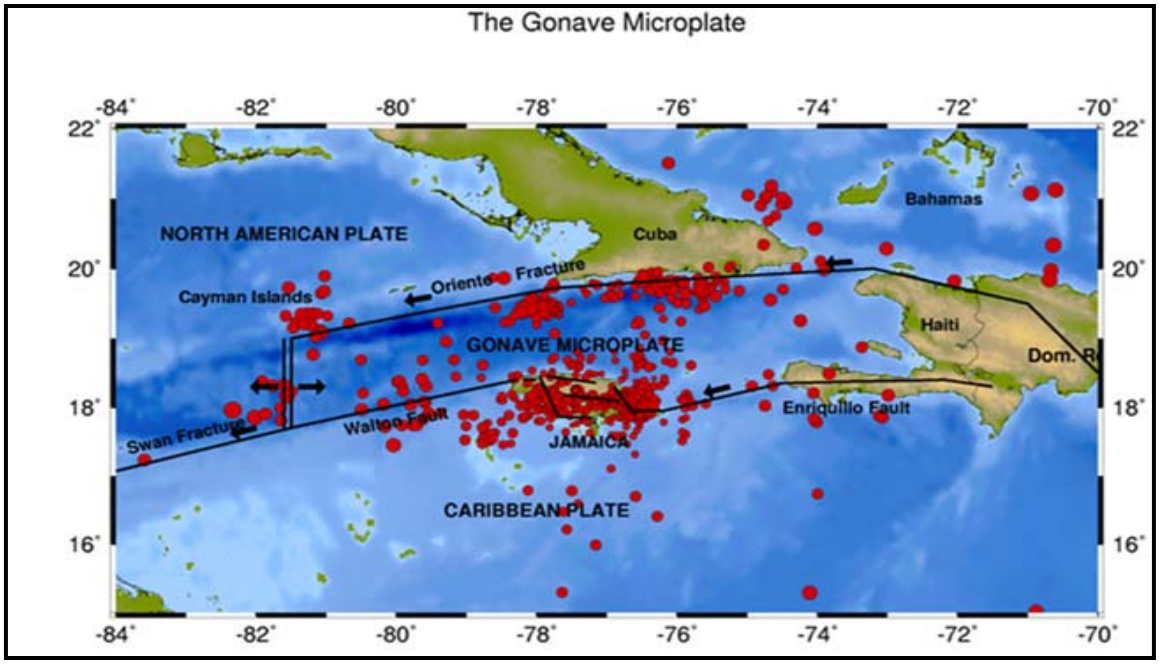


Figure 6.7: Plate Boundaries and Previously Mapped Epicentres

that an earthquake might be "*brewing*" in Long Mountain as the earth under the surface of that area was lifting as a result of plate tectonic actions and could result in a major tremor. The January 1993 earthquake affected areas within the vicinity of the proposed

development and caused damage to the NWC's Filter Plant, ground cracks along the embankment road on the southwestern section of the Mona Reservoir and triggered a large rockslide in the limestone quarry located near the reservoir.

6.2.1.2 Flooding

Flood susceptibility at the propose site is very low however; there is anecdotal evidence of flooding in lower Pines of Karachi. There will be greater surface flows due to an increase in paved surfaces with the potential effect of the flooding of areas down gradient of the site similar to that being experienced by the residents in and around Glenview Terrace at the north northeastern foot of Beverly Hills, below Beverly Drive possibly due to poor engineering practices in Bevely Hills. This is due to the high degree of saturation of the ground and the increased velocity of flows down the slope reducing the capacity for infiltration and inadequate management of storm water flows in the area.

6.2.1.3 Slope Failure

Slope failure in this locality occurs mainly along escarpments in the more friable, less indurated lithologies (as can be observed by solution features in outcrops along the main road). These take the form of rockslides. In general, the well-indurated, massive Newport and rubbly Walderston Limestones that dominate the site are very stable at steep angles. Where this lithology is brecciated (due to faulting) or weathered, rock falls/slides may occur.

6.2.1.4 Soil Erosion and Land Subsidence

Only very willow soils occur atop the White Limestone Formations. However, soil erosion can be expected to occur in the calcarenites on the gentler slopes at the northern sections of the property. This is likely to occur given the physical characteristics of the Bonnygate stony loam is characterized by its high erosional capacity. Given the proposed land use, land degradation issues are not a major concern but given the potential impact of soil erosion on the proposed drainage structures efforts, should be made to reduce soil erosion and its effects.

Variations in the Newport Formation geology at the proposed development location range from a massive rock type to a more honeycombed structure. This variation is evidence of the possible formation of solution activities. In addition, the chalky and nodular form of the Gibraltar-Bonnygate Formation, also at the location, makes it susceptible to erosion by water. This formation also displays the capacity to form solution cavities.

6.2.1.5 Hurricane

Hazard vulnerability to hurricanes at the proposed site will be assessed in relation to the main hurricane season of June to November (which affects the entire island) and the spatial impacts observed from hurricane pathways. Hurricanes normally originate in the southern mid-Atlantic off the west coast of Africa and track northwesterly towards the Florida panhandle and the islands of the Bahamas (i.e. within a very broad zone). Hurricanes may track south of the island, make landfall on the south or east coast, or track north of the island. Hurricanes tend to affect the southern parishes of Jamaica (including St. Andrew) more than the northern parish. Statistically, hurricanes are most likely to hit later in the season, (between September and November). Hurricanes may result in mudslides and

landslides on the steeper slopes of the development site. As shown in Table 6.3, since 1988 several major systems have affected Jamaica.

A system that makes direct landfall on the island's south coast it is expected that maximum hurricane winds and considerable precipitation may occur. This presents the highest level of risk to areas in the KMA and adjacent areas. The susceptibility of the proposed site is exacerbated primarily by its topographic elevations and the expected removal of trees for construction which otherwise act as natural wind buffers. Damage to property and other infrastructure is invariable (depending on construction methods used).

Tropical systems that track just south of the island, hurricane force winds may be experienced with prolonged rainfall. This type can result in major rains and flooding in sections of the KMA. However, the site is not flood prone. Slopes are moderate to steep and drainage primarily occurs in the underlying White Limestone Aquifer.

Hurricanes tracking north of the island may deposit considerable amounts of precipitation along the north coast and notably lesser amounts in the south. This represents the lowest level of risk to the area proposed for development.

Table 6.3: Major weather systems (named) affecting Jamaica (1988-2008)

Name	Date
Hurricane Gustav	August 28, 2008
Hurricane Dean	August 20, 2007
Hurricane Dennis	July 5, 2005
Hurricane Emily	July 16, 2005
Hurricane Ivan	September 10, 2004
Tropical Storm Charley	August 11, 2004.
Hurricane Claudette	July, 2003
Hurricane Lily	September 30, 2002
Hurricane Isidore	September 18, 2002
Hurricane Michelle	October 29, 2001
Hurricane Iris	October 7, 2001
Tropical Storm Helene	September 19, 2000
Hurricane Gordon	November 8, 1994
Hurricane Gilbert	September 12, 1988

Source: EIA for residential development at Ambassador Heights, St. Andrew, 2009

6.3 BIOLOGICAL

6.3.1 Vegetation Survey Results

Based on this survey, it was observed that the vegetation of the area has been exposed to previous degradation and was generally dry limestone secondary growth (Figure 6.8), with few emergent trees of which one species is *Bur sera simarouba*. Overall tree diversity is low, and there is the dominance of woody vines and coppiced trees and xerophytic shrubs. One species of tank bromeliads was observed through the area. The vegetation of the study area may be categorised as having predominantly two layers: (1) Emergent Trees and (2) Shrubs/Trees. The emergent layer was dominated by *B. Simarouba* and ranged in tree heights of 20 – 25m and for a few trees as tall as 30m. Other species were observed include *Cassia emarginata* (Yellow Candlestick). The comprehensive species list is shown in Appendix 16.5.

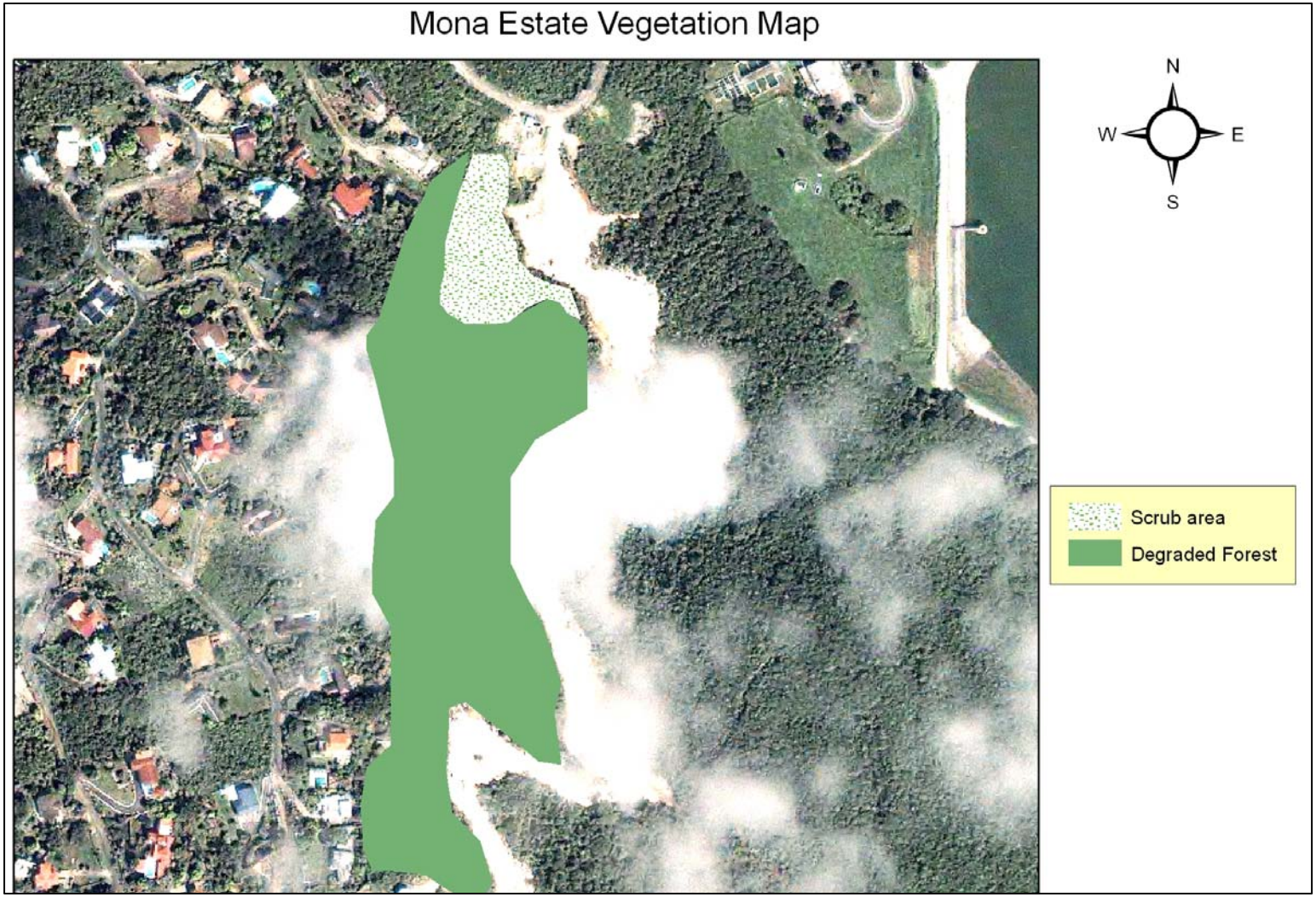


Figure 6.8: Satellite image showing vegetation zones at the proposed Mona Section 1

6.3.1.1 Degraded Dry Limestone Forest

This vegetation subtype created due to the degradation, but not total removal of natural forest is widespread and varied considerably in character between the sample stations assessed. In some areas, almost all larger trees had been removed for timber and firewood due to selective logging and charcoal burning creating gaps and early successional patches of vegetation in what otherwise appeared to be natural forest.

6.3.1.2 Scrubland

In the most extensively disturbed areas, this habitat type is best described as woodland of shrubs, coppiced trees, with scrub characteristics, and scattered emergent trees of primarily *Bursera simaruba* (Red Birch). Common trees within this habitat are *Acacia tortuosa, Bauhinia divaricata, Cassia* emarginata, Spathodea campanulata, Guazuma ulmifolia, Ochroma pyrimidale, Matayba apelata, Cecropia apelata, Rochefortia acanthophora and Piscidia piscipula. Where soil is developed, xerophytic pasture weeds have colonized exposed soil along with small tree and wood shrub species, such as, Caster Oil, Tecoma stans, Croton linearis, Solanum torvum andMelicoccus bijugatus (see photo # 3). In many of these usually more coastal sites, species that are not native to the island were more common, including West Indian Almond (Terminalis catappa), Guango (Samanea saman), and Logwood (Haematoxylum campechianum).

6.3.2 Faunal Survey Results

Twenty eight (28) species of birds were observed and or recorded during the point count period or based on historical review. Of these, eleven (11) were Jamaican endemic species as listed below in Table 6.4:

Table 6.4 List of endemic bird species

Jamaican Euphonia	**Sad Flycatcher**
Mangrove Cuckoo	**Yellow-Shouldered Grass quit**
White-Winged Dove	Northern Mockingbird
Red-billed Streamertail	White Crowned Pigeon
Black Faced Grassquit	Common Ground Dove
Loggerhead Kingbird	Vervain Hummingbird
Bananaquit	Grey Kingbird
Greater Antillean Bullfinch	Smooth Billed Ani
Jamaican Tody	**Jamaican Vireo**
Jamaican Woodpecker	**Jamaican Striped-headed Tanager**
Jamaican Pewee	**White Chinned Thrush**
Yellow Billed Parrot	Caribbean Dove
Olive Throated Parakeet	Barn Owl*
Jamaican Oriole	Black Whiskered Vireo

Overall, the area has a very diverse bird community, and based on the survey the study area supports no less than 39% of Jamaica's extant endemic bird species. Additionally, there were eight (8) Jamaican endemic sub-species present as listed below:

Caribbean Dove	Olive Throated Parakeet
Vervain Hummingbird	Bananaquit
Greater-Antillean Bullfinch	Great Antillean Grackle
Jamaican Oriole	

In general, the Jamaican endemic species and subspecies are inherently of greatest conservation importance in that their entire ranges are restricted to this island and many are limited in their national distributions due to their specific habitat requirements. Overall bird species diversity is low and this is related to the relatively poor condition of the vegetation of the proposed Mona Section 1 property and surrounding areas.

6.3.2.1 Species Distribution

These bird species were present in the disturbed areas, which retained some forest cover despite the fact that these areas had been severely altered. These species, such as, the Smooth-billed Ani and Northern Mockingbird are primarily omnivores and ground feeding insectivores which do well in pasture lands and other areas with low tree densities. This group is positively affected by forest loss and its number would, therefore, be expected to increase within the area along with any human activity that replaces natural forest with other non-forest land uses. The open woodland and savannah species are therefore those of least concern from a conservation perspective.

6.3.2.2 Neotropical Migratory Species

Based on historical records there are six (6) species of migratory birds that visit the area (Table 6.5). Neotropical migrants are North American breeding species which winter in Jamaica and the Wider Caribbean. As a group, Neotropical migrants were found to be proportionately more abundant in the more degraded habitat. This is in keeping with the results of other studies which have shown that Neotropical migrants would be abundant in a variety of degraded habitats with the suggestion that they are in general not dependent upon undisturbed tropical forests while on their winter grounds (Lack 1976, Douglas 2001). None of the known threatened Neotropical migratory species that winter in the Caribbean are known to occur in the proposed Mona Estate area.

Table 6.5 Neotropical Migrants known to occur within the habitat

1. American Redstart	2. Black Throated Blue Warbler
3. Worm Eating Warbler	4. Ovenbird
5. Prairie warbler	6. Northern Parula

The only endemic found is not a species currently considered to be globally threatened with endangerment (Stattersfield A. J et al. 1998).

Table 6.6: Uncommon Bird Species occurring within the survey area

Endemic Species
Yellow-shouldered Grassquit

6.3.2.3 Butterfly Species

Table 6.7: Presence/Absence of butterfly species observed within the study area

Butterfly Species	
	Degraded Area
The Zebra Butterfly *Heleconius sp.*	PRESENT
Julia *Dryas Julia delila*	PRESENT
Cuban (Citrus) Swallowtail *Papilio andraemon*	PRESENT
Josephina	PRESENT

Four (4) species of butterflies were identified from the study area (Table 6.7). One species of moth and a dragonfly was observed. None of the butterfly species identified is considered threatened species (Brown 1972, Garraway, 2005).

6.3.2.4 Observed Anoles

Observed ano;es species were Anolis lineatopus and Anolis garmani

6.4 HERITAGE

Jamaica National Heritage Trust (JNHT) investigation has indicated that historical and archeological records have revealed that the area has been settled by various ethnic groups. Several Tiano settlements were established on Long Mountain, three of which were in close proximity to the site of the proposed development

The property formed part of the Mona Estate that was a former sugar estate that began operation in the 17th Century when 'sugar was King" in the West Indies. The original property comprised 1,372 acres but ceased operation in 1909. In 1914, Kingston General Commissioners purchased the Mona Plantation, the Papine, and Hermitage Estates.

The assessment of the site by the JNHT did not result in any significant findings. Within the depression (Open Space 1) to be utilized for storm water retention a cut stone structure with a red brick arch was discovered. The structure was described as being built into the natural limestone and was felt to be remnants from the sugar age. Fragments of a red brick and

metal feature were seen on the surface. The presence of a gabion basket structure indicated evidence some drainage works.

The conclusion was that based on the archeological features and artifact assemblages at the location there was no need to issue a declaration for preservation. (The full report can be viewed in Appendix 16.4).

6.3 HUMAN/SOCIAL

6.3.1 Human/Social Impact Assessment Methods

The framework for the Terms of Reference outlined by NEPA places emphasis on a Socio-economic Survey, An Assessment of the Historical and Cultural Resources, a Landscape and Visual assessment and a Traffic Impact Assessment . These will be treated with the focus required; however, an overview of other social impact indicators will be included in order to present a more comprehensive portrait of the social and economic conditions of the area within which the project would be located.

This SIA model chosen for this assessment is an effective means of identifying or predicting the probable impacts of a development and recognizes levels of impacts at all stages of the project life cycle – Planning/Policy Development, Construction/Implementation (Phase II), Operation/Maintenance (Phase III), and Abandonment/Decommissioning (Phase IV).

The study for the Mona Section 1 development will seek to understand the behaviours (past, present, & future) of the individuals, communities, and agencies affected by the development. The social variables assessed are captured within the model (*The Interorganizational Committee, 1994)*) and in the matrix in Table 6.8:

- Population Characteristics
- Community and Institutional Structures
- Political and Social Resources
- Individual and Family Changes
- Community Resources

Population Characteristics – this covers the receptor community's demography, that is, the present population, its structure and composition, population projection, migration pattern and death rate in the context of the larger geographical unit – the parish of Westmoreland.

Community and Institutional Structures – the report outlines the size, structure, and level of organization of local government including linkages to the larger political systems. The historical and present patterns of employment and the level of diversification of economic activities are described. The size and level of activity of voluntary associations, religious organizations and interests groups where they exist and how they relate to each other are identified.

Political and Social Resources – seek to identify the "power base" or the distribution of power authority, interest groups and the affected public, and the levels of leadership , their capabilities and capacities within the community and region (constituency).

Individual and Family Changes – the SIA seeks to structure the present concerns that could influence the daily life of individuals and families within the receptor communities. These changes range from attitudes toward the project to an alteration in family and friendship networks to perceptions of risk, health, and safety.

Community Resources – Resources include existing land use patterns; the availability of housing and community infrastructure, such as, health, police, fire protection and sanitation facilities. A key to the continuity and survival of human communities are their historical and cultural resources and their potential role in the continuity and survival of the communities.

Table 6.8: Matrix Relating Project Stage to Social Impact Assessment Variables

Matrix Relating Project Stage to Social Impact Assessment Variables				
Social Impact Assessment Variable	**Planning/Policy Development**	**Implementation/ Construction**	**Operation/ Maintenance**	**Decommissioning/ Abandonment**
Population Characteristics				
Population Change	×	×	✓	×
Influx of temporary workers		✓	✓	×
Community and Institutional Structures				
Interest group activity	✓	✓	×	×
Size and structure of local government	×	×	×	×
Historical experience with change	✓	✓	✓	×
Employment/income characteristics	×	✓	✓	×
Employment equity of minority groups	×	✓	✓	×
Local/regional/national linkages	✓	✓	✓	×
Industrial/commercial diversity	×	×	×	×
Presence of planning and zoning activity	✓	✓	×	×
Political and Social Resources				
Distribution of power and authority	✓	✓	✓	×
Identifications of stakeholders	✓	✓	✓	×
Interested and affected publics	✓	✓	✓	×
Leadership capability and characteristics	✓	✓	✓	×
Individual and Family Changes				
Perceptions of risk, health, and safety	✓	✓	✓	×
Trust in political and social institutions	✓	✓	✓	×
Residential stability	✓	✓	✓	×
Density of acquaintanceship	✓	×	×	×
Attitudes toward policy/project	✓	✓	×	×
Family and friendship networks	✓	✓	×	×
Concerns about social well-being	✓	✓	✓	×
Community Resources				
Change in community infrastructure	✓	✓	×	×
Land use patterns	✓	✓	✓	×
Effects on cultural, historical, and archaeological resources	✓	✓	×	×

6.3.2 Summary of Areas of Social Significance

The socio-economic, physical planning and spatial implications of the proposed residential development is extensive within the context of the KMA. The genesis of the proposed project is the shortfall in projected demand for housing solutions locally and nationally. This project is also geared towards meeting the Agency's mandated objectives providing and facilitating the development of housing solutions and to ensure its, and by extension, the GoJ's economic sustainability.

The sustainable development of the proposed site is measured here within the context of the carrying capacity of the receiving environment, specifically, the socio-demographic and political –economic components based on their relevance in the SIA process. On the other hand, the physical-ecological component is addressed elsewhere in the EIA report.

The following are the primary issues relating to the development:

- The effects of the development of a new subdivision in Mona Estate.

- The implications for carrying capacities - social services and amenities, physical infrastructure, employment and harmony
- The effects of the development on existing and adjacent populations and economic activities
- Limitations and advantages of the physical environment
- Its effects on the general growth and character of the area

Ultimately, the success of the development could be measured in terms of its sustainability. The project would have obtained objectives of sustainability if:

- Locals are given priority for jobs created
- Public Occupational Health and Safety are assured
- There is improvement to the quality of the physical, economic, social and cultural environment
- The development considers the area's uniqueness in terms of biology, population, climate, geography, geology, hydrology, history and culture
- Conservation measures are implemented that help reduce the use of energy and natural resources
- There is a participatory attitude in the planning of the project.

6.3.3 Population Characteristics

6.3.3.1 Demography

The 2001 Population Census (STATIN) fixed the population for the KMA alone in 2001 stood at 579,137, representing 88.8% of the population of Kingston and St. Andrew combined and 22.2% of the country's population. At that census the population of the enumeration districts, that include

Mona Heights and Beverly Hills was 3,665 persons representing 0.7 per cent of the population of St. Andrew. In 2001 also, the population of St. Andrew is stood at 555,828, an increase 15,945 of over the 1991 population figure of 539,883. This also indicates a population growth of 2.95 % in St. Andrew over the 1991 population. In 2010 the population of Kingston and St. Andrew was estimated at 663,320 or 24.4% of the island's population of 2,718,000 (See Table 6.9).

Outside the KMA, the largest capital town in 2001 was Spanish Town in St. Catherine with 131,515 and the smallest, Black River in St. Elizabeth, with 4,095. Although the parish is on of the island's smallest parish, St. Andrew hosts the largest share of the Jamaica's population, accounting for approximately 21.20 per cent (555,827) of the total population in 2002. The parish is also one of the fastest growing as shown in Figure 6.9. This is attributed to the fact that much of St. Andrew constitutes of the KMA, both in land mass and population, with 89.9 per cent of the parish being urban.

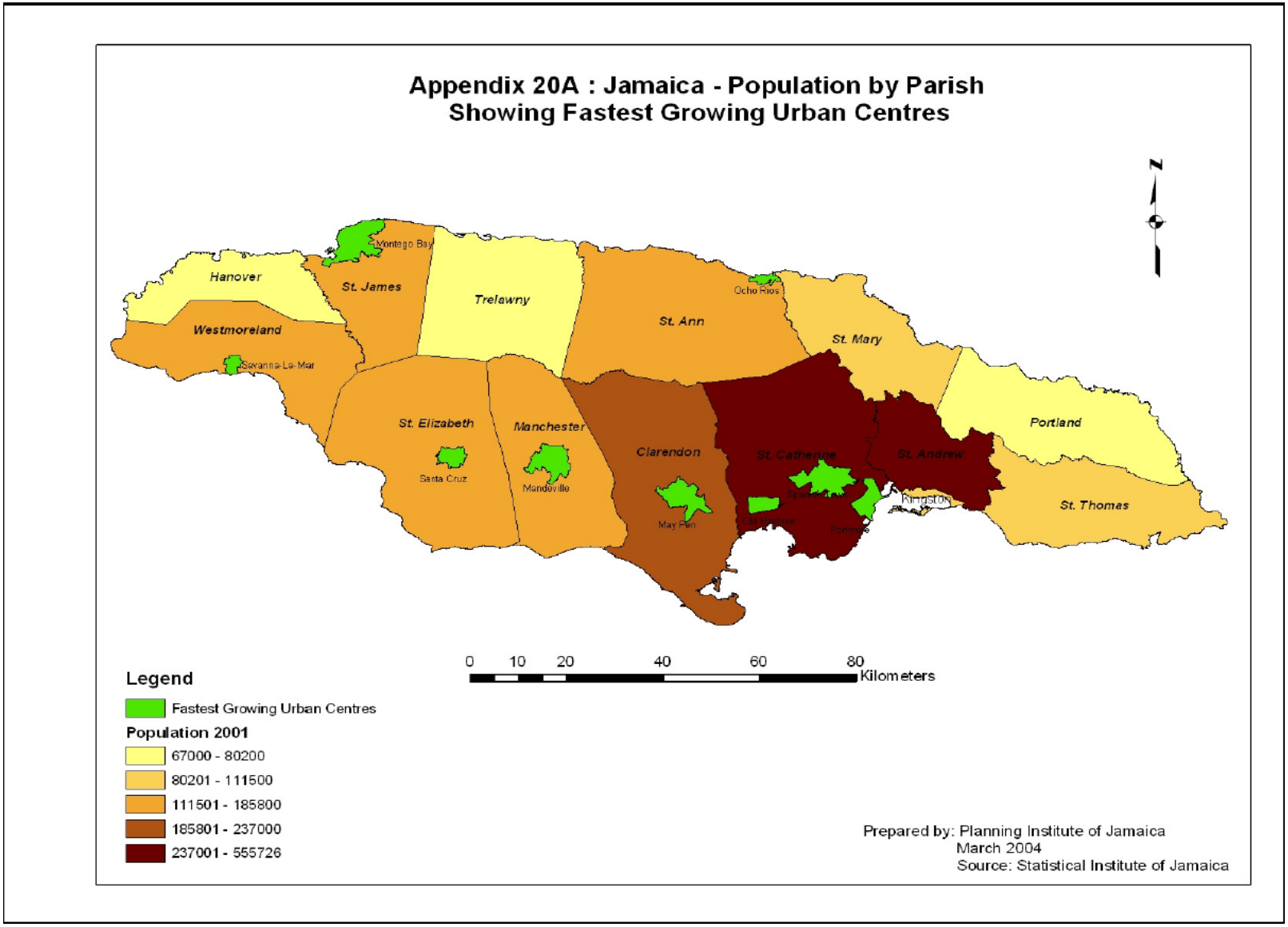


Figure 6.9: Showing St. Catherine and St. Andrew as the two fastest growing urban centres in 2001

The main urban area within the parish is Half- Way– Tree; however, other urban centres include New Kingston, Cross Roads, and Liguanea. The KMA's population stood at 579,137 in 2001.

Relevant population change summaries for 1991 to 2001 are shown below:

- the annual rate of Jamaica was 0.91 per cent
- the annual rate of growth for Kingston was -0.38
- the annual rate of growth for St. Andrew was 0.29

Based on the JSLC Parish Report 2002, sixty two per cent (62%) of St. Andrew's population belong to 15-64 age group (working age), while nine per cent (9%) was over 65. This varied slightly from the 2001 figures, which stood at 63.19 % and 7.03% respectively. The age dependency ratio in 2002 stood at 60 to 100, i.e. 60 individuals to every 100 working age persons, this was the lowest recorded for that period, this figure however, supersedes that of the 2001 census which stood at 58.25 which was also the lowest during that period. These figures would today show slight variations given the continued estimated negative growth rate in KSA.

Hierarchy of Urban Centres

Urban centres are classified as regional centres, parish capitals, main towns and other towns. The Parish of Kingston is classified as 100 per cent urban while its counterpart St. Andrew is said to 87 per cent urban and 13 per cent rural. The KMA, which encompasses areas such as Cross Roads, New Kingston, Half Way Tree, and Manor Park, is Jamaica's Central Business District and the administrative capital, however, when coupled with Portmore the area becomes one of the largest urban areas within the Caribbean. In 2001, the KMA population stood at 579,137, with Constant Spring (12,072), Liguanea (10,410) Half Way Tree (4,936) and New Kingston (1,754) being some of the major population centres.

6.3.3.2 Migration

The main economic sectors of commerce and manufacturing (which provides numerous employment opportunities), and tertiary educational opportunities are the main pull factors affecting migration, as it relates to St. Andrew. Between 1991 & 2001, 24,363 persons migrated to St. Andrew other parishes, while the parish of Kingston lost 66,276 migrants, most of who are assumed to have migrated to St. Andrew or St. Catherine.

6.3.3.3 Population Density

The significant inequality in rural and urban populations in the parish of St. Andrew is influenced mainly by economic opportunities and then topography. As such, the population density within the parish is higher in areas closer to the main business districts such as Cross Roads, Downtown, New Kingston, and Liguanea. The parishes of Kingston and St. Andrews have population densities of 4,760 persons per square mile and 1,254 persons per square mile respectively. The population density of Jamaica is 216 persons per

square kilometer. Population density within the SIA is equally influenced by topography and economic activity.

6.3.3.4 Population Projection

If it is assumed that an annual growth rate of about -0.38% for the period 1991 – 2001 in Kingston remains constant, it is projected that the population will reach approximately 91,066 and 89,349 in the years and 2015 and 2025 respectively. On the other hand, if an annual growth rate of 0.29% is assumed for St. Andrew for the same period then it is projected that the parish's population will stand at 578,824 and 595,831 in the years 2015 & 2025 respectively based on the following formula:

Population $P = [\log P_0 + N * \log (1 + r)]^{10}$

P= Population of a Certain Year

P0= Population of a Region at Year 0

N = Number of years from year 0

r = Annual growth rate

Table 6.9: Population Projection – Jamaica, Kingston & St. Andrew, 2001-2025

	2001	2010	2015	2020	2025
Jamaica	2,607,633	2,718,000	2,761,000	2,806,000	2,845,000[1]
Kingston	96,052	92,817	91,066	89,349	87,664
St. Andrew	555,827	570,504	578,824	587,266	595,831
KSA: % of Total Population	25.0	24.40	24.26	24.11	24.02

Table constructed from data in Demographic Statistics, STATIN, 2001 and Vision 2030 Jamaica National Plan

Thus, population of Kingston and St. Andrew could stand at 669,890 in the year 2015 and at 683,495 in 2025 as shown in Table 6.9.

6.3.4 Community and Institutional Structure

6.3.4.1 Political Organization

The parish of St. Andrew is divided into twelve (12) Constituencies; St. Andrew West Rural , St. Andrew Western, St. Andrew West Central, St. Andrew East Central, St. Andrew South Western , St. Andrew South Eastern, St. Andrew Southern, St. Andrew Eastern, St. Andrew North Eastern, St. Andrew North Central, St. Andrew North Western and St. Andrew East Rural. When St. Andrew's twelve (12) consistencies are combined with Kingston's three (3) constituencies, there are forty (40) Parish Council Divisions (Electoral Districts). The project area falls within the St. Andrew Eastern constituency

[1] http://www.vision2030.gov.jm/Portals/0/Sector_Plan/Microsoft%20Word%20-%20POPULATION2.pdf

6.3.4.2 Community Leadership

The forming of Citizen's Associations is the established way of promoting community leadership for fostering and maintaining the wellbeing of community members and such Associations are normal in the urban landscape including the receptor community.

6.3.4.3 Employment and Income

In 2001, the average unemployment rate for Kingston and St. Andrew were 6.37 and 12.22 per cent respectively. With individual parish data no longer available, based on information obtained from PIOJ, the national unemployment rate at the end of 2010 stood at 12.40 % (See Table 6.10).

Table 6.10: Total labour force employed and unemployed

LOCATION	EMPLOYED	UNEMPLOYED	PERCENTAGE UNEMPLOYED
Kingston (October 2001)	42,600	2,900	6.37
St. Andrew (October 2001)	229,800	32,000	12.22
Average for 2010(Jamaica)	1,786,200	154,700	12.40

Source: Statistical Institute of Jamaica & PIOJ
Note: STATIN/PIOJ no longer publish employment/ unemployment figures by parish

6.3.4.4 Economic Activity

The SIA area for the most part is composed of persons who work within the KMA. Given the proximity to the two major tertiary institutions students and staff members likely are represented in the population. There are also a relatively high number of government employers, such as the residents of the Pines of Karachi. Economic activity is concentrated in Liguanea, one of the largest commercial centres in the KMA.

6.3.5 Individual and Family Changes

6.3.5.1 The Development's Potential for Generating Controversy

The development is already a source of public controversy given the level of "chatter" in the public sphere. Some issues are directly or indirectly related to the new proposal. The residents of Beverly Hills and the Pines of Karachi have been the most vocal and their concerns range from access road, perceived watershed issues, the carrying capacity of the area for further residential development given its location relative to the NWC facilities. Most of these comments/concerns are mentioned in Appendix 16.8.

6.3.6 Community Resources

6.3.6.1 Land Use

The Kingston and St. Andrew Development Order, 1966, the Town, guide Land use in the Municipality and Country Planning Act of 1958 and the Local Improvements Act, 1914 amended 1959.

A. Existing Land Use

The land use is predominantly residential followed by educational institutions and open space. Within the study area or in close proximity are also a number of churches, commercial centre such as Ligunea, educational/knowledge facilities (ranging from nursery, primary, high to universities), police stations, a number of petrol stations, post offices and the Mona Reservoir. There are also a number of medical facilities, such as, the National Chest Hospital, the complex of the University Hospital of the West Indies (a teaching hospital) that includes a Type V medical complex.

B. On Site Land Use

As described above, the proposed site can be best described as a Degraded Limestone Forest.

C. Surrounding Land Use

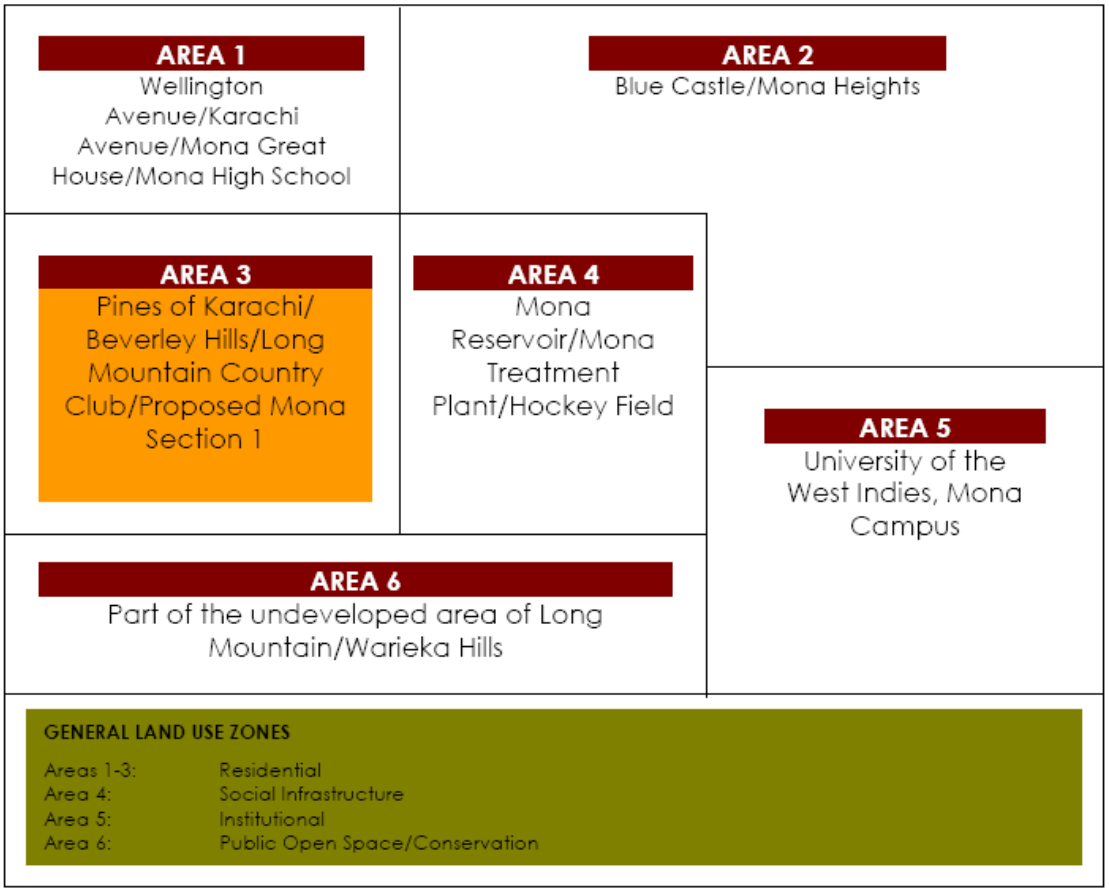


Figure 6.10: Showing schematic of the land use near the proposed development site

The schematic in Figure 6.10 gives an overview of the land use near the proposed development. Properties located to the north, south, and west of the site show similar land use characteristics (Area 3). They are medium to high-income residential properties. Immediately, east the typical Long Mountain vegetation continues to the foot of slope (Area 6). The surrounding areas are:

Area 1: Wellington Avenue/Karachi Avenue/Mona Great House

Area 2: Blue Castle/Mona Heights

Area 3: Pines of Karachi/Beverly Hills/Long Mountain Country Club/Proposed Mona Section 1

Areas 1-3 are contiguous and together represent the present and proposed dominance of residential development on this northern section of the Long Mountain

Area 4: Mona Reservoir/Mona Water Treatment Plant/Hockey Field

Area 5: University of the West Indies, Mona Campus

Area 6: Part of the undeveloped area of the Long Mountain/Warieka Hills

6.3.6.2 Housing

In 2008, it was estimated that annual housing demand was 10,000 to 15.000, however, demand continued to exceed supply and this has helped to fuel rising housing cost (Chang, 2008)[2]. According to the Housing Sector Plan 2009 - 2030 in the *Vision 2030 Jamaica National Development Plan*, the last officially published housing needs assessment report stated that in order to provide housing in line with population growth, housing solutions at a rate of 15,000 per year over the period 1987-2006 was required. However, yearly average over the period was 4,325, this indicated an unmet demand, hence a growing backlog.

In 2004, the Planning Institute of Jamaica (PIOJ) projected a 2005 population of 587,289 in the KMA. On the other hand, homeownership in the KMA was below the national average of 59.8% in 2007. In terms of regional variations, owner occupied housing was highest in rural areas (67.8%) compared with 47.8% in the KMA[3].

Essentially, the KMA is close to its threshold for residential development due to the virtual absence of large tracts of land to meet housing demand created by natural population increase, rural-urban drift and to satisfy the general backlog. This has resulted in the growth of new and emerging population centres in the adjacent parishes, such as, St, Catherine, particularly in Portmore. The proposed Mona Section 1 is, therefore, is a Government of Jamaica response to alleviating the backlog of housing solutions and these fifty-four (54) residential lots are among the projected 9,800 new housing solutions to become available through the HAJL during the period 2010-2011. An additional 212 persons would be added to the area's population (assuming average household size of 4) by the end of the development phase.

The parishes of Kingston and St. Andrew accounted for a total of 192,713 households and 183,340 dwelling units, based on the 2001 Population Census. Of these figures, St. Andrew accounted for a total of 164,513 & 156,137 respectively or 21.9 & 21.6 per cent of Jamaica total number of households and dwelling units. However, it is suspected that these figures

[2] http://www.jis.gov.jm/water_housing/html/20081004T130000-0500_16906_JIS_GOV_T_TO_INCREASE_SHELTER_SOLUTIONS.asp
[3] Ibid.

would have increased due to new developments. The average number of persons per household in 2002 for St. Andrew stood at 3.2, which was less than the national figures of 3.7.

Home ownership within the parish in 2002 stood at 48.2 per cent, whilst 19.2 per cent occupied rent-free and nearly 1/3 rented their dwelling. The main outer wall materials for St. Andrew based on 2001 national survey were: (i) concrete and block (77 per cent), (ii) wood (12 per cent) and (iii) wood and concrete (7 per cent), while the main roofing material was also metal sheeting (73 per cent).

Housing schemes within the project area include the older Mona Heights community, Blue Castle, Mona Great House Circle, Pines of Karachi, Beverly Hills, Long Mountain Country Club, and Lombard Close.

Demand for housing near the proposed development is acerbated by the presence of the two largest tertiary institutions regionally and nationally, University of the West Indies (UWI) is located in Mona while the University of Technology (UTECH) in Papine ensure an increasing demand for accommodation for primarily students but for staff also.

6.3.6.3 Social Services and Amenities Infrastructure

The development would occur in the context of an urban setting where there is the general harmonious integration of all sectors such as the physical, social, cultural, economical, and environmental and governance systems, which are integral to the objective of achieving comprehensive sustainable development and must be embodied in the process from its outset. In this framework, the various social services are described below.

Police - the Matildas Corner, Papine, and August Town Police Stations provide Police service to the area. Both stations are adequately staffed and equipped to serve the communities. Reported crimes vary within the communities, the most frequent being burglaries.

Post Office - Based on the location of the development, residents of the proposed development would be served by the Liguanea Post Office. In addition to offering the regular services such as parcel and mail delivery, issuing of pension and the selling of stamps, the post office offers Bank and Money Orders for sale, bill payment through Paymaster and international package delivery by FedEx (Federal Express). Residents in the area also have the option to purchase mailboxes for their personal mail delivery.

Schools - **Public Schools** - Given the urban setting of the proposed development, options for public high schools vary through out the City. However, for primary schools students are more likely to be accepted into schools in their proximity. The Mona High School to the east and Jamaica College that cater to students in the age 12- 18+ age cohort are the secondary schools are nearby. In 2008/2009, the population at Mona High School was 1,145 students and 67 staff members while that at Jamaica College was 1799 students and 97 teachers. As mentioned above, the Mona and the adjacent Papine area are home to the largest tertiary institutions both nationally and regionally. UWI (Plate 6.6) is located in Mona while the UTECH is situated in Papine. The student enrollment at the UTECH in 2009/2010 stood at 10,737 while that at UWI totaled 11,046.

At the Primary level (ages 6-11 cohort), there are three schools serving the communities. There are the Mona Heights Primary with 1998 -1999 enrollment of 1,286 on two shifts and the August Town Primary School that had an enrollment of 498 students. The third Primary School, the Hope Valley Experimental School had an enrollment of 1,139 during the 1997-1998 academic year.

Plate 6.6: The Annex building at the University of West Indies, Mona

Private Schools – Several private high and preparatory schools are located

throughout the KMA but there is none near the proposed development, however, the Sts. Peter and Paul Preparatory school is located in close proximity.

Special Schools – the Hope Valley Experimental School (Papine) and the Jamaica School for the Deaf (Hope Gardens) lie in the wider development area.

In 2001, the age cohort 5-19 in Kingston & St. Andrew totaled 194,714 or 29.8 per cent of the population.

Health Services - Hospital services (general and specialist) are administered, through the boards of four Regional Health Authorities; South East, Southern, North East, and Western, with hospitals classified as Type A, B or C, according to the level of service offered and the size of the population served.

Fifteen (15) hospitals (public & private) are within the South Eastern Regional Health Authority (SERHA). The University Hospital of the West Indies (classified as a quasi public facility) with approximately 450 beds and one the island's major medical facility is located within the area. The Type V medical complex located at the Hospital is intended for a high-density urban centre. It includes among its services specialist medical services in the areas of Sexually Transmitted Diseases (STDs) and Family Planning Technology.

Fire Service - The area is served by the Half-way-tree Fire Brigade Station.

6.3.6.4 Physical Infrastructure

A. Electricity

Jamaica Public Service (JPS) supplies electricity to the area from the Hope substation through a 24 KV line. All the residents interviewed are pleased with the electricity service being provided by JPS.

B. Telephone, Internet and Cable Services

Telephone and Cable services would be provided by the established providers, such as, LIME, Digicel, FLOW, Claro and other private providers.

C. Potable water supply

The project addresses the issue of inadequate supply of potable water to the KMA as well as the impact of the proposed development on the Mona Reservoir. In a survey among residents conducted in 2010, most residents (90%) interviewed were satisfied with the potable water supply (Table 6.11). None of these resident expressed fear of a threat to the Mona reservoir or the Mona Treatment Plant by the proposed development.

D. Waste Disposal

i. Solid waste

Garbage collection trucks from the Solid Waste Management Authority collect solid waste regularly in the area. Mona Heights and adjacent areas are visited on Mondays and Thursdays. Eighty per cent of the residents interviewed indicated that the garbage collection service is good (see Table 6.11) Approximately 1,838 kilograms of solid waste wood be generated by the population once the development is completed.

*1.52kg * 3.2 (persons per household based on 2001 Population Census) * 54 (number of residential lots) * 7 (amount of days in the week).*

ii. Waste water

Except for Pines of Karachi and Long Mountain Country Club that have central collection sewage systems, the main sewage disposal method in the communities is that of septic tanks for individual dwellings. The 2001 Population Census indicates that the main form of sewage disposal within St. Andrew was water closet not linked to sewer.

Table 6.11: Satisfaction with the Social Amenities and Infrastructure

SERVICES	BAD	FAIR	GOOD
Postal	30%	10%	70%
Transportation	30%	-	5%
Fire Hydrants	20%	5%	70%
Police	10%	5%	90%
Telephone	-	-	40%
Electricity	-	-	100%
Water Supply	10%	5%	90%
Recreational	40%	5%	60%
Garbage Collection	5%	20%	80%
Cable	5%	5%	98%

E. Roads, Transportation, and Traffic

The Mona Road and Karachi Avenue, provide access to the proposed development. Private vehicles are the preferred mode of transportation within suburban, predominantly middle to high-income communities. Public transportation, however, plays an important role especially for students who travel to the various educational institutions and to gardeners and domestic workers who work for families in the area.

The survey indicates that 71% of the residents do not experience traffic congestion within their locality. However, roads that do experience traffic congestion include Mona Road, Pine Boulevard, Wellington Road, and Beverly Drive.

6.3.7 Rapid Traffic Impact Assessment

6.3.7.1 Mona Road (North and South)

Mona Road is an asphalted 2-lane road, which is consistent with its current use as a secondary road. The speed limit along this arterial is 50 km/h. Mona Road is classified as a Class B road and services a number of residential properties, which include the existing Mona Heights, Pines of Karachi, and Beverly Hills communities.

Class 'B' roads or secondary roads are roads of regional importance that connect with arterial roads and normally carry average daily traffic volumes of 500 to 2000 vehicles. The Mona Road converges with the Old Hope Road, a Class A main road.

Mona Road (North and South) Traffic Flow

Traffic surveys were carried out 2009 March 30 by the NWA and the following data when projected at 3% for a year are considered to be indicative of current conditions.

Key results are shown below:

Daily traffic flow: 19,384 vehicles per day

am peak (7am – 8am): 2,181 vehicles

pm peak (4.30pm – 5:30pm): 1,898 vehicles

It should be noted that traffic volumes could vary significantly depending on abutting land use and road layout. However, land use near the proposed development is residential, open space/conservation, social amenities and institutional.

6.3.7.2 Karachi Avenue

Plates 6.7A & B: Showing the intersection Mona Road (South) - Karachi Avenue -Mona Road (North) on 2010 June 09 -PM peak

Karachi Ave run west off Mona road and is classified as a Parish Council (KSAC) road that provides access to residents of Pines of Karachi and Beverly Hills. A 50 km/h speed limit applies along these roads. Parish Council roads allow communications and contact with or

between communities/districts. These roads serve traffic volumes less than 1000 vehicles per day. These roads are used to access lots within residential areas.

,

Karachi Avenue Traffic Flow

Traffic surveys were carried out in on 2010 March 30 at Karachi Avenue and when projected at 3% for a year are considered to be representative of current conditions.

Key results are shown below:

Daily traffic flow: 888 vehicles

am peak (7:00 - 8:00am): 141 vehicles

pm peak (4:30 - 5:30): 64 vehicles

6.3.7.3 Distribution of Traffic on to Surrounding Road Network

Traffic counts between the hours of 7.00 – 8.00 am and 4.30 – 5.30 pm usually increase as persons leave for places of work and the nearby University of the West Indies in the morning and returning home in the evening. Some sites, such as, shopping centres or plazas can have a considerable impact during the pm peak hour, but may have an even greater impact during the evening hours and on Saturdays

At a 3 %, growth rate for one year the indicative traffic distribution for traffic from the direction of the proposed Mona Section 1 development is shown in Table 6.12 and confirm that the highest traffic volumes (82 vehicles) travel toward Mona Road (N) from Karachi Avenue during the am peak. During the pm, peak the largest number of vehicles (87) travel from Mona Road (N) onto Karachi Avenue.

Table 6.12: Traffic leaving and entering Karachi Avenue at the Mona (N)-Karachi Ave-Mona (S) intersection

PERIOD	LEFT IN	RIGHT IN	LEFT OUT	RIGHT OUT
AM PEAK	46	3	82	59
PM PEAK	87	2	34	30
TOTAL	**133**	**5**	**116**	**89**

Distribution of Traffic on to Surrounding Road Network

6.3.7.4 Modal Split

Modal Spilt at the Mona Road (north)-Karachi Avenue-Mona Road (south) intersection was divided into Heavy Vehicles (Hv) and Light Vehicles (Lv). Heavy Vehicles are buses and small trucks and Light Vehicles are cars, SUVs, bicycles and motorcycles. Data for the intersection indicate that there are primarily Light Vehicles traversing the roadways. Heavy vehicles ranged from 1 – 4 % at the intersection for the entire 12-hour count as shown in Table 6.13 below.

Table 6.13: Showing modal split

DAILY TRAFFIC FLOW	FROM MONA ROAD (N)		FROM KARACHI AVENUE		FROM MONA ROAD (S)	
	% Hv	% Lv	% Hv	% Lv	% Hv	% Lv
Total Traffic Flow (7:00 am – 7:00 pm	4	96	1	99	3	97

6.3.7.5 Projection of Traffic Growth

According to nationally accepted data contained in The Institute of Transportation Engineers (ITE) Trip Generation Handbook that outlines specific generation rates for planning purposes for different development types, the proposed units in the development would be classified as Single Family Detached. The generation rate for single-family detached housing was used to calculate an estimate of the development site's traffic generation as shown in Tables 6.14 and 6.15

It is projected that traffic at the Intersection: Mona Road (N)-Karachi Avenue-Mona Road (S) will increase from 20,273 (2010) to 26,354 in ten (10) years at a growth rate of 3%.

Currently the number of vehicles traversing the intersection per minute is 28, while 1 vehicle traverses Karachi Avenue per minute. Within the next ten years, the number of vehicles per minute at the intersection is expected to increase to 35, while the number of vehicles on Karachi Avenue would increase to two (2) vehicles per minute.

Table 6.14: Projected Traffic Generation

LAND USE	UNITS	ITE TRIP GENERATION CATEGORY	TRIP FACTOR (PM PEAK HOUR)	PM PEAK HOUR VEHICLE TRIPS (WEEKDAY)
Single Family Detached Housing	54	ITE Land Use 210	1.01 vehicles per unit/pm peak hour	55 vehicle trips per hour

*ITE – Institute of Transportation Engineers (ITE)

Table 6.15: Traffic Growth Projection –Intersection: Mona Road (N)–Karachi Avenue–Mona Road (S)

	TOTAL TRAFFIC	# OF VEHICLES/HR	5 YRS @ 3% GROWTH)	10 YRS @ 3% GROWTH)	PROJECTED 10 YR # OF VEHICLES/HR (12 HR.)
Total Traffic at Intersection	20,273	1,689	23,314	26,354	2,131
Traffic on Karachi Avenue	888	74	1,021	1,154	96

The proposed Mona Section 1 subdivision will create minimal impact on the area's traffic flow. However, Karachi Avenue, the main entrance point to the development is anticipated to generate approximately 1,021 vehicles per day (in 5 years) and 1,154 vehicles per day (in 10 years). Once the development is at complete build out (within about 5 years), it will generate approximately 55 vehicles during pm peak hour, which would be less than one (1) vehicle per minute.

The proposed Mona Section 1 subdivision is considered satisfactory; therefore, there would be neither traffic management nor operational issues that would warrant refusal for this development. However, in the medium term it might be necessary to signalize the Mona Road (N)–Karachi Avenue–Mona Road (S) intersection.

6.3.7.6 Subdivision - Internal Layout & Parking Requirements

Access and Egress

The road design is laid out in a manner as to discourage use by through traffic. Roads have also been designed to improve site distance.

Road Reservation

The width of road reservations has been designed based on recommendation from the Ministry of Transport and Works /NWA and NEPA.

Design Features

The proposed Mona Section 1 development would bring an increase pedestrian traffic, as well as, vehicle traffic entering and exiting the subdivision roadways. The road design would accomplish the following goals:

- Reduce speed
- Accommodate pedestrians;
- Accommodate traffic to be generated by the development
- Accommodate large vehicles, such as solid waste removal trucks; and
- Maintain compatibility with existing infrastructure and adjacent land uses.

Parking

The NWA Schedule of off street parking requirements by land use should be used as a guide in providing parking space for residential and commercial lots, schools and the community centre. At complete build out (54 units), assuming an average of three (3) bedrooms per unit. The minimum parking space required would be 135 (see Table 6.16 below).

Table 6.16: Parking requirements for the proposed Mona Section 1 Development

MULTI-FAMILY DWELLING	NWA REQUIREMENTS	# OF UNITS	PARKING SPACES REQUIRED
3 Bedroom	2.5 Spaces Per Dwelling Unit	54	135

6.3.8 Landscape and Visual Impact Assessment

6.3.8.1 Introduction and Background

This section assesses the likely landscape and visual impacts of the future development and proposes strategic mitigation measures to alleviate the impacts caused. The nature and scale of the project will alter the landscape and visual environment within the area - part of Mona and Papine Estates and Goldsmith Villa here referred to as Mona Section 1, which will have limited opportunity for direct mitigation, such as screen planting. However, the design allows for the retention of key features, such as, the existing visual corridors, that will serve to avoid unacceptable impacts.

Mona Section 1 lies in East Kingston and lies on the moderately densely vegetated northeastern slopes of Long Mountain and west of the Mona Reservoir. The site is juxtaposed between existing residential developments as described above.

The eastern slopes of the proposed development currently have limited open view, over the communities of Karachi Avenue, of Mona Heights, Mona Great House, and the Mona Reservoir. The development of Mona Section 1 is likely to affect the local landscape but will have a limited effect on the views from these residential properties, as the lower slopes of the Long Mountain will remain in natural vegetation.

6.3.8.2 Landscape and Planning Context

In the development control context, Mona Estate is governed by the Kingston and St. Andrew Corporation (KSAC) and 1966 *Confirmed Kingston Development Order for Kingston*.

The site falls within the land use zone private or public open space that serves to prevent encroachment on the NWC's Mona Reservoir and the Mona Water Treatment Plant. The

proposed development provides rational space for active and passive recreational uses to the northeast of the site and east of the Karachi to Long Mountain main road.

Besides the residential areas mentioned above other residential areas in the vicinity include Karachi Avenue/and Wellington Drive. These land uses are all reviewed as part of this study.

6.3.8.3 Existing Landscape and Visual Resources

A. **Existing Landscape Resources**

This section examines the existing landscape resources of the Project Site. The context of the Project Site is Beverly Drive to the west, Wellington Drive and Old Hope Road to the north and Garden Boulevard to the east. There is variety in the topography in the study area ranging from the flat landscape of Karachi Avenue and Mona Heights to the slopes of the proposed development area. The areas of steep slopes are moderately vegetated.

The large areas of vegetation on the slopes within the Project Site are major landscape resources for the following reasons:

- as an ecological habitat and wildlife corridors
- stabilisation of steep slopes; and
- buffer for the Mona Reservoir and the Mona Water Treatment Plant

Plates 6.8A & B: Residential development at Beverly Hills and the Pines of Karachi respectively

B. **Existing Visual Resources**

The view from the site is towards the north and north east looking towards Mona, Mona Reservoir, Papine, Karachi, Hope Pastures, Jacks Hill, and the Blue Mountains (see Figure 6.11). The developments in Karachi and Mona now view this property as a wooded area with some residential development. These communities would be deprived of some of that green view, but to the east of the site, there is an unspoilt area of natural vegetation.

Figure 6.11: Google satellite image focusing on the immediate view envelope of the proposed Mona Section 1 development.

Table 6.17: Summary of Existing Landscape and Visual Resources

LANDSCAPE ZONE	LANDSCAPE ZONE DESCRIPTION	QUALITY / SENSITIVITY
LZ1	Primary Green Backdrop (90%) Secondary woodland on steep slopes above the Mona Reservoir and below the Pines of Karachi to Long Mountain Country Club Road provides an interesting green backdrop to flat lands below including Karachi Avenue and Mona Heights that link visually with the green slopes. This area acts as a buffer and transition zone between the residential development above and the reservoir below.	High
LZ2	Views of the Built Urban Environment(80%) Residential development and other land uses that span the Mona, Papine, Hope Pastures into Jacks Hill and the Blue Mountains presenting a captivating view of the urban landscape	High

C. **Landscape and Visual Impact Analysis**

The key landscape and visual impacts were considered in the design so that major potential impacts would be avoided as the Project Site is an area of dramatic contrast in the KMA. The presence of the high quality landscape units, namely LZ1, LZ2 (Table 6.17) is a constraint to development. Major encroachment into these areas has been avoided where possible as the Long Mountain Range is considered an area to be preserved due to Issues related to its role in archaeological and biodiversity .

D. **Landscape Impact Assessment**

Plates 6.9 A, B, & C: Showing the character of the landscape along the Long Mountain/Pines of Karachi main road

A coherent landscape and linkage with the surroundings have been achieved during the urban design process. This includes consideration of the design and

site planning and orientation of the development elements, such as, the recreational area. Pedestrian (given the location of the proposed recreational area) and vehicular movement are designed to exploit connections to adjacent communities although limiting connectivity with the existing Beverly Hills community based on their request.

The subdivision while it will alter the existing landscape and visual character of the site from a scrubby, rocky hillside slope into residential use, will conform to the existing residential character of the area.

The site and its surroundings area are of high landscape quality. This factor was incorporated into the design in order to avoid much of the potential impact, which could arise from such a development. The development is, therefore, relatively small (60 lots) and is contained on the western side of the Karachi/ Long Mountain Country Club Road. Due to the existing feeder road, there is less direct impact on local topography and the extent of l vegetation loss.

Within the site, there will be a change from an open expanse of land in natural vegetation to a modern middle-income development with at least multi storey structures and infrastructure with open space/recreational facilities. This is a change, which will create a new landscape character compared to the one existing; however, it will fulfill its intended use. Thus, the scheme will cause significant localized landscape impacts due to expansion of the residential character of the area.

E. **Visual Impact Assessment**

The main impacts will be more visual than landscape due to the surrounding residential receptors and the NWC property and facilities. The primary source of

Plate 6.10: High quality view from Mona Road to the proposed Project Site

the impacts will be the change in view from vegetation that will significantly affect the visual envelope as shown in Plates 6.9 and 6.10 and Figure 6.11. The visual

impact assessment found there might be minor impacts incurred by short and medium distance viewers concentrated to the northeast of the site. However, there will be major visual impact for the nearby communities, such as, Mona Heights.

6.3.9 Onsite - Visual and Landscape

During the construction/Implementation, and operational phases, the visual and landscape impacts of the proposed site will undergo changes. Site preparation and construction activities will result in visual disamenity and severe disturbance of the landscape.

The removal of trees and the disturbance of the terrain doing earthworks in order to prepare roads, sewerage and potable water lines will be features of the construction/implementation phase. During the construction of individual houses, the impact will vary given the fact that individual timetable for development will vary over time and space.

6.3.10 Conclusion

During the design of the subdivision there was cognizance to the concerns of the adjacent Beverly Hills residents, the approval granting agencies and general public opinion and specifically as they relate to the potential impacts on the landscape and visual resource. The design, therefore, attempts to minimize anticipated impacts on the surrounding sensitive receptors.

The relatively small size of the subdivision means that the scale of the impacts will inevitably result in landscape and visual impacts that in general are not excessive. The primary ones are the loss of local natural vegetation west of the main road and the visual impacts to the residents in close proximity to the site. However, the type and scale of the development, together with the more elevated location of the primary surrounding receptors, remove the need for major direct mitigation measures except for replanting of vegetation in order to recapture the visual appeal and recapture that element of the landscape character of the site and the area.

7. ENVIRONMENTAL IMPACTS AND MITIGATION

ASSUMPTIONS AND ASSESSMENT GUIDELINES

1. Physical Resources

a. Geology

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

- Expose people or structures to major geologic hazards

b. Soils Resources

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

- Cause substantial erosion

c. Surface waters

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

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

d. Ground Waters

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

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

2. Air Resources

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

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

3. Biological Resources

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

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

4. Social Impact Assessment

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

- Substantially exceed carrying capacities of community resources
- Present risk to human health and safety
- Present a risk to historical and archeological heritage
- Substantially affect the visual and landscape views of receptor communities

The checklists below rate impacts identified, their duration, and significance and whether these impacts are direct or indirect, based on the following legend:

LEGEND: Environmental Issues

IMPACT	RATING
I	No Impact
II	Low
III	Moderate
IV	High
SIGNIFICANCE	**RATING**
I	Not significant
II	Less Than Significant Impact
III	Potentially Significant Impact
DURATION OF IMPACT	**RATING**
I	None
II	Short Term
III	Medium Term
IV	Long Term
DIRECT/INDIRECT IMPACT	**RATING**
I	No Impact
II	Direct
III	Indirect
* - Identifies positive Impacts	

7.1 PHYSICAL

Table 1A: Geology and Soils: Impacts on Public Safety and Structures

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
I. Geology and Soils Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: i) Rapture of a known earthquake fault, as delineated on the most recent earthquake fault-zoning map issued by the Mines and Geology Division or based on other substantial evidence of a known fault? ii) Seismic related ground failure, including liquefaction and solution cavities? iii) Landslides?	II I II	II I II	IV IV I	III I I
b) Result in substantial soil erosion or the loss of top soil?	III	III	III	II
c) Be located in a geological unit or soil that is unstable, or that would become unstable, as a result of the project, and potentially result in on or off-site landslide lateral spreading, subsidence, liquefaction or collapse?	II	II	III	III
d) Be located on expansive soil, creating substantial risk to life or property?	I	I	I	I
e) Have soil incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	I	I	I	I

Table 1B: Geology and Soils: Specific Impacts

INDICATOR	IMPACT
	Construction/Implementation
Soils *Erosion Impacts*	**Impact** The Bonnygate Stony Loam that has a high erosional capacity resulting in thin layers on steeply sloping areas underlies the proposed development. Soil erosion can be expected to occur in the calcarenites with the clearing of land. As a result of prevailing ground conditions from geological faulting, abundant rock materials of varying sizes are loosely embedded in weathered rock/soil matrix on the slopes. In the event of intense rainfall, high flows will have the potential to carry rocks, debris and erode the slopes during development and post-development stages. This will eventually lead to blocked storm water drains onsite and offsite, particularly at the culverts down gradient of the site. This could contribute to overflow of the drains near the Pines of Karachi.
Geology *Landslide/rock slide*	**Impact** Information from the Landslide Susceptibility Map of Kingston (CDMP, KMA Project 1998)

INDICATOR	IMPACT
Earthquake/Seismic Impacts	for shallow and deep-seated landslides indicates that the project site and its environs exhibit low landslide susceptibility. General observations reveal that slopes are generally stable in areas that are undisturbed by construction or other types of earthwork activity. There is potential for slope movement, occurring as rockslides, along prominent fracture zones of the western slope. Impacts will invariably be generated, as access roads are cut and site preparation and construction works occur. These impacts include: . Increased vulnerability to slope failures of fractured rock along moderate to steep gradients. Solution cavities may present a risk during site excavation activities. **<u>Impact</u>** Geological faults traverse the project area, environs, and in general constitute a seismically active area of the Wagwater Belt. Disruptions to the natural environment from site preparation and construction works may result in rock movement and instability near the proposed development. Opening of sealed fissures on the floor of the reservoir can result in vast and uncontrollable leakages.

Table 2A: Hydrology and Water Quality: Impacts on Eco-systems and Public Health

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
III. Hydrology and Water Quality Would the project:				
a) Violate any water quality standards or waste discharge requirements?	II	I	-	-
b) Substantially deplete ground water supplies or interfere substantially with ground water recharge, such that there would be a net deficit in aquifer volume or a lowering of the local ground water table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)?	III	III	IV	III
c) Substantially alter the existing drainage pattern of the site or the area, including thorough alteration of the course of a stream or river, in a manner, which will result in on or off site erosion or siltation?	II	II	IV	III
e) Create or contribute to runoff water that would exceed the capacity of existing or planned storm water drainage systems or provide substantially additional sources of polluted runoff?	III	II	IV	II
f) Substantially degrade water quality?	I	I	I	I
g) Place housing within a 100-year flood hazard area, as mapped on a federal flood hazard boundary or flood insurance rate map, or other flood hazard delineation map?	I	I	-	-

h) Place structures that would impede or redirect flood flows within a 100-year flood hazard area?	II	II	IV	III
i) Expose people or structures to a significant risk of loss, injury, or death from flooding, including flooding resulting from the failure of a levee or dam?	I	I	-	-
j) Result in inundation by hurricane or tsunami?	III	III	IV	III

Table 2B: Hydrology and Water Quality: Specific Impacts

INDICATOR	IMPACT
	Construction/Implementation
Hydrology *Flooding*	**Impact** No documentary evidence of flooding in the immediate project area but mention was made of flooding on the Mona Road. In addition, the socio-economic survey revealed no significant concern among residents. Storm water from the site and adjoining areas drains directly into the city's drainage network in the Pines of Karachi (see Plate 7.1 below). Development of a site for residential purposes normally leads to a 1.5 to 2--fold increase in storm water runoff caused by increase in pavement structures, such as, paved roads, driveways and sidewalks, as well as, runoff from roofs of houses. Permeability is, therefore, significantly reduced leading to increased runoff into gullies and drains nearby. If the drainage system for the site is undersized and there is frequent blockage due to rock/soil debris entering the system, flooding could occur on the site, which may also impact negatively on developments adjoining the property. The site generally slopes to the North East direction with significant drainage paths towards a 10m depression at the extreme north of the proposed subdivision development Field observations indicate that storm water flows downhill, along the main road, from the Long Mountain Country Club could impact the site negatively, **Potential Risk** The Gibraltar-Bonnygate and Newport Limestone Formations are classified as aquifers due to their relatively high permeability which will support significant groundwater storage and movement under normal hydrologic conditions *Risk to Groundwate/Surface wtarer* Contamination of groundwater is dependent on the depth to water within the aquifer, the hydraulic conductivity of water within the aquifer, and the subsequent attenuation time in the soil. Perennial drainage is predominantly underground and the project area constitutes the general recharge area for the Long Mountain aquifer. Normally the construction of impermeable surfaces, such as, roads and other paved areas at the project site will directly affect and reduce surface areas available for recharge. However, the difference between pre and post construction discharge is found to be insignificant because of the small size of the development and therefore it will not have an adverse effect on the aquifer. The point of deposit for storm-water at the proposed retention pond will effectively

INDICATOR	IMPACT
	recharge the local aquifer. However, the quality of water collected must be monitored to reduce impacts to public supply wells that tap the aquifer. The proposed drainage infrastructure will have no negative impacts on the quality of water resources at the reservoir **Risk Management** Having identified potential risks to the groundwater quality, there is need to focus on appropriate management solutions to avoid contaminants entering groundwater despite the challenge of managing levels of contaminants in storm water. Although the Bonnygate Stony Loam soil unit is characterized by rapid internal drainage there is yet a considerable depth below ground surface to the water table. This may be of significance in attenuating contaminants present in storm water and protecting groundwater quality.

Plate 7.1: The Pines of Karachi drain as it enters the larger paved drain down stream

Plate 7.2: Existing drains in the Pines of Karachi

Table 3A: Local Climate: Impacts on Ecology and the Public

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
VI. Local Microclimate Would the project:				
a) Have a substantially adverse effect on microclimate through the use of concrete and asphalt?	III	II	IV	III
b) Substantially reduce the number of trees in the project area?	IV	III	IV	II
c) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	IV	III	IV	III

Table 3B: Local Climate: Specific Impacts

INDICATOR	IMPACT
	Operation/Maintenance
Local Climate	**Impact** It is likely that the microclimate at the project site will be altered from its present condition due to the type of project. Operational aspects that are likely to alter micro-climate include: ▪ Reduced numbers of trees ▪ Increased paved surfaces (heat trapping) ▪ Discharges of humid air from air conditioners ▪ Increased ambient lighting

7.2 Natural Hazards

Table 4A1: Natural Hazards: Impacts on Public Safety, Structures and Ecology

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Hazards -Natural Would the project:				
a) Result in substantial damage from flooding caused by torrential rainfall?	I	I	I	I
b) Result in serious loss or damage from the primary and secondary effects of a hurricane?	III	III	I	III
b) Result in serious loss or damage from the primary and secondary effects of an earthquake?	III	III	IV	III

7.3 Manmade Hazards

Table 4A2: Manmade Hazards: Impacts on Public Safety, Structures and Ecology

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Hazards – Other Would the project:				

a) Expose the population to hazardous materials?	I	I	I	I
b) Expose the natural environment to hazardous materials?	I	I	I	I

Table 4B: Hazards: Specific Impacts

INDICATOR	IMPACT
	Operation/Maintenance
Hazards	**Impacts** Following the occurrence of a natural disaster, such as a hurricane, the following effects can occur: ▪ Water pollution and increased public health risk. ▪ Disruption in essential services: power, water, communications. ▪ Blockage of access roads by debris. ▪ Wind, water or structural damage to property, and effects on business ▪ Operations and insurance. ▪ Loss of productive time.

7.4 BIOLOGICAL

Table 5A: Biology - Impacts on the Terrestrial Environment

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/ INDIRECT IMPACT
Biological Resources Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modification on any species identified as rare or endangered in local or regional plans, policies or regulations, or by NEPA?	1	I	I	I
b) Have substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies or regulations or by NEPA?	I	1	I	I
c) Have a substantial adverse effect on Protected Wetlands as defined under NEPA's Policy for Protected Areas through direct removal filling, hydrological interruption, or other means?	I	I	I	I
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native residents or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	III	II	IV	II

e) Conflict with any local policies or ordinances protecting biological resources such as a tree preservation policy or ordinance?	III	II	IV	II
f) Have a substantial adverse effect on any protected areas identified by local policies and regulations or by NEPA?	I	I	I	I

Table 5B: Biology: Specific Impacts

INDICATOR	IMPACT
Construction/Implementation	
Biology *Flora*	**Impact** I. Direct Impacts As those species of birds (namely observed endemics), which are forest dependent, would be affected most by forest removal, then the following measures should be taken: The direct impact of the proposed development will produce extensive and irreversible change in the vegetation composition and structure of the area in the short and medium term with a near complete removal of the remaining natural vegetation of the area. This change in land use will intern dramatically alter the fauna of the site by way of a sharp decrease in both numbers of individuals, species diversity, and a compete loss of endemic fauna/birds at the site.
Fauna	**Impact** Removal of the current forest will completely modify the fauna of the area. The dominant faunal group, the birds, will be among those species most significantly affected. Approximately 50% of the property's birds are forest dependent. As such, the development will produce a change in the avian community from one dominated by forest dependent species, composed of many endemic species and subspecies, to a community comprised of a few species almost totally of non-endemic birds.

7.5 HERITAGE

Table 6A: Cultural Resources: Impacts on Historical Features and Resources

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Cultural Resources Would the Project:				
a) Cause a substantial adverse change in the significance of a historical resource?	I	I	I	I
b) Cause a substantial adverse change in the significance of an archaeological resource?	I	I	I	I
c) Directly or indirectly destroy a unique palaeontological resource or site or unique geologic feature?	I	I	I	I
d) Disturb any human remains, including those interred ou'tside of formal cemeteries	I	I	I	I

Table 6B: Cultural Resources: Specific Impacts

INDICATOR	IMPACT
Construction/Implementation	
Historical Resources	**Impact** No impact.

7.6 Human/SOCIAL

Table 7A: Aesthetics: Impacts on the Landscape and Visual Resources

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE OF IMPACT	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Aesthetics Would the Project:				
a) Have a substantially adverse effect on the scenic vista?	II	I	II	II
b) Substantially damage scenic resources, including, but not limited to trees, within a scenic highway?	II	II	IV	II
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	II	II	II	I
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	II	II	IV	III

Table 7B: Aesthetics: Specific Impacts

INDICATOR	IMPACT
Construction/Implementation	
Landscape /Scenic Vista	**Impact** Construction of the proposed development warrants removal of the majority of tree species currently on the site. This would affect negatively on the scenic vista of the area; however, although some revegetation will occur with primarily domestic trees the impact will be long term. There would also be a permanent change in the landscape.
Operation/Maintenance	
Landscape/ Scenic Vista	**Impact** * It is not anticipated that there will be any negative impacts associated with the scenic vista of the site during the operation/maintenance phase as based on the existing subdivisions; the development will be aesthetically pleasing.

Table 8A: Air Quality: Impacts on Public Health

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Air Quality Would the Project:				
a) Violate any air quality standards or contribute substantially to an existing or projected air quality violation?	II	II	II	III
b) Result in a considerable cumulative net increase of any criteria pollutant based on NEPA ambient air quality standards (including releasing emissions, which exceed quantitative thresholds for ozone precursors)?	I	I	I	I

c) Expose sensitive receptors to substantial pollutant concentrations?	II	II	II	II
d) Create objectionable odours affecting a substantial number of people?	I	I	I	III

Table 8B: Air Quality: Specific Impacts

INDICATOR	IMPACT
Construction/Implementation	
Air Quality	**Impact** In general the impact is short term (limited to the construction phase). The operations of heavy-duty vehicles and equipment are likely to produce increased combustion emissions. Also, there is the potential for increased atmospheric dust from bare soils, stockpiles, uncovered, overloaded trucks and storage equipment. This impact is classified as minor because of: ▪ The strong presence of the northeast trades will disperse the emissions rapidly from the site. ▪ The actual pace of development will be dictated by the preference of individual lot owners, therefore, the impact of fugitive beyond the period of site preparation will be insignificant The transport of materials from source to site would entail use of heavy trucks, which have the potential to produce polluting gaseous emissions and dust, depending on the material being transported. The movement of heavy trucks could also lead to additional road wear. These impacts are of short-term duration, but are of particular importance, as the main road leading to the site is a major thoroughfare, which already has a high volume of vehicular traffic. There is the possibility of a change in ambient air quality conditions due to elevated levels of emissions, such as, PM 2.5, PM10, CO, SOx.

Table 9A: Noise and Vibration: Impacts on the Public

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Noise and Vibration Would the project:				
a) Generate or expose people to noise levels in excess of standards established in a local general plan or noise ordinance, or in other applicable local standards?	II	II	II	II
b) Generate or expose people to excessive ground-borne vibrations or ground-borne noise levels?	IV	III	III	II
c) Create a substantial permanent increase in ambient noise levels near the project (above levels without the project).	I	I	I	I
d) Create a substantial temporary or periodic increase in ambient noise levels approximately the project, in excess of noise levels existing without the project?	III	II	II	III

Table 9B: Noise and Vibration: Specific Impacts

INDICATOR	IMPACT
Construction/Implementation	

INDICATOR	IMPACT
Noise & Vibration	**Impact** Impacts will invariably be generated, as access roads are cut. These impacts include: Noise nuisance that is likely to result from construction activities above the maximum 70 dB standard level.

Table 10A: Waste and Hazards: Impacts on Public Health and the Environment

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/ INDIRECT IMPACT
Waste and Hazards Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous material?	I	I	I	I
b) Create a significant hazard to the public or the environment through reasonable foreseeable upset and accident conditions involving the release of hazardous materials in the environment?	I	I	I	I
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	I	I	I	I
e) Substantially increase solid waste in the project area thereby exceeding the present landfill capacity?	II	II	IV	III
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	I	I	I	I
g) Expose people or structures to a significant risk of loss, injury, or death involving wild land fires, including where wild lands are adjacent to urbanized areas or where residences are intermixed with wild lands?	II	II	IV	III

Table 10B: Waste and Hazards: Specific Impacts

INDICATOR	IMPACT
	Construction/Implementation
Solid Waste	**Impact** During site clearance and earthwork activities, construction waste will be generated. This occurs if the material contains high clay content, high quantities of large boulders or limestone blocks that cannot be reused. If construction waste is improperly stored on site, it can be easily removed/eroded during storm events thereby affecting communities nearby.

7.7 Carrying Capacity

Table 11A: Social Infrastructure: Impacts on Public Services within the Development area

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Social Infrastructure Would the project:				
a) Result in substantial adverse impacts associated with the provision of new or physically altered governmental facilities, or the construction of which could cause significant environmental impacts in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public service?				
▪ Fire Protection?	II	II	IV	III
▪ Police Protection?	II	II	IV	III
▪ Schools?	II	II	IV	III
▪ Health Centres?	II	II	IV	III
b) Provide a substantial number of employment opportunities for neighbouring community members throughout the project lifecycle?	III	II	III	II

Table 11B: Social Infrastructure: Specific Impacts

INDICATOR	IMPACT
Construction/Implementation	
Social Infrastructure	**Impact** The demand for housing solutions is expected to be maintained, with potential purchasers likely to come from individuals employed in government, service, education, and business sectors. The expected increase in the population will have little impact on existing community resources.
Employment	**Impact** The proposed project provides the opportunity for employment of construction workers and tradesmen for the duration of construction period some who may be members of the community. New jobs created during the construction phase could result from activities in the development of infrastructure and housing solutions. Priority will be given to residents within the immediate community for employment possibilities created during the implementation of the project.
Operation/Maintenance	
Employment	The opportunity for employment in the operation phase will be insignificant, and limited to gardeners, helpers, and security personnel if necessary.

Table 12A: Utilities and Services: Impacts on Social Services and Resources

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
VII. Utilities and Services: Would the project:				
a) Exceed wastewater treatment restrictions or standards of NEPA?	I	I	I	I
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	I	I	I	I
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	II	II	III	II
d) Have sufficient water supplies available to serve the project from existing sources.	I	I	I	I
e) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	I	I	I	II
f) Comply with NEPA/NSWMA statutes and regulations as they relate to solid waste?	I	I	I	II
g) Significantly increase energy consumption in the project area, which would contribute substantially to the greenhouse gases?	III	II	IV	III

Table 12B: Utilities and Services: Specific Impacts

INDICATOR	IMPACT
	Construction/Implementation
Physical Infrastructure *Solid Waste*	**Impact** The proposed development areas will produce an unknown quantity of solid waste. This is not considered a significant environmental impact, however, the effects waste production can include: ▪ Increased demand for and consumption of limited landfill space. ▪ Increased demand for municipal collection services. ▪ Increased use of roads by collection trucks which could affect the surface of ▪ the road, congestion, fugitive dust along roads. ▪ Breeding of pests and disease vectors such as flies, vermin and roaches if storage areas are not hygienically maintained. ▪ Visual dis-amenity and odours.
Potable Water	**Impact** There will be a demand for potable water for residents. The NWC have indicated its wiliness to supply the proposed development. The increased demand will however, add to the burden on municipal resources that has to be reliably met.

INDICATOR	IMPACT
Energy Consumption	**Impact** Although the power demand of the development can probably be met by JPSCo. the issue pertains to the use of non-renewable resources, and the national fuel bill, as well as, contributions to green house gases, which are ultimately detrimental to the environment. .

Table 13A: Land Use and Planning: Impacts on Community Conservation and Habitat Conservation

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Land Use and Planning Would the project:				
a) Physically divide an established community?	I	II	IV	II
b) Conflict with the applicable land use plan, policy, or regulation of NEPA (including, but not limited, to a general plan, specific plan, local zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.	IV	III	IV	II
c) Conflict with any applicable habitat conservation plan or natural community conservation?	IV	III	IV	II

Table 13B: Land Use and Planning: Specific Impacts

INDICATOR	IMPACT
Construction/Implementation	
Community Conservation	**Impact** The project is proposed for an area zoned for conservation/public open space.

Table 14A: Population and Housing: Impacts on the Public and Social Infrastructure

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Population and Housing Would the project:				
a. Induce substantial population growth in the area, either directly (for, example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	III	II	IV	II
b. Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	I	I	I	I

c. Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	I	I	I	I

Table 14B: Population and Housing: Specific Impacts

INDICATOR	IMPACT
Construction/Implementation	
Population growth	**Impact** Given the number of housing solutions being provided through the project it is expected that the population of Mona Section 1 will experience modest growth over the short to medium term.

Table 15A: Transportation and Traffic: Impacts on Public Safety and Travel

ENVIRONMENTAL ISSUES	IMPACT	SIGNIFICANCE	DURATION OF IMPACT	DIRECT/INDIRECT IMPACT
Transportation and Traffic Would the project:				
a. Cause a substantial increase in traffic, in relation to existing traffic load and the capacity of the street system (i.e., a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?	III	II	IV	III
b. Exceed, individually or cumulatively, the level of service standards established for the designated roads or highways?	II	II	IV	III
e. Result in inadequate emergency access?	I	I	I	I
f. Result in inadequate parking capacity?	I	I	I	I
g. Conflict with adopted policies, plans or programmes supporting alternative transportation (e.g., bus turnouts, bicycle rack)?	I	I	I	I

Table 15B: Transportation and Traffic: Significant Impacts

INDICATOR	IMPACT
Construction/Implementation	
Traffic	**Impact** There will be an increase in traffic volume due to development works. The travel of employees to and from work will increase traffic flow especially during peak hours, while the transportation of paving, filling and other construction material as well as solid waste may increase the heavy vehicle traffic flow during both peak and off-peak periods. An increase in traffic flow may inadvertently result in traffic delays.
Operation/Maintenance	
Traffic	**Impact** The increase in traffic along Karachi Avenue and at the T Junction with Karachi Avenue and Mona Road. However, severe congestion is not anticipated.

8. CUMULATIVE IMPACTS

8.1 CUMULATIVE IMPACTS

Environmental impacts are considered *cumulatively considerable* when the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other and current projects and the effects of future projects. The site of the Proposed Action would occur within the density requirement of 30 habitable rooms per acre established by NEPA and with similar developments in close proximity. The geographic scope of the addition of 11.18 hectares of residential development is shown in Table 8.1 below.

Table 8.1: Geographic scope of cumulative impacts

RESOURCE ISSUE	GEOGRAPHIC AREA	IMPACTS
Visual/Landscape Resources	Local	Change on and off site
Air Quality	Local	Ambient air quality
Biological Resources	Local	Reduction
Land Use Planning	Regional and local	Zoning requirements
Geology, Soils and Seismicity	Local	Effects of and on population
Hazards	Local (within the vicinity of the project)	More traffic greater exposure to traffic accidents Effect of increase in storm water flows
Hydrology	Local, regional	Potential impact of water quality
Noise	Local (within immediate project vicinity)	Construction activities on site and in Pined of Karachi
Employment, Population & Housing	Local (within the parish, and adjacent parishes)	Positive impact on housing demand nationally.
Public Services and Utilities	Regional (potable water, electricity, solid waste, police, fire and postal services)	Increase demand for potable water and other services
Transportation and Traffic	Regional and local	Low impact on public transportation but increase in traffic flows.

Source: Personal interpretation

The January 1993 earthquake resulted in damage to the embankment and any compounded effects from site development could result in the opening of sealed fissures along the floor of the reservoir.

Cumulative reduction in recharge amounts resulting from the proposed and prior developments will impact long-term yields of production wells that tap the local aquifer. These include the Beverly Hills, Long Mountain, Hampstead Road and Rennock Lodge wells. These wells are currently used for domestic water supply by the NWC. It is expected that in excess of 5 million gallons per day is already abstracted from these wells with a proposed increase from the Hampstead source well for augmentation of supply to served areas.

9. RESIDUAL IMPACTS

9.1 SUMMARY OF RESIDUAL IMPACTS

Residual effects of this project are considered as those that remain significant after the mitigation measures, have been applied. These impacts nonetheless would likely have been reduced in magnitude with the implementation of the mitigation measures proposes in Section 9.

Generally, residual impacts of the project will be insignificant; as change in land use will produce the greatest effect. This land use change will affect primarily biological resources. With respect to positive impacts, the area specifically and the KMA in general would see an increase in available residential serviced lots on the market that would be a step in reducing the backlog in housing solutions.

Other potential residual impacts are summarized below.

9.1.1 Physical

Soils, Geology and Hydrogeology – During construction depending existing conditions drainage pathways will have to be established in order to manage storm water flows during site preparation, the hydraulic impact is likely to be relatively high given site geology.

While there is a likely reduction in catchment size the associated groundwater recharge capacity will be maintained once the mitigation measure has been implemented.

Climate - The residual impact on climate from the operation of the scheme will be insignificant given the sixe of the proposed subdivision.

Water quality - Provided good working practices are adopted during construction and post construction, there will be no significant residual impact on underground water quality.

Existing drainage - The residual impact assessment assumes that there will be no direct or indirect impact on existing drainage channels except that that every possible mitigation measure will be employed to minimize any risk through the design of new drainage structures or the improvement of existing ones.

9.1.2 Natural Hazards

Earthquake – Given the existence of fault lines in close proximity and the awareness of their roles in the onset of earthquakes, one residual impact of the

location of the proposed development is the exposure of the new population to any potential risk that might exist.

9.1.3 Manmade Hazards

The mitigation measures proposed can adequately address any potential flooding risk that might have been created in developing the site.

9.1.4 Biological

Habitat - The role of most of the proposed site as a habitat will change permanently, however, the areas zoned for open space and recreation will be disturbed but will be left to regenerate naturally or will be rehabilitated and landscaped, as appropriate, once construction is complete.

Negative impacts on fauna during the construction stage will be reduced following construction. This will occur during the In the operational phase, over the medium to long term as replacement domestic and other plants grow and landscaping is completed.
.

9.1.5 Heritage

No residual impacts are anticipated.

9.1.6 Human/Social

Noise and Vibration - During the construction/implementation (site infrastructure) phase of the project there will be some low impact on nearby residential properties due to noise emissions from site traffic and other activities. Limits placed on noise generated and hours of operation, along with implementation of appropriate noise control measures, will ensure that noise impact is kept to a minimum.

There can be no reliable timetable placed on the duration of noise and vibration during the construction/ implementation (construction of individual houses) phase of the project as lot owners will build based on their schedule. It is anticipated therefore that the greatest impact will be during he site preparation phase; therefore, the subsequent residual impact will be insignificant.

Measures shall be taken to reduce vibration due to plant and machinery on the site. Where appropriate, at agreed locations, prior to construction activities, baseline vibration surveys may be carried out. There is therefore not likely to be any significant vibration impacts during the construction phase.

The proposed subdivision development is not expected to give rise to vibration that is either significantly intrusive or capable of giving rise to structural or even cosmetic damage.

Landscape and Visual - For the purposes of discussing the impacts, the operation stage is considered to include the period when there is complete build out of the subdivision in the short term thereafter (pre-establishment), general negative visual impact will continue to arise from residential and from other property close to the proposed site

Visual impact will arise primarily through housing construction that will significantly and permanently alter the local character of the immediate vicinity.

9.1.7 Carrying Capacity

Traffic - One local residual impact is the increase in traffic flow, though insignificant, on the existing road network. The use of the Long Mountain/Karachi Road should be encourage in order to reduce any residual impact on the Beverly Hills roadways.

10. RECOMMENDED MITIGATION

10.1 PHYSICAL

Table 1: Geology and Soils: Mitigation

INDICATOR	MITIGATION
	Construction/Implementation
Soils *Erosion Impacts*	**Mitigation / Erosion Protection Measures** **A. Removal of Vegetation** The project area must not be stripped entirely of vegetation during construction. It is important that vegetation be removed only in areas that are in the path of proposed infrastructure works and footprints of buildings. The preservation of vegetation cover will offer good protection to the ground surface during development and post-development stages. **B. Handling of Earth Moving Operations** Material excavated from earth moving operations during construction of roads etc. must be handled efficiently and removed quickly and economically to its final destination. Stockpiling of waste from construction must be carried out in areas that will not be affected by rapid runoff from the site. Since the earth material is highly erodible, it is best to protect excavated cuts for roadways on site as soon as possible after they are exposed. This could take the form of a surface dressing with a sealer such as bitumen or by using sub-base material. **C. Drainage and Erosion Control Measures** In the design of onsite drainage, it will become necessary to use sediment traps/grating to minimize blockage because of eroded material entering the drainage system and the proposed storm water retention area. In such instances, buried drains are not recommended, as this will be difficult to maintain, as such drains are prone to becoming blocked on a regular basis.
Geology *Landslide/rock slide*	**Mitigation** Rock fall will be the main mode of slope movement on the project site. Large, loose, or loosely attached boulders must be removed from the slope in a safe and economic manner. In cases where boulders are too large to be removed by mechanical means, the rock should be broken up by controlled measures such as by using pneumatic drills. Any evidence of solution cavities should be reported to the Mines and Geology Division for its assessment.
Earthquake/Seismic Impacts	**Mitigation** The type of housing structures that will best withstand moderate to large earthquakes are short, stiff structures such as single-2 storey structures. The height of these buildings responds best to long period waves, which are frequently generated during large earthquakes. Reinforced concrete structures tend to withstand earthquake loads better than most other types of building structures. Un-reinforced masonry structures suffer badly during ground shaking and should not be encouraged. There needs strict adherence to the Building Code.

INDICATOR	MITIGATION
	Removal of boulders and loosely attached rock in the project area is important in mitigating against rock /boulders, which could be mobilized down the slopes from earthquake ground shaking, creating major rock fall hazards for the development.

Table 2: Hydrology and Water Quality: Mitigation

INDICATOR	MITIGATION
	Construction/Implementation
Hydrology *Flooding*	**Mitigation/ Flood Protection Measures** **A. On-Site Flooding** On site flooding would be prevented by following primary measures and LEED principles have been incorporated in the design where appropriate: • Drains have been designed for 25-year return period as shown in Appendix 16.4. • Off site storm, water form Rutland Drive in Beverly Hills could flow onto the site but that runoff will be directed to the proposed retention pond. • Two spillways from the main road that flow onto the property will be blocked and an inlet manhole installed with grill covers in the kerb. • A buffer of approximately 15m is proposed between the residential lots and the berm of the retention pond. There is also a difference in elevation of approximately 3m. **B. Reducing Storm Water Runoff from the Development** This natural depression will be used to deposit 80% of storm water generated from the catchment area. Excess water from the retention area will be conveyed via a 1500mm wide x 1,200mm deep drain (Appendix 16.4) across the main road to an existing drain in the Pines of Karachi (Plates 7.1& 7.2, west of the Mona Reservoir). The accumulated flow from Mona Section 1 is approximately: q= 0.89 m^3/s and the drain is capable of handling 8.27 m^3/s . It is important, however, to ascertain the capacity of the existing drainage infrastructure to carry excess flows, however, based on the design capacity proposed on site; it is not likely that the subdivision will result in excess capacity under moderate conditions. **C. Upgrading of the Drainage System** In the medium to long term, there appears to be no need for the upgrading of the off-site drainage structures. However, a drainage/flood impact assessment would become necessary if subsequent rainfall events prove that engineered structures prove inadequate. **D. Control of Construction Waste and Removal of Vegetation** Waste material from earth works and vegetation from site clearance should be should be stockpiled and cleared promptly. **E. Erosion/Sediment Control Measures** • Divert upslope water around the disturbed site or pass it along a protected channel • Expose disturbed areas for the shortest possible time (maximum limit 14 days) • Treat any runoff water before it leaves the site (by perimeter filter fencing, or with a sediment pond. **Potential Risk** The Gibraltar-Bonnygate and Newport Limestone Formations are classified as aquifers due to their relatively high permeability which will support significant groundwater storage and movement under normal hydrologic conditions

INDICATOR	MITIGATION
Risk to Groundwate/Surf acewtarer	Contamination of groundwater is dependent on the depth to water within the aquifer, the hydraulic conductivity of water within the aquifer, and the subsequent attenuation time in the soil. Perennial drainage is predominantly underground and the project area constitutes the general recharge area for the Long Mountain aquifer. Normally the construction of impermeable surfaces, such as, roads and other paved areas at the project site will directly affect and reduce surface areas available for recharge. However, the difference between pre and post construction discharge is found to be insignificant because of the small size of the development and therefore it will not have an adverse effect on the aquifer. The point of deposit for storm-water at the proposed retention pond will effectively recharge the local aquifer. However, the quality of water collected must be monitored to reduce impacts to public supply wells that tap the aquifer. The proposed drainage infrastructure will have no negative impacts on the quality of water resources at the reservoir **Risk Management** Having identified potential risks to the groundwater quality, there is need to focus on appropriate management solutions to avoid contaminant entering groundwater despite the challenge of managing levels of contaminants in storm water. Although the Bonnygate Stony Loam soil unit is characterized by rapid internal drainage there is yet a considerable depth below ground surface to the water table. This may be of significance in attenuating contaminants and protecting groundwater quality.

Table 3: Local Climate: Mitigation

INDICATOR	MITIGATION
Operation/Maintenance	
Local Climate	**Mitigation** It is recommended that the developers try to maintain as much tree cover as possible and regrass and revegetate by landscaping - both by the developer and new owners. The installation of low glare lighting fixtures would reduce the effects of ambient light.

10.2 Natural Hazards

Table 4a: Natural Hazards: Mitigation

INDICATOR	MITIGATION
Operation/Maintenance	
Natural Hazards	**Mitigation** The effect level of this impact will vary with the event itself, the vulnerability of the population, and

	the disaster risk management measures employed by the developers/owners. It is recommended that the developer recommend that a Disaster Management Plan be prepared the property. This Plan should cover design and planning, preparedness aspects, and emergency response and recovery procedures at a minimum. As it relates to mitigating the effects of natural hazards on property, it is recommended that roofs be slabbed or hurricane straps be used for other roofs.

10.3 Manmade Hazards

Table 4b: Manmade Hazards: Mitigation Measures

INDICATOR	MITIGATION
Operation/Maintenance	
Waste Management	**Mitigation** The suitable management of all waste will serve to reduce any risk on ground water quality. The management of sormwater flows to reduce any flooding impact was treated elsewhere.

10.4 BIOLOGICAL

Table 5: Biology: Mitigation

INDICATOR	MITIGATION
Construction/Implementation	
Biology *Flora*	**Mitigation** Mona Section 1 development site is of some significant ecological importance given it is location. • Maintain vegetation corridors with the forested area adjacent to the property and those of adjoining properties as far as possible. • Within areas of high plant diversity, relatively tall continuous tree canopies trees the developer should recommend that they be preserved as far as possible over areas with scrub type habitat. The designated area beside the property highlighted as a "Conservation Area/Green Space" should be maintained. This area would act as a Biological/Carbon Sink for the surrounding disturbed habitat. - Aesthetic Enhancement Maintaining as many of the larger trees of the site ,with trunk size greater than twenty-five (25) centimetres Incorporating limestone outcrops within the site where possible into the landscaping design. Relocating native plants with landscaping value where possible, in particular the endemic palms and the lignum vitae.
Fauna	**Mitigation** It is anticipated that faunal groups, especially endemic species, would relocate to the similar

INDICATOR	MITIGATION
	adjacent habitat.

10.5 HERITAGE

Table 6: Cultural Resources: Mitigation

INDICATOR	MITIGATION
	Construction/Implementation
Historical Resources	**Impact** No mitigation

10.6 Human/SOCIAL

Table 7: Aesthetics: Specific Mitigation for Landscape and Visual Resources

INDICATOR	MITIGATION
	Construction/Implementation
Landscape /Scenic Vista	**Mitigation** The scenic vista of the area will be restored once construction activities are completed, expanding the existing residential landscape in the area. Additionally, specific trees will be marked for landscaping purposes and others required will be obtained. During the construction/Implementation stage this potential impact will be mitigated by the erection of temporary opaque fencing at the subdivision preparation stage. Individual lot owners will be required to secure their properties while carrying out their construction activities.
	Operation/Maintenance
Landscape/ Scenic Vista	**Impact** * It is not anticipated that there will be any negative impacts associated with the scenic vista of the site during the operation/maintenance phase as based on the existing subdivisions; the development will be aesthetically pleasing.

Table 8: Air Quality: Mitigation

INDICATOR	MITIGATION
	Construction/Implementation
Air Quality	**Mitigation** ▪ Dust carrying equipment and facilities should be wetted frequently to minimize the amounts of dust affecting the site. ▪ Roads - paved and unpaved should be wetted to lessen the possibility of dust emissions affecting the site and adjacent properties. ▪ The contractor should ensure that trucks carrying construction and solid materials are covered with tarpaulins to reduce air pollution. Vehicles should be properly maintained and serviced to reduce emissions. ▪ Personal Protection Equipment (PPE), such as, dust masks and other respiration protecting equipment should be provided wherever possible to workers on the site in order to safeguard their respiratory health. ▪ In the event that a concrete batching plant is to be set up on site, site-specific impacts on air quality and noise will have to be assessed.

Table 9: Noise and Vibration: Mitigation

INDICATOR	MITIGATION
Construction/Implementation	
Noise & Vibration	**IMitigation** • Attempt to remove hard limestone rock by mechanical means. • These effects are not expected to be persistent beyond the initial site preparation phase. • Construction activities should occur during periods when disturbances to the residents are minimized and equipment will be properly maintained. • Develop a timetable to perform activities that might produce excess noise or vibration

Table 10: Waste and Hazards: Mitigation

INDICATOR	MITIGATION
Construction/Implementation	
Solid Waste	**Mitigation** Its effects can be effectively mitigated against by implementation of a waste management plan at the construction camp. This plan should cover separation and appropriate storage of the different kinds of waste including oily rags from the servicing of equipment if this is to be done at the construction site. Organic waste, namely vegetation, would be composted on site and used for soil improvement (soil conditioning) during landscaping. Branches can be put through a wood chipper to prepare soil cover for garden beds, etc. Excess inorganic waste would be stockpiled (away from drainage features) for infilling of lot sites where necessary. Adequately located and maintained temporary latrine facilities would be made available for construction workers. To avoid the harmful effects of poor solid waste disposal adequate arrangement would be made with the National Solid Waste Management chipped and used as mulch during landscaping). It is expected that any top soil that is removed during grading would be stockpiled properly, and re-used Authority (NSWMA) or with a private contractor to dispose of solid waste at the authorized dumpsite. Provisions for disposal at an approved land fill. Some materials can be beneficially re-used (e.g. vegetation debris can be during the final landscaping efforts.
Operation/Maintenance	
Waste management	**Mitigation** Development a waste management plan for all waste to be generated.

10.7 Carrying Capacity

Table 11: Social Infrastructure: Mitigation

INDICATOR	MITIGATION
Construction/Implementation	

INDICATOR	MITIGATION
Social Infrastructure	**Mitigation** None required.
Operation/Maintenance	
Employment	The opportunity for employment in the operation phase will be insignificant, and limited to gardeners, helpers, and security personnel if necessary.

Table 12: Utilities and Services: Mitigation

INDICATOR	MITIGATION
Construction/Implementation	
Physical Infrastructure *Solid Waste*	**Mitigation** ▪ Domestic waste reduction, re-use, and re-cycling. Examples of this is separation of organic waste for composting, recycling of glass bottles, and reuse of cooking oils for diesel production. ▪ Adequate solid waste storage bins and other facilities within the development including the recreational area. Residents should be encouraged to ensure that storage containers are tightly covered to prevent the breeding of mosquitoes and other vermin.
Potable Water	**Mitigation** Protection of recharge areas in the source catchments is the most effective means of mitigating against the increased demand, as it will safe guard water production. However, there are other measures that could be encouraged by the developer, including: ▪ Re-use of treated wastewater and storm water for irrigation. ▪ Water conservation (e.g. low flow toilets, controlled shower and faucet heads, maintenance and monitoring water mains). ▪ There should be on site reserves of water in the event of disruption of public supplies (due to drought or heavy turbidity). Indigenous ornamental species that do not require large amounts of water should be used for landscaping as far as possible. This includes hardy species like bougainvillea, palms, and lantana.
Energy Consumption	**Mitigation** ▪ The use of renewable resources should be encouraged - including the use of solar and wind power. Excess energy can now be accommodated through JPSCo's net metering programme. ▪ There should be energy saving lighting installed for all buildings using lights and other Energy Star rated equipment.

Table 13: Land Use and Planning: Mitigation

INDICATOR	MITIGATION
Construction/Implementation	
Community Conservation	**Mitigation** The options are: Dialogue with the citizens, the developer and the relevant authorities, such a s NEPA with a view to: 1. Negotiating the possibility of a trade-off given the high demand for residential

	accommodation in the KMA and the small scale of the proposal (approximately 11.18 hectares) while ensuring all potential environmental impacts are adequately addressed 2. Ensuring adherence to the Kingston and St. Andrew Development Order

Table 14: Population and Housing: Mitigation

INDICATOR	MITIGATION
Construction/Implementation	
Population growth	**Impact** Given the number of housing solutions being provided through the project it is expected that the population of Mona Section 1 will experience modest growth over the short to medium term.

Table 15: Transportation and Traffic: Mitigation

INDICATOR	MITIGATION
Construction/Implementation	
Traffic	**Mitigation** The development of a transport schedule; e.g. during the off-peak hours would help to alleviate the effects of traffic congestion. While the use of flagmen during the construction period could aid in the direction and flow of traffic during peak periods.
Operation/Maintenance	
Traffic	**Mitigation** Planning trips carefully ensuring that multiple activities are conducted in each trip. Carpooling is also another option.

10. NATURAL RESOURCES VALUATION

10.1 TOTAL ECONOMIC VALUE

Natural Resource Valuation of Mona Section 1/Mona Estate will be approached in terms of a qualitative economic assessment of environmental and social impacts.

Total economic value – Ecosystem goods and services are classified according to how they are used as shown in Figure 9.1 below. The two broad categories in reference to ecosystem good and services are their use values and their non-use values. Use values may be Direct Use values (can be consumptive or non-consumptive and enjoyed by persons living or visiting the ecosystem), Indirect use values are derived form ecosystem services that provide benefits outside the ecosystem. Option value refers to the option in the future to use ecosystem goods and services. Non-use values are more sensory – the feeling of enjoyment of knowing that a resources exists even if they might not be used directly.

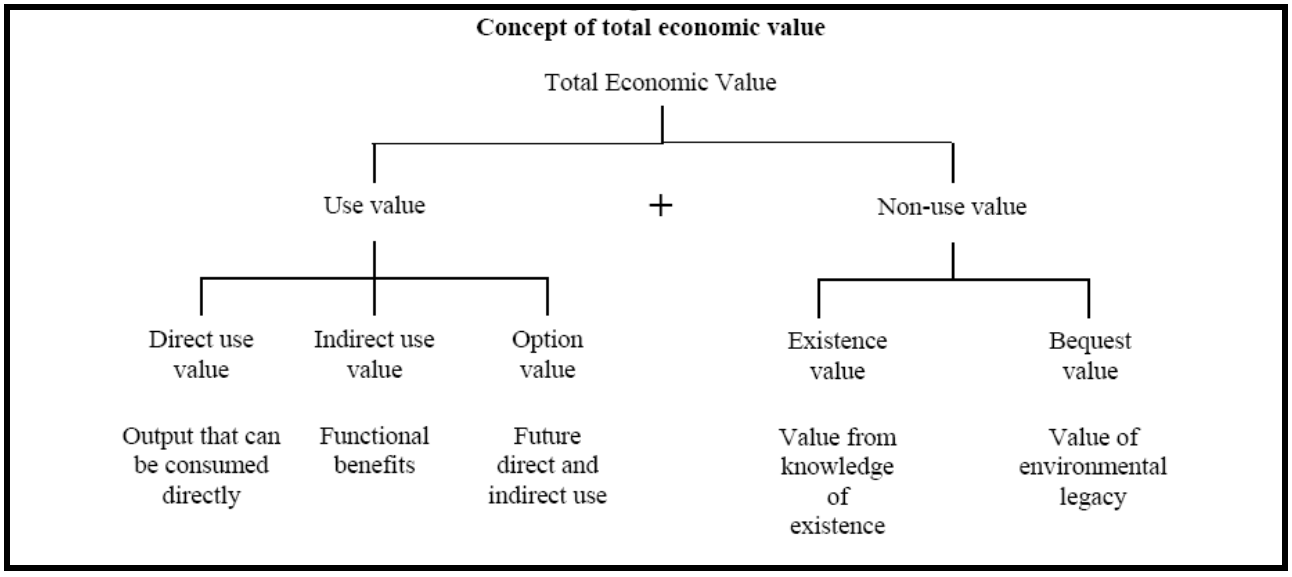


Figure 9.1: Illustrating the concept of total economic value

Traditional pricing of natural resources have included H*edonic Pricing* analysis (based on the notion that economic goods are based on the aggregate of different characteristic) and the *Travel Cost Model* (generating a demand curve for a resource by arraying people's expenditure against their visit to the resource). This EIA, in the absence of actual prices, has made qualitative judgment on the values placed on the goods and services provided by the site in its natural state and after project rollout.

At Long Mountain the area of the proposed project , the ecosystem services identified are (1) the area potentially acts as a carbon sink (2) It is a habit for primarily endemic species (3) groundwater recharge area for the underground aquifer (4) It has a role in maintaining biological diversity (5) in its natural state it does not contribute to flooding of adjacent areas (6) as an open space area it provides non-use values.

10.1.1 Carbon Sink

By definition, a carbon sink is anything that absorbs more carbon that it releases, whilst a carbon source is anything that releases more carbon than is absorb. Forests, soils, oceans and the atmosphere all store carbon and this carbon moves between them in a continuous cycle. This constant movement of carbon means that forests act as sources or sinks at different times. The Mona Estates area is a recognized dry forest area and therefore those locations with large forest cover remaining currently would act as a carbon sink for the specific locality. It is important to recognize that based on encroachment activities and re-growth from natural regeneration there is both carbon loss and carbon storage. Generally, the biomass within drier forests is generally lower and so the absolute carbon sink may be smaller (www.geog.ox.ac.uk/~ymalhi/publications/publications2010). This, therefore, further indicates that the forested area is important as a carbon sink and in many ways though estimates of carbon offset may be difficult to calculate for the location, there is some important CO^2 offset from the forest.

10.1.2 Habitat/Wildlife Corridor

The are generally is a habitat for a variety of avifaunal species, for example, during the assessment process a total of twenty-eight (28) bird species were identified eleven(11) of which are endemic. However, it was found that the area was exposed to previous degradation, therefore, dry limestone secondary growth with few emergent trees were found.

10.1.3 Groundwater Recharge Area

The recharge of groundwater occurs when there is a surplus in the soil moisture budget. This recharge may result in a rise in the water table. This situation is also facilitated by the site geology that where the Newport Formation shows variations that include a honeycomb structure that is evidence of solution cavities.

10.1.4 Maintaining Biological Diversity

As a habitat for a variety of plant and avifaunal species in it natural form the are serves a role as in maintaining biological diversity.

10.1.5 Prevention of Flooding /Buffer to the Mona Reservoir and Mona Water Treatment Plant

While performing the role of a groundwater recharge, the area effectively prevents the flooding of adjacent properties includimg Mona Reservoir and Mona Water Treatment Plant. The construction activities that would result in an increase in paved surfaces and a reduction in surfaces for percolation will contribute to flooding.

10.1.6 Open Space

The site would be preserved for its non-use value as described above.

10.2 QUALITATIVE SYSTEM OF VALUATION

As shown in Figure 9.2 without conservation, the extraction of goods and services will dominate, being the greatest impact on system degradation. Aquifer recharge would still be significant given the proposal for a retention area. On the other hand, there would be a reduction in the other system services such as biological diversity, habitat, and open space.

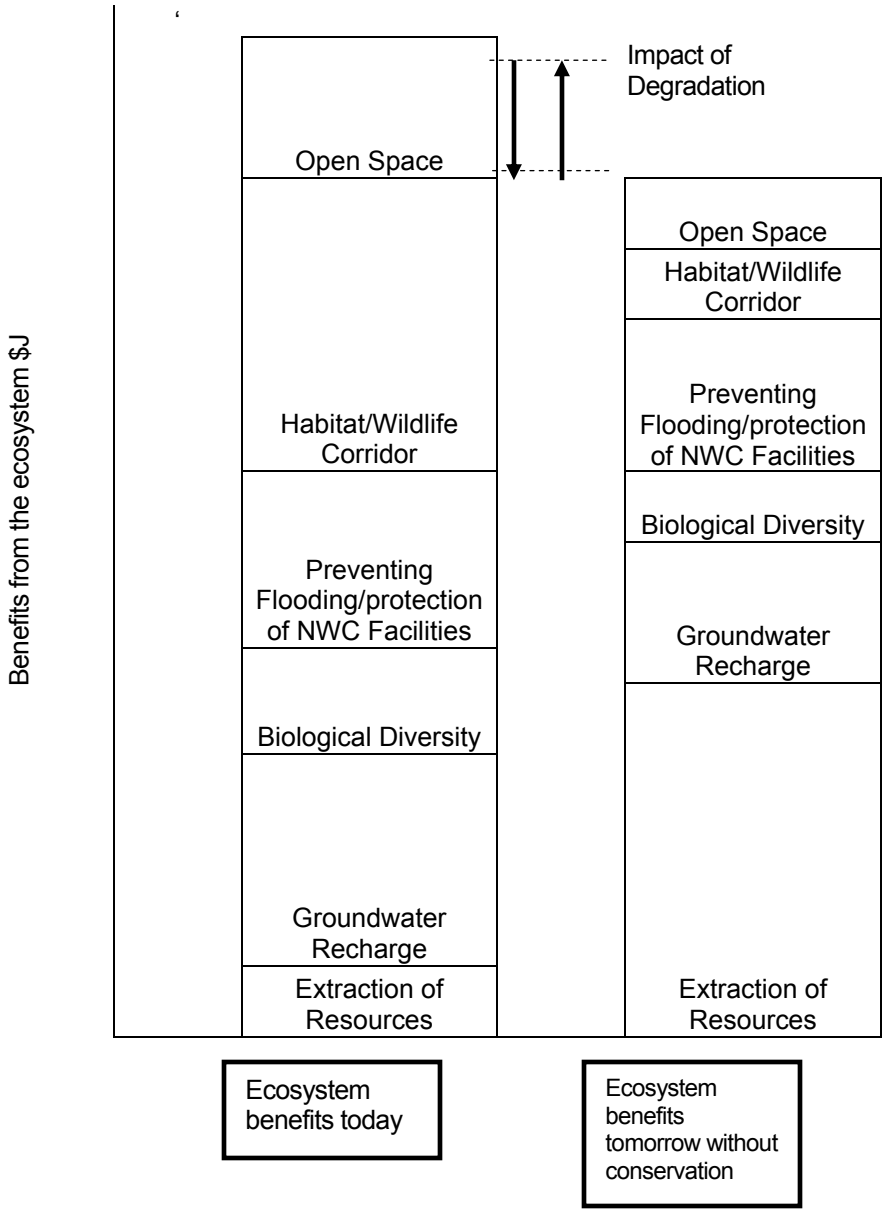


Figure 9.2: Change in ecosystem benefits resulting from the proposed subdivision development

11. COST BENEFIT ANALYSES

11.1 SWIFT BENEFIT/COST ANALYSIS

Benefit/ Cost to Environmental Resources

INDICATORS	BENEFITS TO THE ENVIRONMENT	COST TO THE ENVIRONMENT	MONETARY VALUE
1) Aesthetics	The proposed development will be aesthetically pleasing.	Vast removal of trees in the development area and the resulting loss of faunal & floral habitats.	Actual value would be based on the actual cost of using the resources
2) Air Quality	_	Air quality would be negatively affected as a result of construction activities (increase in particulates etc.). The impact, however, would not be long term.	_
3) Waste & Hazardous Material	_	The environment would be negatively impacted if waste and hazardous materials are not properly disposed of.	Cost for preparing a Waste Management Plan
4) Topography & Drainage	_	Both drainage and infiltration capacity would be reduced significantly possibly causing increased surface runoff.	Cost for building on and off site drainage structures
5) Climate	_	Temperatures within in the development area may increase slightly due to changes in the microclimate.	Cost for increased Air Conditioning temperatures
6) Energy Consumption	Alternate forms of energy will be utilized where feasible e.g. use of solar and wind energy.	Energy consumption would increase dramatically within the area.	Cost per kilowatt of energy projected consumption
7) Natural Hazards	Proper building design and construction practices would be encouraged and employed so as to reduce the risk of loss of life and damage to property by natural hazards such as hurricanes, earthquake, fire, etc.	Hazards such as hurricanes may cause damage to the structures to be located on the property as well as destroy flora.	▪ Cost to rebuild/repair structures on property (cost depends on the extent of damage) ▪ Cost to replant trees and plants (cost depends on the extent of damage). ▪ Cost of property insurance
8) Other Hazards	The risk of other hazards such as health-ecological and social-organizational hazards may be less anticipated than that of natural hazards such as fires and earthquake.	Other hazards such as health–ecological and social-organizational hazards may pose a threat mainly to employees and clients.	_
9) Upset & Accidental	_	Because accidents are unpredictable, they may result in	▪ Cost for Life Insurance – ▪ Cost for Property Insurance

INDICATORS	BENEFITS TO THE ENVIRONMENT	COST TO THE ENVIRONMENT	MONETARY VALUE
Conditions		loss of life and damage to property.	(depends on the value of the property).

11.2 SOCIO-ECONOMIC COST/BENEFIT

INDICATORS	SOCIO-ECONOMIC BENEFITS	SOCIO-ECONOMIC COSTS	MONETARY VALUE
1) Police	Opportunity to increase efficiencies and capacities	Increased pressure on the service	Cost to employ additional Officers Cost to purchase additional vehicles
2) Post Office	Opportunity to increase efficiencies and capacities	Increased volume of mail at the Post Office.	▪ Possible cost to employ an additional post office attendant ▪ Cost to expand the mail holding area (depends of the size of the area)
3) Schools	Opportunity to increase efficiencies and capacities	The capacities of existing schools within and outside the area may be affected.	▪ Cost to employ teachers and other members of staff
4) Hospitals	Opportunity to increase efficiencies and capacities	Increased pressure on the infrastructure and services offered by Hospitals within KMA.	–
5) Health Centres	Opportunity to increase efficiencies and capacities	Similar to the Hospitals, it is expected that Health Centres within the development area would experience an increase in patients.	–
6) Fire	Opportunity to increase efficiencies and capacities	Increase in demand for the services offered by the currently under-equipped Fire Station.	Cost to acquire new equipment for the Fire Station
7) Employment	The proposed development has a moderate job creation potential. Jobs will be created in the pre-construction phase, the construction phase and to a lesser extent in the post construction phase.	Possible competition between locals and persons outside the development area to gain employment.	–
8) Housing	Increase in the housing stock in the KMA	To government for infrastructure	Cost to the national budget
9) Public Utilities	Public utilities services such as potable water supply, telephone and electricity would be improved	Increase in pressure on service providers such as the National Water Commission, the National Works Agency and LIME etc. to provide services to the development area.	Cost to the NWC to provide the service Cost to the developer to obtain the service and to the residents to maintain the service
10) Solid Waste Disposal	Opportunity to increase efficiencies and capacities	Increase in solid waste generation during the construction and post-construction phases. Also, increase in pressure on the Riverton landfill in St. Andrew to accommodate the additional solid waste.	Cost for the removal of solid waste during all stages both to the developer and to the municipal service provider. –
11) Roads	Possible improvement of		

INDICATORS	SOCIO-ECONOMIC BENEFITS	SOCIO-ECONOMIC COSTS	MONETARY VALUE
	the access road.	_	Road infrastructure cost
12) Health & Safety	Measures will be incorporated to ensure that health and safety are maintained.	Health and safety of both employees and visitors may be at risk mainly during the construction phase especially if the necessary precautions are not taken.	▪ Cost to cover medical expenses for injured visitors/employees (cost depends on the severity of injury) ▪ Cost for Liability Insurance ▪ Cost to implement Occupational Health & Safety programme
13) Noise & Vibration	_	There will be an increase in noise levels during the construction period, which may affect near-by residents.	Cost for residents affected by the noise to acquire relief)

12. IDENTIFICATION AND ANALYSIS OF ALTERNATIVES

12.1 ALTERNATIVE TO THE PROPOSED DEVELOPMENT

12.1.1 Alternative 1: "No Action"

The no–action alternative means that the project proponent would not proceed with the development of the proposed residential subdivision. In that event, the site would remain undeveloped, maintaining the character for which it is zoned. The impact on the physical environment would be nil.

12.1.2 Project Design

Site Layout- ideally road alignment could be less curvy but is constrained by site topography

Sewers – Given the slope of the land this design requires substantial pumping for the life of the subdivision and the ever increasing attendant maintenance and electrical charges follow. The associated costs will be reduced with a 1% sewer from manhole R1-3 down Road 1 to a new manhole would have its deepest excavation at about 3.0m for relatively a short distance.

Site Drainage - The full length of the overflow drain needs too be shown.

12.1.3 Proposal for the development of Mona Estate

In 2007, the National Housing Development Corporation (NHDC) (now HAJL) solicited bid of the preparation of a Development Plan and an EIA for its entire property of 222.38 acres (90 hectares) at Mona Estate, St. Andrew. This was in light of the fact that the (NHDC) - one of the Government's main housing providers had been providing housing solutions to individuals and families of varying economic status island wide, for at least the previous ten (10) years. Besides, the GoJ has been the primary developer in the area going back to the 1950's

Then as it is now, Kingston and St. Andrew combined represented the largest population centre in Jamaica with 24.78 per cent (658,759) of the population living within the parishes in 2005, an increase of approximately 6,859 persons when compared to 2001 figure which stood at 651,900. This increase in the population, coupled with the shortfall in housing starts in Kingston & St. Andrew had led to the need to satisfy the increasing demand for housing. The NHDC then sought to fill some of the shortfall through the development of its property.

This proposal was subsequently abandoned due to sustainability and land use planning issues that were raised at the time and the Agency's desire to follow existing laws, plans and the relevant Development Order.

13. ENVIRONMENTAL MANAGEMENT OF THE PROJECT

13.1 MANAGEMENT AND MONITORING PLAN

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

A: Indicators, Targets, and Agency/Individual Responsible

INDICATORS	TARGET	AGENCY/INDIVIDUAL RESPONSIBLE
I. Construction/Implementation		
1. Aesthetics	Create an aesthetically pleasing site: - Marking of trees to be maintained for landscaping - Additional trees and plants required for the landscaping will be obtained.	Developer/Contractor/ Lot Owner
2. Air Quality	- Use of dust masks by employees to reduce effects - Use of water trucks to sprinkle property and roads.	Contractor
3. Health & Safety	Implement measures to reduce the risk of harm to health and safety, such as, the use of PPE	Developer/Contractor
4. Noise	Reduce noise levels by: - use of ear muffs by employees	Contractor
5. Solid Waste	Proper and timely disposal of solid waste (including construction waste) from the site.	Metropolitan Parks & Markets (NSWMA) /Developer
6. Sewage Treatment	Implement measures to ensure the sewerage infrastructure works efficiently.	Engineer/Contractor
7. Traffic Control	Reduce traffic congestion through measures such as use of flagmen and the erection of signs.	Developer/Contractor
8. Building Plans	Ensure adherence to the approved building/development plans.	Kingston & St. Andrew Corporation/Contractor / Developer
9. Flood & Erosion Control Measures	Implement measures to: - reduce run off and prevent flooding. - protect roads from inundation. - erosion control features and measures should inspected and reviewed weekly and the necessary repairs made particularly after rainfall events that exceed 0.5 inches.	Engineer/Contractor
10. Construction Materials	Obtain construction material from the nearest legitimate local sources	
11. Removal of trees	Institute penalties for the unwarranted removal/cutting of trees.	NEPA/Developer
II. Operation/Maintenance		
12. Effluent Quality	Monthly monitoring of effluent quality from wastewater treatment plant based on NEPA guidelines and standards especially during the early stages of operation.	NWC
13. Education of employees and residents	Thorough education of both employees and residents of: - the importance of proper waste management practices	NSWMA and Public Health Department
14. Potable Water	Potable water supply quality must be monitored monthly and maintained at a high standard.	NWC

B: Monitoring Guidelines

INDICATOR	PARAMETER	FREQUENCY	LOCATION
1. Effluent from waste water facility	pH, BOD, COD, TSS, TDS	Based on NWC standard	Well in the vicinity
2. Water related diseases	Identification of water related diseases and determine adequacy of local vector control and curative capacities etc.	Twice annually	Well in the vicinity
3. Soil erosion	Soil erosion rate	Twice annually	-
4. Revegetation	Landscape Plan – Status of revegetation programme – landscaping (regrassing, planting of trees and ornamental plants)	Initially, monthly, later annually	Open spaces, vegetation lining main road., etc.

14. REFERENCES

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15. APPENDICES

16.1

EIA TERMS OF REFERENCE

MONA SECTION 1 SUBDIVISION

HAJ HOUSING agency of JAMAICA LIMITED
Building Jamaica. One community at a time.

ENVIRONMENTAL IMPACT ASSESSMENT

FOR A PROPOSED SUBDIVISION OF LAND PART OF MONA AND PAPINE ESTATES AND GOLDSMITH VILLA, ST. ANDREW (CALLED MONA ESTATE, SECTION 1)

TERMS OF REFERENCE

FINAL

2011 June 1

TABLE OF CONTENTS

ENVIRONMENTAL IMPACT ASSESSMENT FOR A PROPOSED SUBDIVISION OF LAND PART OF MONA AND PAPINE ESTATES AND GOLDSMITH VILLA, ST. ANDREW (CALLED MONA ESTATE, SECTION 1)

TERMS OF REFERENCE (FINAL)

BACKGROUND

A set of Technical Reports in a document titled "Environmental Site Assessment of a Proposed Residential Development, Mona Estate, Section 1, St. Andrew" was submitted to the National Environment Planning Agency (NEPA) by the Housing Agency of Jamaica (HAJL). Subsequent to the presentation of that document and its review, HAJL has been advised by NEPA that an Environmental Impact Assessment (EIA) be required by the Agency. NEPA has advised that the Terms of Reference for the EIA report should be developed for its approval within but not limited to the framework presented below:

1. An overall evaluation of the existing environmental conditions, values, and functions of the proposed development area.
2. A flora and fauna survey.
3. A detailed assessment of the present and proposed infrastructure for the subdivision to include but not be limited to roads and traffic, drainage, sewage treatment and disposal.
4. An assessment of hazard vulnerabilities of the site.
5. An assessment of the historical and cultural resources.
6. Landscape and visual assessment.
7. The effects of the development on the Mona Reservoir and the Mona Treatment Plant.
8. An assessment of slope stability.
9. A Socio-economic survey.

1. THE EXECUTIVE SUMMARY

The Executive Summary is summary of the findings, analyses, and recommendations. This will give a synopsis of the EIA report.

2. INTRODUCTION

This section will include a general description of the project and its genesis, background and the approaches/models used in arriving at the findings presented in the EIA.

3. POLICY, LEGISLATIVE AND REGULATORY CONSIDERATIONS

The relevant legislations, regulations, policies and local and national government agencies, and their roles with regard to the project permit and approval requirements will be identified.

A description will be provided of the social and economic objectives, which the development will seek to address, and whether such objectives stem from current National, Regional and Local Policy Plans, legislations, regulations and policy initiatives including the Kingston (Confirmed) Development Order, 1966 and Vision 2030 Jamaica Development Plan. Also to be covered are:

- Policy framework for conducting EIAs
- The EIA process
- Relevant statutory designations (nature reserves, parks and protected areas, heritage sites, monuments, protected species)
- Relevant international legislation/Agreements/Conventions

4. PUBLIC PARTICIPATION AND CONSULTATION

The report will include a detailed review of the issues surrounding the proposal gleaned from the print and voice media sources. The findings and conclusions of a community survey among a representative sample of the residents in the Enumeration Districts within an approximately one-mile radius will also be included.

- The methodology used to determine the representative sample size would be clearly indicated.
- Community leaders including those of Citizens' Association members in the vicinity will also be consulted.

- Responses including any objections will be clearly indicated, including reason/basis for these objections. Generally, findings will be summarized and incorporated in the EIA.

5. COMPREHENSIVE DESCRIPTION OF THE PROJECT

5.1 The Proponent

Statement on the project proponent and purpose of the project.

5.2 Project Concept & Description

Physical characteristics including site boundaries, proposed alterations including details of proposed physical infrastructure including access and transport arrangements.

5.3 Project Infrastructure

Any impact of storm water runoff on the proposed development and NWC properties such as the Mona Reservoir, the Mona Treatment Plant and the Beverly Hills well and on adjacent properties such as the Pines of Karachi will be thoroughly examined and illustrated using diagrams and photographs.

Technical assessment of the appropriateness of the project design including the hydraulic design will be based on a return period of 100 years.

A statement incorporating the green design of the development as it relates to green, grey, and social infrastructure, complete streets, alternative energy sources, and water conservation will be included.

A statement on how green principles in line with LEED principles will be incorporated within the proposed subdivision/development will be included.

The report will provide a description of the proposed wastewater treatment solution, the volume of sewage to be treated and alternatives, if any

The EIA will include a Limited Traffic Impact Assessment including recent traffic counts at the intersections of the proposed primary transportation corridors and a description of these routes.

5.4 Project Operations & Maintenance

Land use requirement, and activities during construction, for example, excavations, and disposal of surplus material.

The report will show existing and modified ground levels and cross-sections to determine the physical impact of the proposed construction works. Soil handling proposals will include the need for import of export of soil, and the

conditions that will be created to protect the quality of the material and to minimize soil erosion and siltation of culverts.

Any phasing of the proposed development will be indicated.

6. DESCRIPTION OF THE EXISTING ENVIRONMENT

6.1 Physical

Maps, plans, diagrams, models and/or photographs (aerial and land based).

Meteorology (rainfall distribution, temperature/humidity, winds).

Site topography (including discussion of terrain, landforms, and surface drainage)

Regional and site geology (including superficial bedrock, caves, sinkholes faults, cover, such as, soils)

Hydrology (groundwater including regional groundwater, controls and water demand and supply issues)

Maps and photographs will be included as necessary.

6.2 Natural hazard

A multi-hazard risk assessment of the proposed site will be included

6.3 Biological

Assessment of the relative abundance of floral species

With respect to faunal species - rare, endangered, or endemic species and nocturnal species will be identified.

Sensitive habitats where they exist will be mentioned and discussed.

The assessment will also include any evidence in changes in species composition as they relates to summer and winter months

A description of the environmental significance of the location in its broader context will be included.

The period in which the assessments are scheduled to be conducted will be clearly indicated.

6.4 Heritage

The cultural environment will cover the development area in its historical context. This section will provide the baseline data that will lead to the determination of the historical and cultural value of the location.

The Archeological Report from the Jamaica National Heritage Trust will be incorporated in the EIA report

6.5 Human/Social

The social and economic environment will be studied using some elements of the social variables captured within the *The Interorganizational Committee, 1994* model. The Social Impact Assessment (SIA) model is an effective means of identifying or predicting the probable impacts of a development and recognizes levels of impacts at all stages of the project life cycle – Planning/Policy Development (Phase I), Construction/Implementation (Phase II), and Operation/Maintenance (Phase III) and Decommissioning (Phase IV) (although not relevant in this scenario).

The SIA for the proposed Mona Section I will seek to understand the behaviour (past, present, & future) of the individuals, communities, and agencies affected by the development under the following captions:

- Population Characteristics
- Community and Institutional Structures
- Political and Social Resources
- Community Resources
- Environmental Health – Water Quality, Air Quality , Sanitation /Hygiene

Datasets used will be current and relevant and cover a period of at least twenty (20) years.

Landscape and visual assessment -A baseline survey of the existing landscape and visual character and quality will be undertaken from site and desktop surveys. Landscape elements considered include:

- local topography

- vegetation extent and type
- built form
- patterns of settlement
- land use
- prominent water feature
- archaeological and cultural identity.

The baseline survey of all views towards the proposed site will be undertaken by identifying:

- The visual envelope or visual zone within which the proposed development would be contained either wholly or partially.

- Typical views, the sensitivity of each receptor group, and how they are influenced by their location and direction of views relative to the subdivision will be considered. These include views from residences and open spaces.

- Findings will be illustrated by the inclusion of a vegetation map indicating the extent and type of vegetation and the approximate percentage of each type.

- The zoning of the site as well as the traditional land use it and the immediate surroundings will be clearly outlined.

7. IDENTIFICATION AND ASSESSMENT OF POTENTIAL DIRECT AND INDIRECT IMPACTS

There will be a description of the impacts to the ecosystem components because of the project during the Construction/Implementation (Phase II), and Operation/Maintenance (Phase III) phases. The evaluation/analysis of impacts of on and off-site impacts will be quantitative and qualitative, where appropriate.

7.1 Physical

Landform – physical changes, erosion potential of site, features of special interest

Meteorological conditions as they relate to the area will be discussed.

7.2 Natural hazards

Potential natural disaster impacts including any increased potential flooding, landslides, slope failures etc

7.3 Manmade Hazards

An outline of drainage considerations (including any impact of flooding on adjacent properties) will be presented.

Any potential for pollution of the potable water supply.

7.4 Biological

Wildlife (avi-fauna) and vegetation impacts - any obvious change in species composition and distribution, habitat change/fragmentation, displacement, corridor impairment, endangered and special species.

7.5 Heritage

Development in a location of sensitive archeological or cultural significance

7.6 Human/Social

Social and economic effects of project activities - including solid waste disposal and sewage disposal methods and potential impact on surface and groundwater

. Any potential impact of the proposal on the NWC facilities and potable water supply will be thoroughly treated in the EIA

7.7 Carrying Capacity

Any potential negative impact on social and physical infrastructure

The impacts will be presented in a matrix as described in the table below. The most significant impacts based on their levels of sensitivity will be highlighted for further analysis and investigation where necessary.

Direction	Positive Or Negative
Duration	Long-, Medium- Or Short - Term, Episodic
Location	Direct or Indirect Project On Environment Environment On Project
Magnitude	Large Or Small – Major, Minor
Extent	Sphere Of Influence - Local, National, Regional

8. CUMULATIVE ENVIRONMENTAL IMPACT

Changes within the area over time because of the project along with those being experienced from existing facilities and developments and any approved or proposed will be noted.

9. RECOMMENDED MITIGATION

Impact mitigation measures will focus on minimizing ecosystem effects through design elements, construction techniques and long term operational practices, based on impact sensitivity described in the matrix on impacts as they relate to direction, duration, location, magnitude, and extent.

10. RESIDUAL IMPACTS

Given the mitigation measures, recommended, environmental changes that may result from project implementation will be described.

11. NATURAL RESOURCE VALUATION

This will take the form a primarily qualitative economic valuation of the natural resources at the proposed site. This will be conducted based on the ecosystem services related to carbon sink, watershed, maintaining biological diversity and prevention of flooding.

12. COST BENEFIT ANALYSIS

A cost benefit analysis will be conducted. It will outline the related benefits and costs related to the primary project indicators, such as, air quality, waste & hazardous materials, topography and drainage, multi-hazards, LEED principles and climate.

13. IDENTIFICATION AND ANALYSIS OF ALTERNATIVES

All the alternatives taken into account in the development of the project will be documented. Each alternative will be evaluated in respect of its potential environmental impact and economic viability. The environmental losses and gains will be combined with the economic costs and benefits in order to give the full picture for each alternative.

The project design will also be examined with a view to assessing the choices with respect to zoning, site layout and lot sizes.

14. ENVIRONMENTAL MANAGEMENT OF THE PROJECT

14.1 Environmental Monitoring and Management Plan

Given any significant impacts identified and mitigation strategies, areas for monitoring during and after the construction phase will be identified. Recommended follow-up activities will be recommended where necessary. The responsible persons/agencies will be indicated.

14.2 Training for Construction Staff

Construction staff will be trained in techniques specific to the project. These include management of solid waste, construction techniques including the application f LEED principles in the development of grey and green infrastructure. Training will also include the methods to be implemented for the protection of sensitive site features and marked trees that sre to be preserved..

15. REFERENCES

16. APPENDICES

16.1 EIA Terms of Reference
16.2 Glossary of Technical Terms
16.3 Reference Documents
16.4 Specific Technical Studies/Reports
16.5 Data Tables
16.6 Photographs and Maps
16.7 Composition and details of the Study/Research Team
16.8 Notes of Public Consultation sessions
16.9 Instruments used in Community Survey

16.2

GLOSSARY OF TECHNICAL TERMS

MONA SECTION 1 SUBDIVISION

Aquifer: A porous, water-saturated layer of sediment and bedrock under the Earth's surface; also described as artesian (confined) or water table (unconfined).

Anthropogenic: Human-induced or human-caused, derived from the Greek root anthropos meaning "man."

Biological diversity (biodiversity): The variety of different living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the variety of different ecosystems that they form. This includes diversity within species, between species and of ecosystems, and the genetic variability of each species.

Carbon sink: place where carbob dioxide s absorbed – the oceans, sil and detritus, trees and other vegetation

Carrying Capacity: The ability of a biophysical, social or economic system or structure to adapt to or absorb change without irreversible effects.

Cumulative Effects: Changes to the environment that are caused by a project in combination with other past, present, and planned projects in the region.

Ecosystem: A dynamic and complex system of plant, animal and microorganism communities and their non-living environment all interacting as a functional unit within a defined physical location. The term may be applied to a unit as large as the entire ecosphere, but usually refers to a division thereof.

Endangered species: A species threatened with extinction.

Erosion: The wearing away of land surface by wind, water, glaciers, chemicals, and exposure to the atmosphere. Erosion occurs naturally but can be intensified by land-clearing practices related to farming, residential or industrial development, road building or deforestation.

Fault: a fracture in thr earthe's vrust accompaniedby the shifting of oneside of the fracture wity respect to the other

Greenhouse gases: Those gaseous constituents of the atmosphere, both natural and artificial, that absorb and reemit infrared radiation and that are responsible for global warming. The most potent greenhouse gas, carbon dioxide, is rapidly accumulating in the atmosphere due to human activities.

Groundwater: The supply of fresh water found beneath the earth's surface (usually in aquifers) which is often accessed through wells and springs.

Habitat :L and and water used by wildlife. This may include biotic and abiotic aspects such as vegetation, exposed bedrock, water, and topography

Land degradation: The reduction or loss of the biological or economic productivity from rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands. Land degradation usually results from unsustainable land use.

Pollution: The contamination of a natural ecosystem, especially with reference to the activity of humans.

Project Area Project Footprint/Study Area: The area includes all lands subject to direct disturbance from the project and associated infrastructure.

Public Participation: The process by which the general public are able to become involved in the EIA process, a method of raising issues that may otherwise be overlooked in the process.

Precipitation: Any and all forms of water, whether liquid or solid, that fall from the atmosphere and reach the Earth's surface. A day with measurable precipitation is a day when the water equivalent of the precipitation is equal to or greater than 0.2 mm.

Retention pond: A retention pond/basin is a type of best management practice(BMP) that is used to manage stormwater runoff to preventflooding and downstream erosion, and improve water quality in an adjacent river, stream, lake or bay.

Quota sampling: A sampling method of gathering representative data from a group. As opposed to random sampling, quota sampling requires that representative individuals are chosen out of a specific subgroup. It is a form of non probability sampling technique

Storm water unoff: Storm water from city streets and adjacent domestic or commercial properties that may carry pollutants of various kinds into the sewer systems and from there to rivers, lakes or oceans.

Total Economic Value:

Visual Assessment: The study of the psychological responses to appearances. Most often used in the context of how visual impact of land disturbance or reclamation can be minimized.

Watershed: All lands enclosed by a continuous hydrologic-surface drainage divide and lying upslope from a specified point on a stream.

Water Quality: A term used to describe the chemical, physical, and biological characteristics of water with respect to its suitability for a particular use.

Zoning: Zoning is the exercise of the civil authority of a municipality to regulate and control the character and use of property.

16.3

REFERENCE DOCUMENTS

MONA SECTION 1 SUBDIVISION

10 Caledonia Avenue, Kingston 10, Jamaica Tel: (876) 926-3210-9 Fax: (876) 926-2572

ANY REPLY OR SUBSEQUENT REFERENCE SHOULD BE ADDRESSED TO THE CHIEF EXECUTIVE OFFICER AND THE FOLLOWING REFERENCE NUMBER

Ref. No.:

MANAGING DIRECTOR'S OFFICE
NOV 1 2010

South Regional Office
16 Hagley Park Road
Kingston 10
Tel: 968-7226, 968-1878
Fax: 929-7227

Central Regional Office
23 Caledonia Road
Mandeville, Manchester
Tel: 962-2563
Fax: 961-0172

Western Regional Office
Flankers Main Road
Flankers, St. James
Tel: 940-7357
Fax: 940-7975

North Eastern
Regional Office
West Street
Port Antonio
Portland
Tel: 993-2031
Fax: 993-9555

27th October 2010

The Government Town Planner
National Environment & Planning Agency
10 Caledonia Avenue
KINGSTON 5

Dear Sir:

Re: Environmental Permit Application for Proposed Residential Subdivision, Part of Mona, St. Andrew by Housing Agency of Jamaica Limited
Reference No. 2009-02017-EP00234

Further to meeting held 5th October 2010, and revised plans and engineering report received 8th October 2010, regarding the above, we are to advise that after careful review of the application submitted for an Environmental Permit, the National Works Agency offers no objection in principle to **APPROVAL** being granted for the Environmental Permit subject to the following conditions:

1. The proposed 600mm diameter pipes along the existing road to Long Mountain should be increased to a minimum of 750mm in size.
2. The proposed 300mm freeboard in the manholes for the sediment trap should be increased to a minimum depth of 600mm.
3. The design of the outlet manhole in the retention area should be improved to a "riser" type chamber and the proposed design submitted to the National Works Agency for our review and recommendation before implementation of the drainage infrastructure.

Reason: To allow for the safe inflow of water.

Note: The only set of detailed plans and one copy of the revised plans are retained for our files, the others are returned to the National Environment and Planning Agency and the Kingston and St. Andrew Corporation herewith.

Yours truly,

WINSTON HARTLEY
Manager, Development Control and Physical Planning Unit

PATRICK ROSE
Director, Planning and Research
for Chief Executive Officer

4/11/10

RECEIVED
NOV 1 - 2010
Engineering & Design Dept.

Copied to: The Town Clerk – Kingston and St. Andrew Corporation
The Parish Manager - National Works Agency, KMR

'Developing Safe, Reliable and Quality Roads'

NATIONAL WATER COMMISSION
Water is Life

☐ 28-48 Barbados Avenue
P.O. Box 65, Kingston 5
Tel: (876) 929-5430-5
Fax: (876) 926-1329

☐ 4 Marescaux Road
Kingston 5
Tel: (876) 929-3540-5
Fax: (876) 960-0582

☐ 2a Manhattan Road
Kingston 5
Tel: (876) 929-3540-5
Fax: (876) 968-8247

☐ 18 Oxford Road
Kingston 5
Tel: (876) 926-5825-7
Fax: (876) 929-1480

☐ 231A Old Hope Road
Kingston 6
Tel: (876) 977-4998-9
(876) 977-5000
Fax: (876) 927-1870

☐ 231B Old Hope Road
Kingston 6
Tel: (876) 977-2496
(876) 977-9330
Fax: (876) 977-2708

WITHOUT PREJUDICE

October 22, 2009

Ms. Rose-Marie Brown
Snr. Manager, Project Development
Housing Agency of Jamaica Limited
13 Caledonia Avenue
Kingston 5.

Dear Ms. Brown;

Re: Development of Lands at Mona (Part of Beverly Hills) St. Andrew. Availability of Sewage Disposal / Domestic Water Supply Services for 54 No. Quarter Acre Serviced Lots.
NWC Ref # 0560/07

We acknowledge receipt of your letters dated September 10, and October 13, 2009 enquiring about the availability of the captioned services to your proposed serviced lots development at the above location.

The National Water Commission (NWC) advises that it should be possible to proffer an engineering solution for the provision of potable water and sewage disposal services as outlined, albeit at an Impact Charge which amount can only be determined upon receipt of your formal application inclusive of an engineering report prepared by a duly registered engineer in the relevant discipline.

The attached outlines what ought to be included in your formal application.

Notwithstanding the foregoing, it must be understood that this letter does not constitute an NWC approval; such approval must be endorsed by the President and Chairman.

With regard to your request for *"the NWC to provide its comments with regard to the proposed project in relation to the Mona Reservoir"*; the Commission, at this time, would be concerned with the matter of storm water run-off as it relates to possible flooding of our existing Mona water treatment plant.

/2

October 22, 2009

Ms. Rose-Marie Brown
Snr. Manager, Project Development

We trust that you find this information useful and look forward to doing business with the HAJ, our prospective valued customer.

Yours truly,
NATIONAL WATER COMMISSION

Franklin T. Williams
Chief Engineer (Senior Vice President)

Copy: Mr. E.G. Hunter, President – NWC
Mr. Vernon Barrett, V. P. Corporate & Strategic Planning – NWC
Mr. Michael Dunn, V. P. Eastern Division - NWC
Mr. Joseph Shoucair, Managing Director - HAJ
Mr. Desmond Young, Director, Technical Services - HAJ

NATIONAL ENVIRONMENT & PLANNING AGENCY

10 & 11 Caledonia Avenue, Kingston 5, Jamaica W.I. Tel: (876) 754-7540/3 Fax: (876) 754-7595-6 Tollfree: 1-888-991-5005
E-mail: ceo@nepa.gov.jm, Website: http://www.nepa.gov.jm

Ref no. 2009/02017-4IP00234

03 June 2011

Mr. Joseph Shoucair
Managing Director
Housing Agency of Jamaica
13 Caledonia Avenue
Kingston 5

Dear Sir:

Re: Application for a Permit under Section 9 of the Natural Resources Conservation Authority Act, 1991, in respect of the Subdivision of Lands at Part of Mona and Papine Estates and Goldsmith Villa, St. Andrew by Housing Agency of Jamaica Limited (HAJL)

The National Environment and Planning Agency (NEPA) offers no objection to the revised Terms of Reference (TOR's) dated 2011 June 1 received via email on 01 June 2011 for the Environmental Impact Assessment (EIA) in connection with the captioned application.

On this basis, you should proceed with the execution of the EIA. Please note that on completion, fourteen (14) copies and an electronic copy of the EIA report are to be presented to this office. One copy of the report should be perfect bound. Please also be reminded of the requirements for the Public Presentation that is to be conducted. The guidelines for which can be found on our website at http://www.nepa.gov.jm/business/guidelines/general/GuidelinesforPublicPresentations2007.pdf.

Any reply or subsequent reference to this communication should be addressed to the Chief Executive Officer, to the attention of Miss Natalie Davidson, and the above reference number quoted.

Sincerely

Ainsley Henry
for Chief Executive Officer / Government Town Planner

AH/ndd

cc: Mrs. Beverlina Brown Smith EJPN Consultants Limited
Miss Rosemarie Brown, Snr. Manager, Project Development, HAJL

16.4

SPECIFIC TECHNICAL STUDIES/REPORTS

MONA SECTION 1 SUBDIVISION

HYDRAULIC DESIGN

DRAINAGE

Utilizing the Rational Method

$$q = 0.278 * C * I * A$$

Where: Q- Peak runoff (discharge)

C- Dimensionless runoff coefficient based upon degree of imperviousness and infiltration capacity of the drainage surface

C= 0.33↔0.77 →Use *C=0.5 for post-development*
C=0.33 for predevelopment

A- Drainage or tributary area of the terrain.

I-Rainfall intensity lasting for a critical duration or concentration time (*tc*) and corresponding to return period (*T*)

Drain Easement #3

A= $6419m^2 = 0.006419km^2$

For a twenty five year recurrence period for storm water the concentration time is

tc= 10mins (entrance time for storm water).

From the graph provided for the Norman Manley International Airport, Kingston of the Rainfall intensity-duration-frequency curve; which shows duration (minutes) against rainfall intensity. For *tc= 5mins ↔120mins* and for T= 25 years:

I=170 mm/hr

Therefore: $q = 0.278 * 0.5 * 170 * 0.006419 = 0.15\, m^3/s$

Predevelopment $q^* = 0.278 * 0.33 * 170 * 0.006419 = 0.10\, m^3/s$

U-Drainage testing using the Manning Method

Proposed drainage size= 600 x 600mm

$$Q = 1/n * A * R^{2/3} * S^{1/2}$$

Where: n=0.013
A=WxH (Cross-section area of drainage)

$$R=\frac{Area(wet)}{perimeter(wet)}=\frac{W*H}{2H+W}=0.2$$

S= 40% (Pipe gradient between Manhole and outlet)

$$Q=\frac{1}{0.013}*(0.6x0.6)*(0.2)^{2/3}*(0.40)^{1/2}=5.99\,m^3/s$$

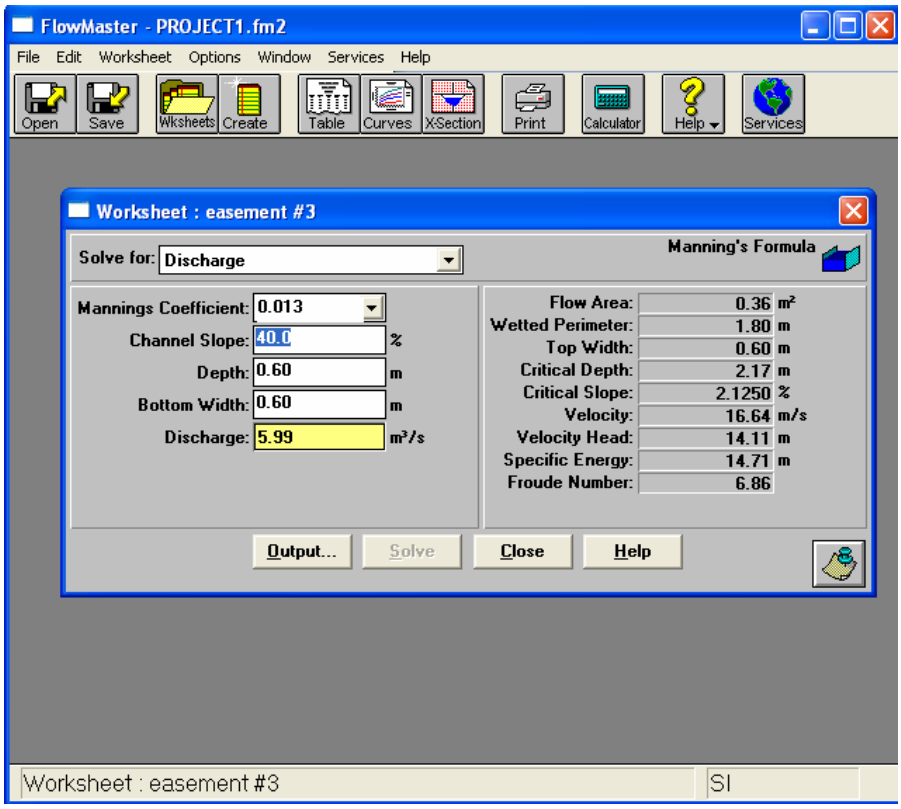


Fig 4.Easement #3 Design Results

Testing

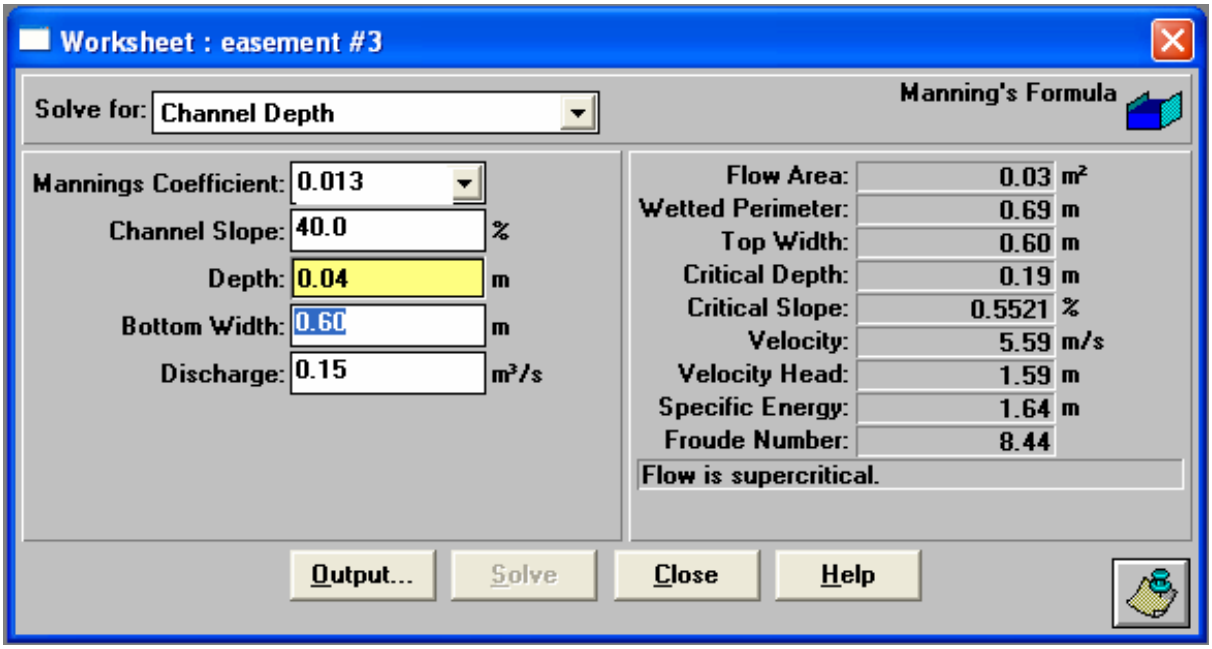


Fig 5.Easement #3 Testing

$\frac{q}{Q} = \frac{0.15}{5.99} = 0.025$ Therefore the drain will operate at 2.5% full.

Conclusion: The size of the drain is sufficient to handle the storm water flow, however due to the steep gradient the velocity of the water is greater than 3m/s.

It is recommended to use 3 dissipating chamber in route of the drain to cut the velocity of the water flow.

Derived from the Manning's formula **V = (1.0/n)($R^{2/3}$)($S^{1/2}$)**

The minimum slope that will be required to reduce the velocity of the runoff to 3 m/s will be
S = V /(1.0/n)($R^{2/3}$) where R=0.043 (flow area/ wet perimeter)

$$S = \frac{\mathrm{V}}{(1.0/\mathrm{n})(\mathrm{R2/3})} = \frac{3}{(1.0/0.013)(0.043^{2/3})} = 0.31 \text{ or } 31\%$$

Therefore the slope of the drain will have to be reduced to a 31% slope utilizing the dissipating chamber.

Drain Easement #2

A= $26336m^2 = 0.026336km^2$

For a twenty five year recurrence period for storm water the concentration time is

tc= te + tr where te=10mins (tc=from easement #3)

$tr = \frac{dis\tan ce}{v * 60}$ (runoff time for storm water)

distance = 45m (distance between manholes)

v= $1 m/s \leftrightarrow 3 m/s$ (velocity of water flow) Use *v*=$1 m/s$

Therefore *tr*= $\frac{45}{1*60} = 0.75 \min$

tc= 10mins +0.75min=10.75mins

From the graph provided for the Norman Manley international Airport, Kingston of the Rainfall intensity-duration-frequency curve; which shows duration (minutes) against rainfall intensity. For *tc= 5mins ↔120mins* and for T= 25 years:

I=170 mm/hr

Therefore: $q = 0.278 * 0.5 * 170 * 0.026336 = 0.62 m^3/s$

Predevelopment $q^* = 0.278 * 0.33 * 170 * 0.026336 = 0.41 m^3/s$

Add q from easement #3 = 0.77 m^3/s

U-Drainage testing using the Manning Method

Proposed drainage size= 900 x 900mm

$$Q = 1/n * A * R^{2/3} * S^{1/2}$$

Where: n=0.013
A=WxH (Cross-section area of drainage)

R= $\frac{Area(wet)}{perimeter(wet)} = \frac{W * H}{2H + W} = 0.3$

S= 20% (Pipe gradient between Manhole and outlet)

$Q = 1/0.013 * (0.9x0.9) * (0.81)^{2/3} * (0.20)^{1/2}$ = 12.49 m^3/s

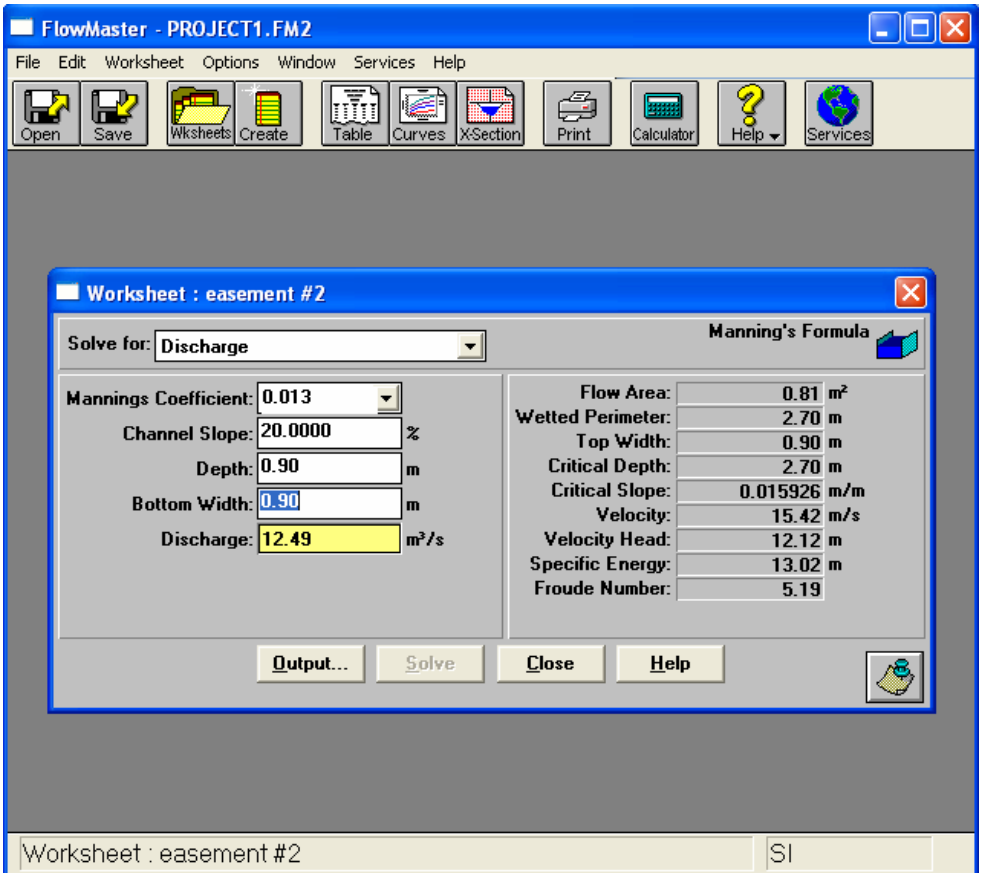


Fig 6.Easement #2 Design

Testing

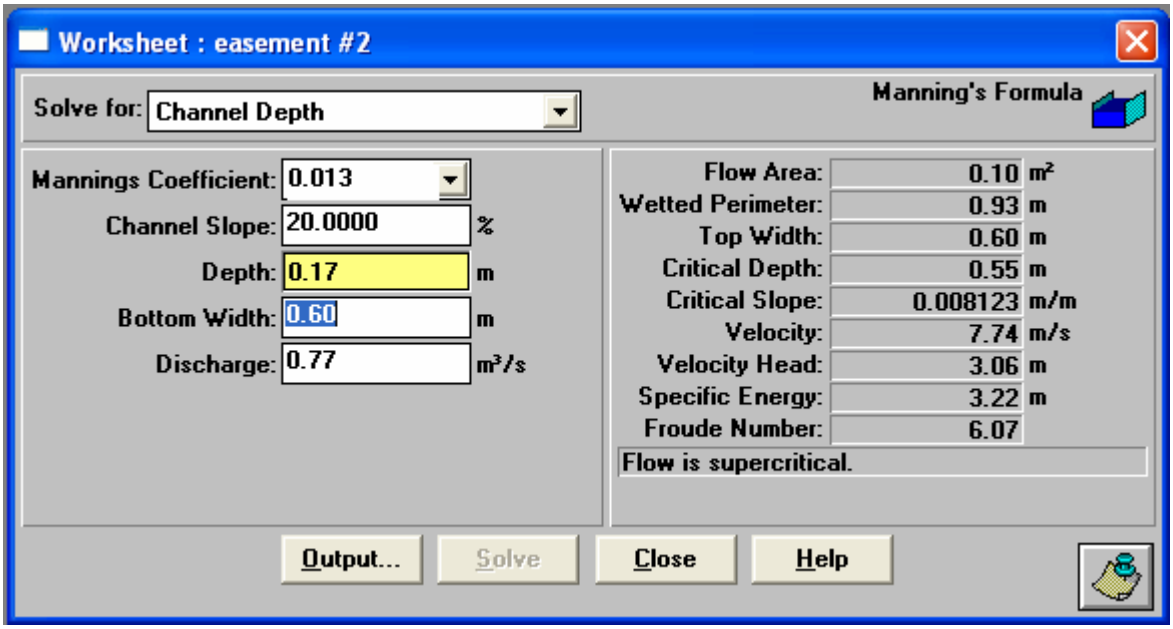


Fig 7.Easement # 2 Testing

$\frac{q}{Q} = \frac{0.77}{12.49} = 0.06$ Therefore the drain will operate at 6% full.

Conclusion: The size of the drain is sufficient to handle the storm water flow, however due to the steep gradient the velocity of the water is greater that 3m/s.

It is recommended to use 1 dissipating chamber in route of the drain to cut the velocity of the water flow.

Derived from the Manning's formula **V = (1.0/n)($R^{2/3}$)($S^{1/2}$)**

The minimum slope that will be required to reduce the velocity of the runoff to 3 m/s will be

S = V /(1.0/n)($R^{2/3}$) where R=0.11 (flow area/ wet perimeter)

$$S = \frac{V}{(1.0/n)(R2/3)} = \frac{3}{(1.0/0.013)(0.11^{2/3})} = 0.17 \text{ or } 17\%$$

Therefore the slope of the drain will have to be reduced to a 17% slope utilizing the dissipating chamber.

Drain Catchment for the retention depression using 100 year storm event

The depression labeled Open Space #1 has been designated for the deposit of the storm water from the development. It will be necessary to excavate and shape the area by removing an additional 2m of soil from the bottom of the depression and removing additional soil from the northern side and depositing some soil to the southern side to form a berm. The soil deposited to the southern side will be supported by a retaining wall. A percolation test was conducted to a depth of 2m and the soil found was mainly reddish-

brown sandy silt with gravel, boulders and some clay. After the excavation of the depression another percolation test will be done as it is expected that the soil below 2m will be mainly fractured limestone rocks. If the new percolation rate at the excavated level is slow, then the retention pond will be converted to a detention pond from which the excess water will be carried across the main road (Pines of Karachi/ Long Mountain) by way of an overflow pipe of 1200mm culvert to an existing drain in the Pines of Karachi development.

A= $43427m^2 = 0.043427km^2$

The **time of concentration** for the drainage area should be used as the duration for the design storm. The time of concentration of a drainage area is the time required for runoff from the farthest part of the drainage area to reach the outlet. Is the time of concentration the right duration to use for the design storm? Keeping in mind that we want the peak runoff rate for the specified design return period (e.g. 50 years), we note that for any storm of duration *less* than the time of concentration, the entire drainage area will never be contributing to the runoff from the outlet all at the same time.

On the other hand, for a specified return period, a longer duration storm will be less intense than a shorter duration storm. As a result, for storm duration longer than the time of concentration, the storm intensity will be less and the runoff rate from the entire drainage area will be less than that of a storm with duration equal to the time of concentration. Thus a storm of the specified return period, and of duration equal to the time of concentration of the drainage area, will give the maximum runoff rate from that drainage area in comparison with any other storm having the specified return period.

Therefore in this case since the assessment is being done for a storm of 24 hour duration the tc=24hrs

From the graph provided by the Norman Manley International Airport, Kingston of the Rainfall intensity-duration-frequency curve; which shows duration (minutes) against rainfall intensity. For *tc= 2hrs ↔24hrs* and for T= 100 years:

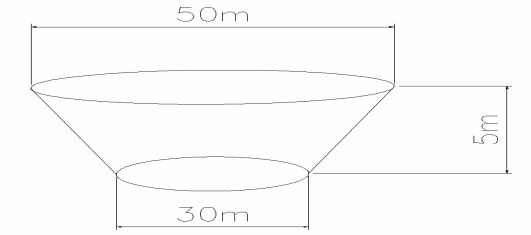
I=11.80 mm/hr

Therefore: $q = 0.278 * 0.5 * 11.80 * 0.043427 = 0.071 \, m^3/s$

Predevelopment $q^* = 0.278 * 0.33 * 11.80 * 0.043427 = 0.05 \, m^3/s$

It is not required to add the flow from the drain easements as the entire land area was used in the analysis.

Analysis of the retention depression



Volume (capacity) of shape depression = (A_1+A_2)/2 x h = (707+1963)/2 x5 = 6675m^3

*Water volume in 24 hours rainfall duration=0.071m^3/s *(86400s) = 6134.4m^3*
Therefore the capacity of the retention pond is adequate to handle a storm event of 100years recurrence period for 24hours duration.

Depth of depression = 5m
At a flow rate of 0.071m^3/s it will take approximately 26 hours to fill up.

Total surface area of depression approximately=1335m^2
And the soil will percolate at a rate of approximately 115 *l/m^2/day*. The total surface area required for the design flow will be:

Area Required = Flow/percolation rate

Flow= 0.071m^3/s = 6134400 *l/day*

Area required for a full day = $\frac{6134400\, l/\text{day}}{115\, l/\text{m}^2\ /\ day} = 53342.61 m^2$

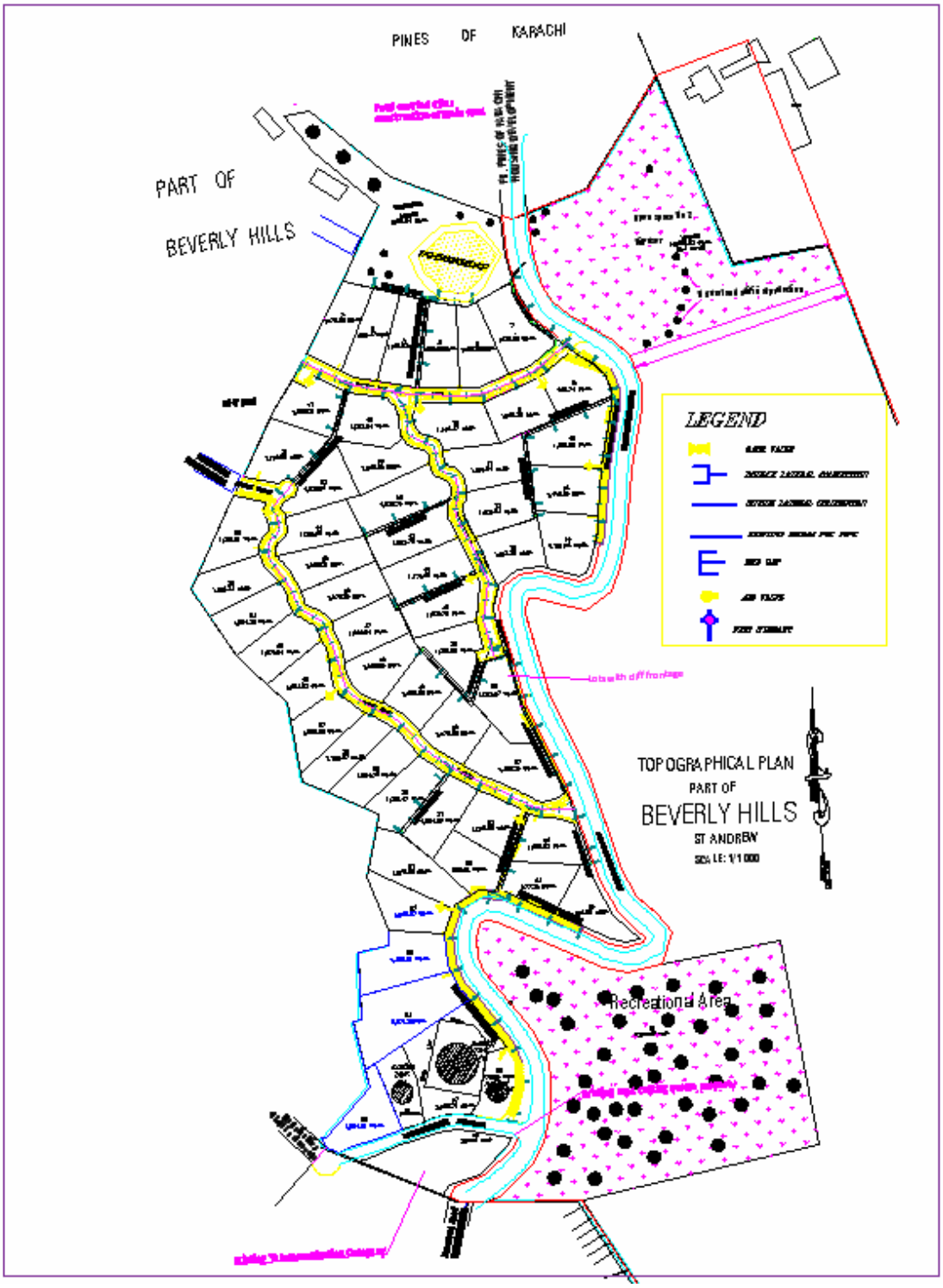
Conclusion:

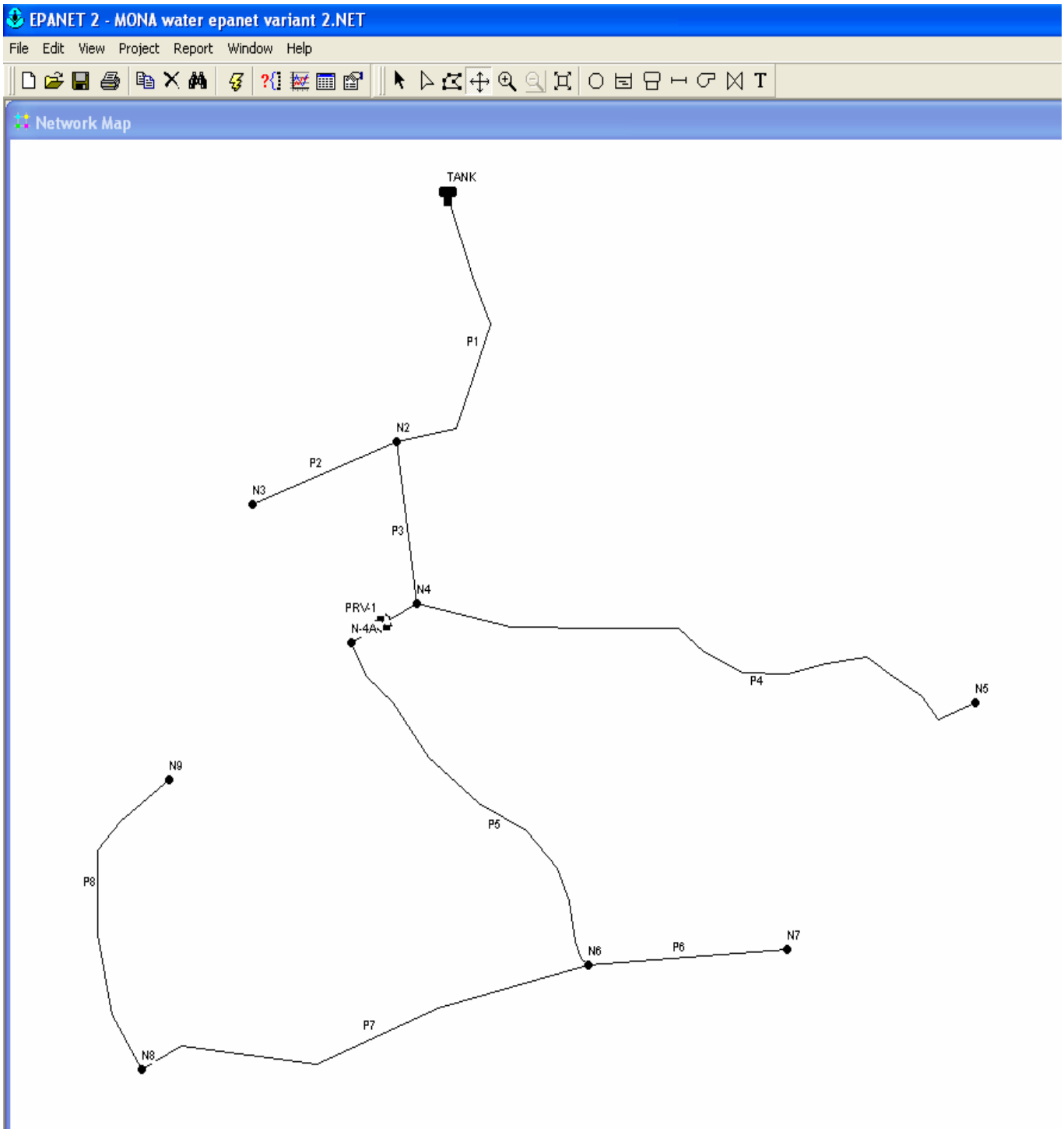
1. The capacity of the retention is capable of handling a storm event of 50years recurrence period for 24hours duration.

2. The surface area required for the depression based on the percolation rate of the soil is insufficient and therefore a new percolation text will be conducted after the depression has been excavated. If it is found to be insufficient the depression should be converted into a retention pond.

3. The difference between the preconstruction and post-construction runoff discharge is insignificant to the aquifer recharge as the post-construction condition will not affect the local aquifer. The total amount of runoff water will be injected into the soil by percolation in the retention pond.

POTABLE WATER SUPPLY




EPANET 2 - MONA water epanet variant 2.NET
File Edit View Project Report Window Help
Network Map
TANK
P1
N2
P2
N3
P3
N4
PRV-1
N-4A
P4
N5
N9
P5
P8
N6
P6
N7
P7
N8

Results from Epanet Model

11/12/2009 1:57:32 PM

E P A N E T *

Hydraulic and Water Quality *

Analysis for Pipe Networks *

Version 2.0 *

Input File: MONA water epanet variant 2.NET

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm	
P1	TANK	N2	135	150	
P2	N2	N3	42	50	
P3	N2	N4	52	150	
P4	N4	N5	290	100	
P6	N6	N7	67	100	
P7	N6	N8	150	100	
P8	N8	N9	118	100	
P5	N-4A	N6	315	150	
PRV-1	N4	N-4A	#N/A	150	Valve

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
N2	0.12	275.99	25.99	0.00	
N3	0.05	275.99	33.99	0.00	
N4	0.00	275.99	34.99	0.00	
N5	0.52	275.97	42.97	0.00	
N6	0.25	245.50	44.50	0.00	
N7	0.12	245.50	37.50	0.00	
N8	0.15	245.50	49.50	0.00	
N9	0.00	245.50	39.50	0.00	
N-4A	0.00	245.50	5.00	0.00	
TANK	-1.21	276.00	3.00	0.00	Tank

Link Results:

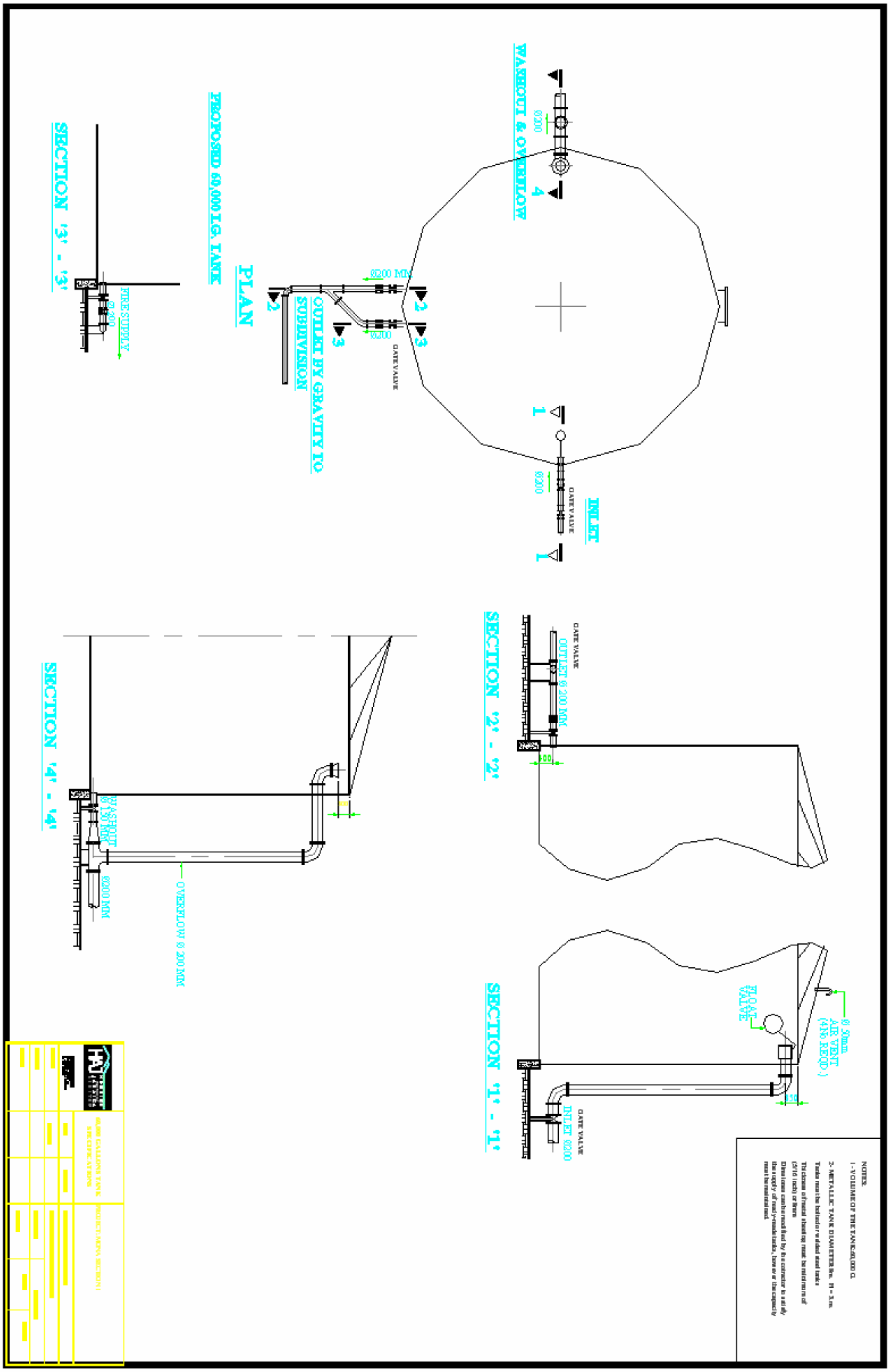
Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
P1	1.21	0.07	0.05	Open
P2	0.05	0.03	0.03	Open
P3	1.04	0.06	0.04	Open
P4	0.52	0.07	0.07	Open
P6	0.12	0.02	0.00	Open
P7	0.15	0.02	0.01	Open
P8	0.00	0.00	0.00	Open

P5 0.52 0.03 0.01 Open
PRV-1 0.52 0.03 30.49 Active Valve

Summary

	Tank	Node 2	Node 3	Node 4	Node 5	Node 6	Node 7	Node 8	Node 9	Node 4A
# lots	0.00	5.00	2.00	0.00	21.00	10.00	5.00	6.00	3.00	0.00
Population	0.00	25.00	10.00	0.00	105.00	50.00	25.00	30.00	15.00	0.00
Average demand(*l/d*)	5675.00	2270.00	0.00	23835.00	11350.00	5675.00	6810.00	3405.00	0.00	0.00
Peak Day(l/d)	0.00	7093.75	2837.50	0.00	29793.75	14187.50	7093.75	8512.50	4256.25	0.00
(l/s)	0.00	0.08	0.03	0.00	0.34	0.16	0.08	0.10	0.05	0.00
Peak Hour(l/d)	10640.63	4256.25	0.00	44690.63	21281.25	10640.63	12768.75	6384.38	0.00	0.00
Demand(l/s)	0.00	0.12	0.05	0.00	0.52	0.25	0.12	0.15	0.07	0.00
Pressure(m)	3.00	25.99	33.99	34.99	42.97	44.50	37.50	49.50	39.50	5.00
Pressure(Psi)	4.26	36.93	48.30	49.72	61.06	63.23	53.28	70.33	56.13	7.10

Discussion: A pressure-reducing-valve is necessary to maintain the pressure between 20psi and 70psi as required by the NWC standards. This will be placed after node 4.


PLAN
PROPOSED 60,000 I.G. TANK
INLET
WASHOUT & OVERFLOW
OUTLET BY GRAVITY TO SUBDIVISION
GATE VALVE
FIRE SUPPLY
SECTION '1' - '1'
SECTION '2' - '2'
SECTION '3' - '3'
SECTION '4' - '4'
OVERFLOW Ø 200 MM
FLOAT VALVE
AIR VENT
NOTES

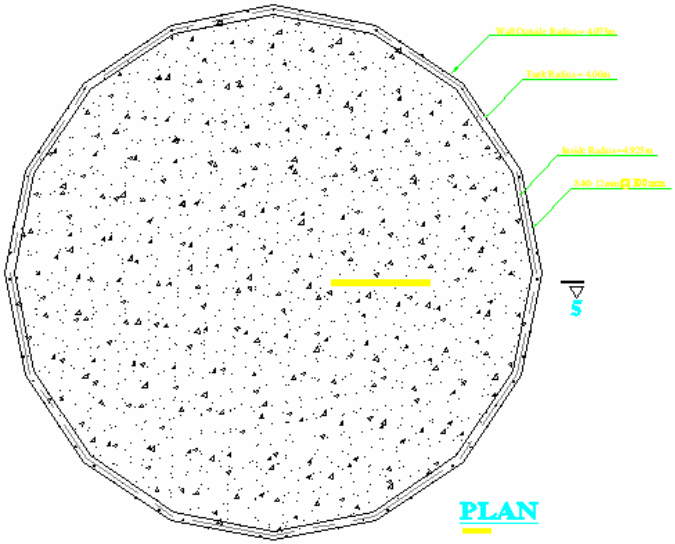
NOTES:
1 - VOLUME OF THE TANK=60,000 G.

2- METALLIC TANK DIAMETER 8 m. H = 3m.

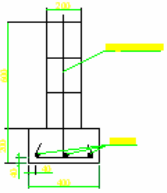
Tanks must be bolted or welded steel tanks

Thickness of metal sheeting must be minimum of (5/16 inch) or 8mm

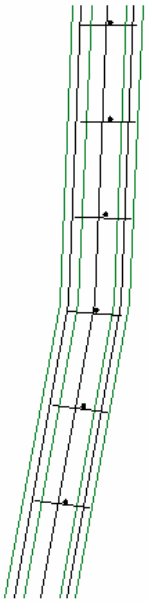
Dimensions can be modified by the contractor to satisfy the supply of ready-made tanks, however the capacity must be maintained.

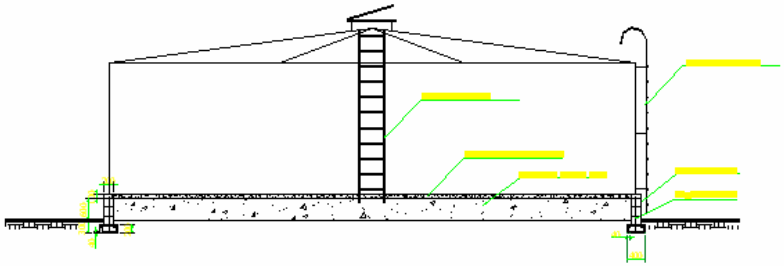


PLAN



FOUNDATION DETAILS





SECTION '5' - '5'

BASE OF TANK

PROJECT: MONA SECTION 1

SEWAGE COLLECTION

Pump Station Design

Design Flow.

Number of lots =54

Population @ 5 persons per lot =270

Waste water per person =230 *l/day*

Discharge =230*270 =62100 *l/d*

Design flow (Q_D) = $\left[Q + Q*10\%\right]*1.15$ =149971.5*l/d*

=149.9715m^3/d

10%-- Infiltration

15%--Future expansion

Hydraulic design of lift station
Ground elevation at lift station=187m

Ground elevation at destination =194m

Distance=35m (0.035km)

Average flow= 0. 04m^3/min

Design flow = 0.104m^3/min

Pre-dimensioning of sump and determining levels at which pumps starts.

Using Peak flow
Assuming pumps start every 30 minutes and work for approximately 15 minutes, the volume required is equal to V=0.104m^3/min x (30mins)=3.12m^3

Pre-dimensioning the base of the sump to be 3m x 2m

For Pump-A using normal flow of 0.04m^3/min

V=0.04m^3/min x (30mins) =1.2m^3

For the base of the sump at 3m x 2m and leaving a minimum water level of 0.4m

Pump-A will start at 0.4m+ $\frac{1.2m^3}{3m*2m} = 0.6m$ high from the bottom of sump

and leaving a minimum water level of 0.4m while using the Peak flow therefore pump-B will start at 0.4m+ $\frac{3.12m^3}{3m*2m} = 0.92m$ high

Calculating the Head
Considering the Head Loss to be approximately 10m/km

Static head = [final elevation – initial elevation]= 194-187=7m

Dynamic head= pipe length (km) x head loss

=0.035km x 10m/km

=0.35m

Head loss at pump is approximately 4m

Total head =7+ 0.35 + 3 ≈ 10m

Estimated diameter of pipe
Flow≈ D x D/2

Therefore D=√(2*flow) =√(2*1.74 *l/s*)=2”

Use 4” =100mm pipe

Summary Pump specs

Q=1.74 *l/s*

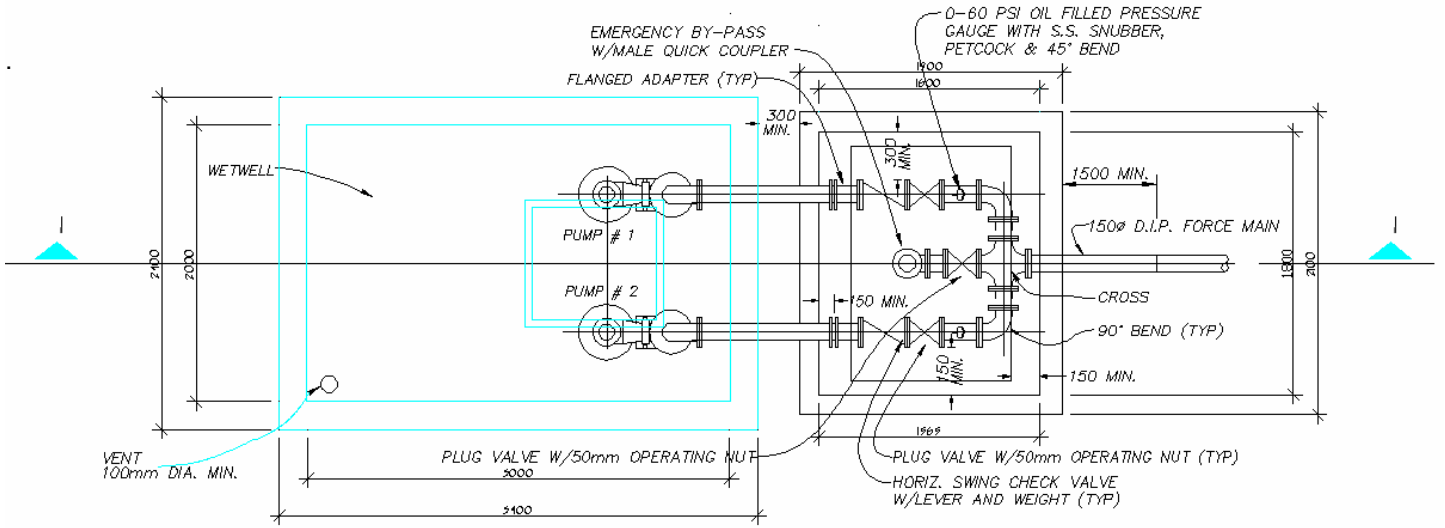
H=10m

Frequency -50Hz

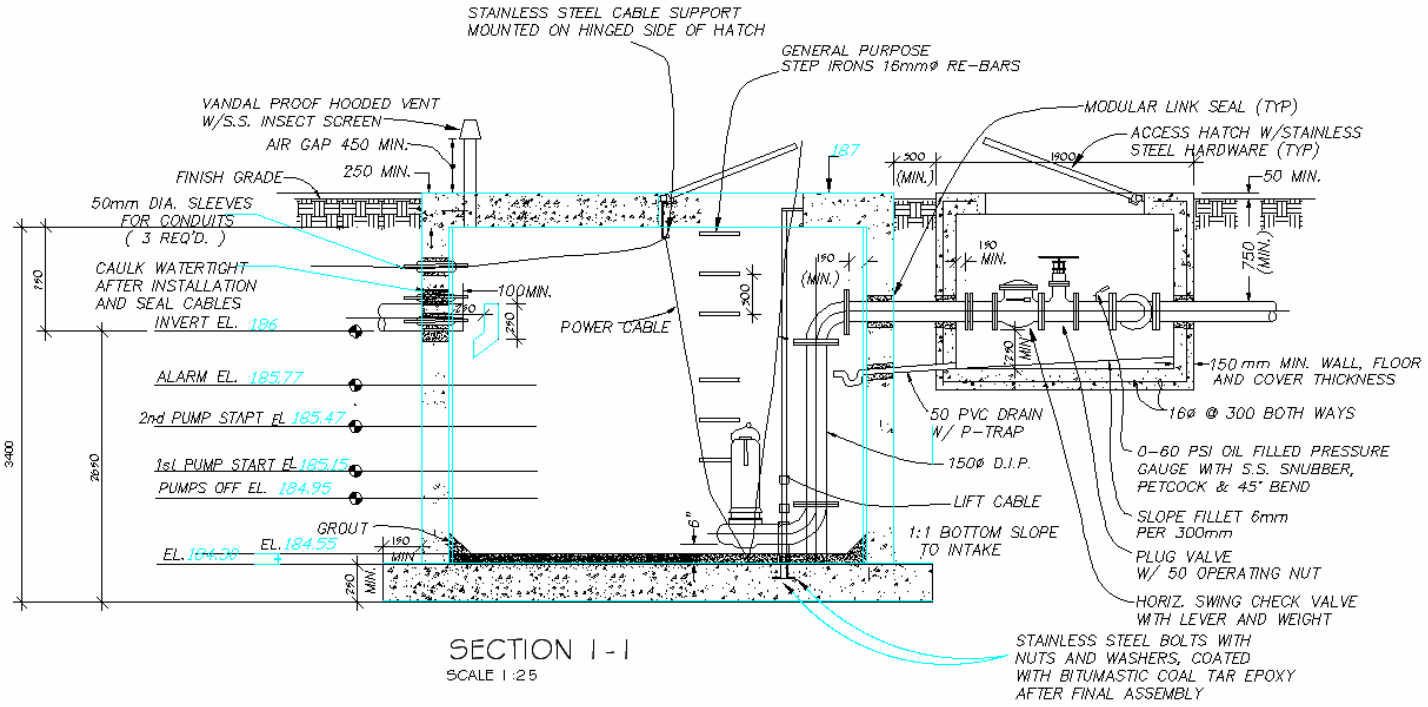
Hp= 5

Rpm= 2900

Type Submersible



PLAN
SCALE 1:25



SECTION 1-1
SCALE 1:25

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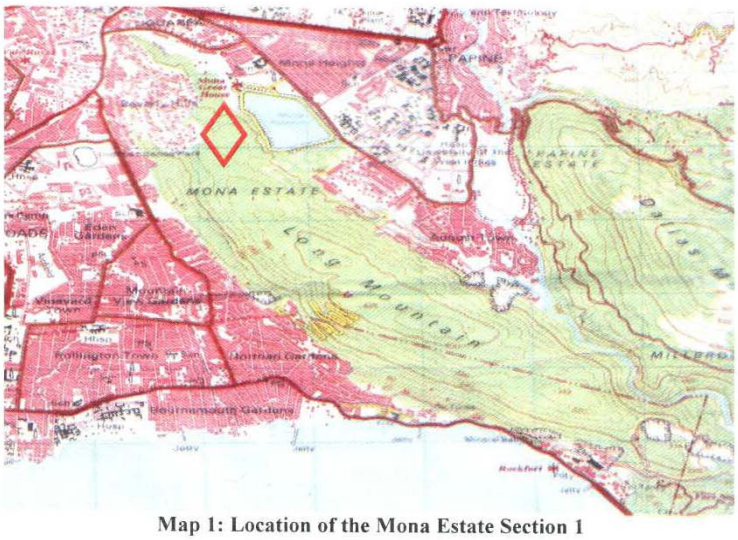
June 10, 2010

Mrs. Beverline Brown Smith
President
EPN Consultants,
Suite # 7 Main Plaza,
83 ½ Red Hills Road
Kingston 19.

Mona Estate Section 1
Archaeological Appraisal/Survey

During June 1-2, 2010, a team of archaeologists from the Jamaica National Heritage Trust (JNHT) conducted an archaeological appraisal/survey at the proposed Mona Estate Section 1 site in the parish of St. Andrew. This was in response to a request made **re Universal Application Number: 2009- 02017-EP00234 housing development of 20.8 acres at Mona, Papine Estate and Goldsmith Villa, St Andrew** that was sent to the National Environment & Planning Agency (NEPA).

The proposed development, the Mona Estate Section 1 is located north of the Pines of Karachi housing development, and south of the Long Mountain Country Club. It abuts Beverly Hills to the east.



Map 1: Location of the Mona Estate Section 1

Historical and archaeological records have revealed that the area has been settled by various ethnic groups. The Long Mountain range has been home to several Taíno settlements, and three Taíno sites are located in the vicinity of the site. The area was a part of the historic Mona Estate, which was established in the late 17th century. The Mona Estate produced sugar for over two centuries under numerous owners until it ceased production in 1909. In its heyday it encompassed a total of 1,372 acres, produced 182 puncheons of sugar and had 187 enslaved Africans.

The plantation also had 101 East Indian indentured labourers in 1880. It was the only sugar producing estate in St. Andrew during the late 19th century until it was sold. In 1914, the Mona Plantation combined with the Papine and Hermitage Estates were purchased by Kingston General Commissioners.

The area proposed for the development encompasses 20.8 acres. It is divided into 60 lots, with over 50 residential lots ranging from 942.74 sq. m. to 2,599.71 sq. m. The largest lots being public areas and open spaces: Lot 59: Recreation Area (22,825.8 sq. m.), Lot 1: Open Space No. 1 (6,335.24 sq. m.) and Open Space No. 2 (13,899.62 sq. m.).

The Mona Estate Section 1 is housed on the Long Mountain that was formed from Tertiary limestone. On the northern section of the mountain, areas of honey-combed limestone can be observed beneath the red soil surface.

Figure 1: Stratigraphy profile exposed at cliff frontage lots

The Long Mountain rises to elevations ranging from 200 to 400 metres. It has been said to be steeper on the south side facing the sea, whilst the northern section has a more gradual descent, and is more rugged. A number of caves have been reported in the area, including the Beverly Hills burial cave associated with the Taíno, which is just outside of the proposed site.

This mountain range is one of the last dry limestone forests in Kingston and St. Andrew. The vegetation at the site consists of flora associated with dry limestone forests such as Red Birch (*Bursera simaruba*), acacia bush (*Acacia tortuosa*), agave (*Agave* spp.), thatch (*Thrinax* spp.) and cactus (*Opuntia* spp.). During the appraisal the team did encounter evidence of settlement vegetation such as Ackee (*Blighia sapida*), Banana (*Musa acuminate*), Breadfruit (*Artocarpus altilis*), and Coconut (*Cocos nucifera*). In addition, a small cultivation plot that had cassava

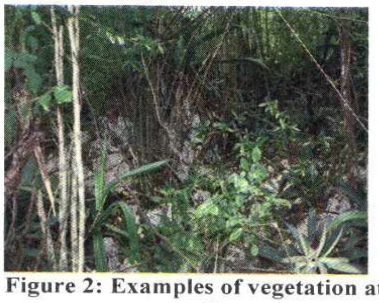


Figure 2: Examples of vegetation at the site

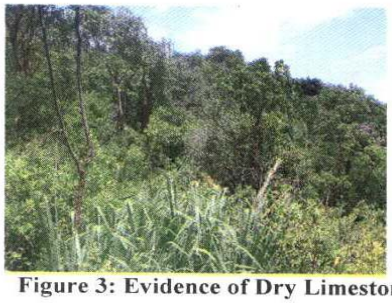


Figure 3: Evidence of Dry Limestone Forest

(*Manihot esculenta*) and gungo peas (*Cajanus cajan*) was observed during the assessment.

The assessment of the Lots 1 to 7 incorporated the large depression which has been designated as a sinkhole on the plan. The team entered the area from the Beverly Hills end, and encountered a small depression or gully running in a northerly to southerly direction towards the "sinkhole". It was realized that the "sinkhole", was not an actual sinkhole in the sense of "an open shaft or pit", but a part of a natural waterway. We were told by a resident that the waterway was dumped up, and that there are pipes that led water to the sewage plant. In the large depression, the team discovered a small cut stone structure, with a red brick arch. The structure was built into the natural limestone and is probably associated with the sugar producing era. Fragments of red brick and a metal feature were observed on the surface. Further exploration revealed the presence of gabion baskets evidence of efforts at river training and to prevent soil erosion.

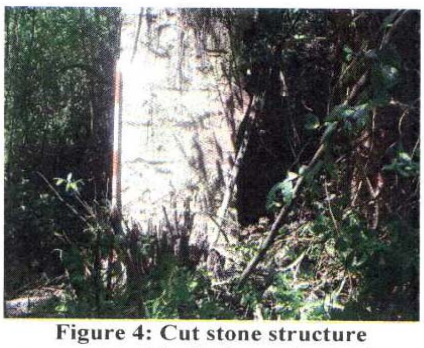


Figure 4: Cut stone structure encountered in the large depression

Figure 5: Gabion baskets

A proper appraisal of the lots located in the interior, particular Lots 37-50, were difficult to assess due to the dense vegetation. Archaeological records note the presence of a Taíno site within this area, but we were unable to confirm its location. The area seems to have been used as a temporary shelter. It was also used to burn coal, as the team encountered three "coal kiln" sites. We did not see evidence of deforestation to pinpoint the source of wood for the burners of charcoal.

Figure 6: Temporary Shelter

Figure 7: One of the Coal burning

The assessment of Lots 51-58 revealed very little cultural material outside of fragments of red bricks. Lots 56 and 57 that house the National Water Commission and Long Mountain tanks only produced piles of rubble that was probably associated with the construction of the tanks. Lot 59, the future site for the recreational area seems to be a drop off, as numerous boulders were pushed there, which is possibly associated with the construction of the Long Mountain Country Club.

Conclusion

Based on the archaeological evidence available to us at this time, the value of archaeological features and artefact assemblages observed are not significant to the point that they will require a declaration for preservation. **The JNHT therefore has no objection against the proposed development providing that an archaeological watching brief is conducted during the infrastructural excavation phase of the development.**

Dorrick Gray

Dorrick Gray (Mr.)
Technical Director of Archaeology
Jamaica National Heritage Trust

16.5

DATA TABLES

MONA SECTION 1 SUBDIVISION

Source: Beverly Hills Well

Date	Chloride	Nitrate
08-Jan-08	19.0	11.7
22-Jan-08	16.0	13.3
29-Jan-08	18.0	13.0
12-Feb-08	17.0	12.7
21-Feb-08	15.0	13.2
11-Mar-08	16.0	14.5
17-Apr-08	18.0	14.0
05-May-08	19.0	14.1
15-May-08	16.0	17.4
20-May-08	19.0	15.9
02-Jun-08	20.0	14.1
12-Jun-08	19.0	13.6
17-Jun-08	17.0	13.0
26-Jun-08	14.0	14.3
03-Jul-08	17.0	15.2
10-Jul-08	16.0	15.4
22-Jul-08	15.0	16.4
08-Aug-08	17.0	15.6
15-Aug-08	15.0	15.4
26-Aug-08	21.0	9.9
Average	**17.2**	**14.1**
07-Dec-09	16.0	16.0
07-Jan-10	15.0	13.6
20-Apr-10	19.0	27.1
28-Apr-10	19.0	14.1
18-May-10	24.0	14.7
10-Jun-10	36.0	45.0
Average	**22.6**	**22.9**

List of observed Bird Species at the proposed Mona Section 1 development site

Common Name	Scientific Name	Local Name	National Status
Cattle Egret	Bubulcus ibis	Ticks Bird or Gaulin	R1
American Kestrel	Falco sparverius	Lizard Hawk or Killy-Killy	R1
Red-tailed Halk	Buteo jamaicensis	Chicken Hawk	R1
Rock Dove	Columba livia	Pigeon	I1
White-crowned Pigeon	Columba leucocephala	Ball Plate	R1
Ruddy Quail-Dove	Geotrygon montana	Copper Partridge	R2
Common Ground Dove	Columbina passerina	Ground Dove	R1
Caribbean Dove	Leptotila jamaicensis	White-belly	R1
White-winged Dove	Zenaida asiatica	White-wing	R1
Zenaida Dove	Zenaida aurita	Pea Dove	R1
Green Rumped Parrotlet	Forpus passerinus	Parakeet	I1
Jamaican Parakeet	Aratinga nana	Parakeet	R1
Jamaica Lizard Cuckoo	Saurothera vetula	Old Woman Bird	E2
Chestnut-bellied Cuckoo	Hyetornis pluvialis	Old Man Bird	E2
Smooth-billed Ani	Crotophaga ani	Savanna Blackbird	R1
Red-billed Streamertail	Trochilus polytmus	Doctorbird	E1
Vervain Hummingbird	Mellisuga minima	Little Doctorbird	R1
Jamaican Mango Hummingbird	Anthracothorax mango	Doctorbird	E2
Jamaican Tody	Todus todus	Robin Redbreast	E1
Jamaican Woodpecker	Melanerpes	Woodpecker	E1

Common Name	Scientific Name	Local Name	National Status
	radiolatus		
Jamaican Pewee	Contopus palidus	Pewee	E1
Stolid Flycatcher	Myiarchus stolidus	Tom Fool	R1
Sad Flycatcher	Myiarchus barbirostris	Little Tom Fool	E1
Rufous Tailed Flycatcher	Myiarchus validus	Big Tom Fool	E2
Loggerhead Kingbird	Tyrannus caudifasciatus	Loggerhead	R1
Jamaican Crow	Corvus jamaicensis	Jabbering Crow	E1
White-Chinned Thrush	Turdus aurantius	Hopping Dick	E1
Northern Mockingbird	Minus polyglottos	Nighting Gale	R1
Jamaican Vireo	Vireo modestus	Sewi-sewi	E1
Black Throated Blue Warbler	*Dendroica virens*		W1
Prarie Warbler	*Dendroica discolor*		W1
American Redstart	*Setophaga ruticilla*		W1
Black- Whiskered Vireo	*Vireo altiloquus*	John Chew it	S1
Ovenbird	*Seiurus aurocapillus*		W1
Bananaquit	Coereba flaveola	Yellow-belly	R1
Yellow-faced Grassquit	Tiaris olivacea	Squit or Grassquit	R1
Black-faced Grassquit	Tiaris bicolor	Squit or Grassquit	R1
Jamaican Striped-headed Tanager	Spindalis nigricephalus	Mark Head or Guley	E1
Yellow-shouldered Grassquit	Loxipasser anoxanthus	Squit or Yellow-back Grasssquit	E2
Greater Antillean Bullfinch	Loxigilla violacea	Black Sparrow	R1
Jamaican Euphonia	Euphonia jamaica	Cho-cho Quit	E1

Common Name	Scientific Name	Local Name	National Status
Orangequit	Euneornis campestris	Orange Quit	E1
Greater Antillean Grackle	Quiscalus niger	Cling-cling	R1
Jamaican Oriole	Jamaican Oriole	Banana Katie	R1
Shiny Cowbird	Molothrus bonariensis		R2
Barn Owl	Tyto alba	Patoo	R2

Key:

R - Resident; **E** - Endemic Species;

I - Introduced;

W - Winter Migrant

S - Summer Resident

1 - Common in suitable habitat

2 - Uncommon

N.B. Endemic species shown in bold. Migratory species in italics.

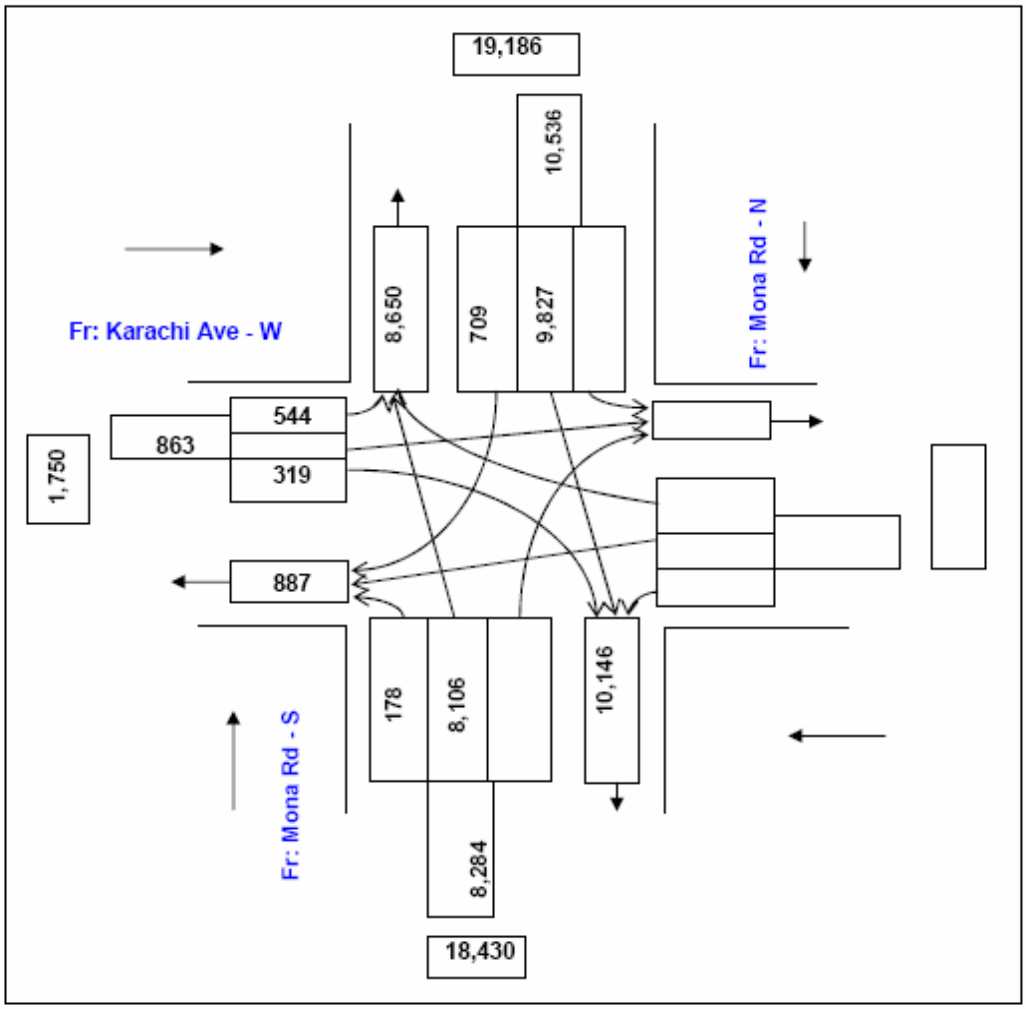
List of observed tree species observed at the proposed Mona Section 1 development site

Natural		Degraded		Residential	
Scientific Names	**Common Names**	**Scientific Names**	**Common Names**	**Scientific Names**	**Common Names**
Ceiba pentandra	Silk Cotton Tree	*Bursera simaruba*	Red Birch	*Musa spp.*	Banana/Plantains
Guazuma ulmifolia	Bastard Cedar	*Haematoxylum campechianum*	Logwood	*Blighia sapida*	Ackee
Piscidia piscipula	Dogwood	*Piscidia piscipula*	Dogwood	*Magnifera indica*	Mangos
Tabebuia rosea	Pink Poui	*Nectandra sp.*	Sweet Wood	*Annona spp.*	Sweetsop/Soursop
Netandra sp.	Sweet Wood	*Cecropia peltata*	Trumpet Tree	*Citrus spp.*	Lime, Orange
Brosimum alicastrum	Breadnut	*Brya ebenus*	Coccus Wood	*Guango*	Terminalis catappa
Brya ebenus	Coccus Wood	*Cassia emarginata*	Senna Tree or Yellow Candle Wood	*Artocarpus altilis*	Bread Fruit
Bursera simaruba	Red Birch	*Gliricidia sepium*	Grow Stick	*Cocos nucifera*	Coconut
Comocladia spp.	Maiden Plum	*Samanea saman*	Guango	*Carica papaya*	Paw Paw or Papaya
Crescentia cujete	Calabash	*Bauhinia divaricata*	Bull Hoof or Moco John	*Prosopis juliflora*	Cashaw
Guaiacum officinale	Lignum Vitae	*Crescentia cujete*	Calabash	*Terminalis catappa*	West Indian Almond
Dipholis sp.	Bullet Wood	*Guazuma ulmifolia*	Bastard Cedar		
Vitexumbrosa	Fiddlewood	*Psidium guajava*	Guava		
Sapium jamaicensis	Blindeye	*Prosopis juliflora*	Cashaw		
Drypetes spp.	White Wood	*Coccoloba sp*			
Ficus sp.	Ficus	*Guaiacum officinale*	Lignum Vitae		
Adenanthera pavonina	Red Bead Tree	*Luceanea sp.*	Lead Tree		
Allophylus cominia					
Average Canopy Height	**18 metres**	**Average Canopy Height**	**8 metres**	**Average Canopy Height**	**5.8 meters**

TRAFFIC COUNT DATA

12 HOUR 5

TRAFFIC VOLUME FIELD SHEET
Intersection: Mona Rd / Karachi Ave
Date: March 30, 2009
Weather:



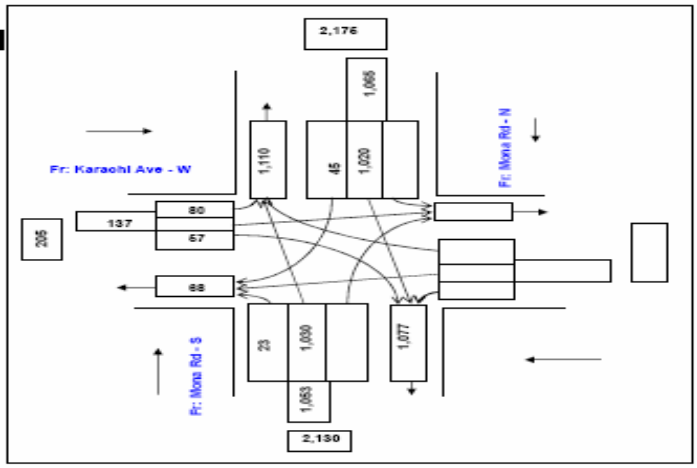
Peak Diagram

TRAFFIC VOLUME FIELD SHEET

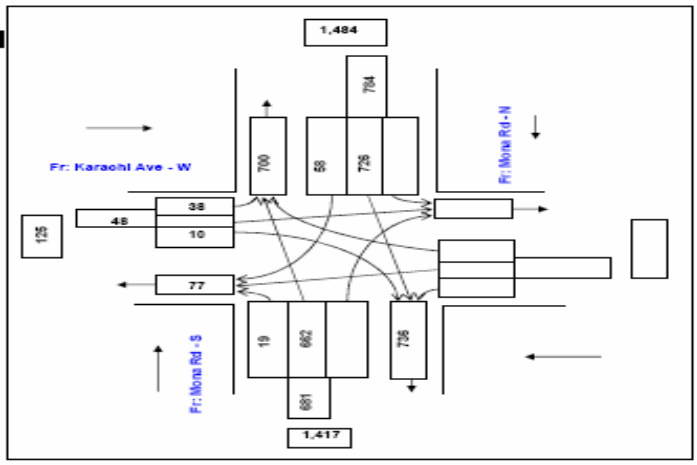
Intersection: Mona Rd / Karachi Ave

Date: March 30, 2009

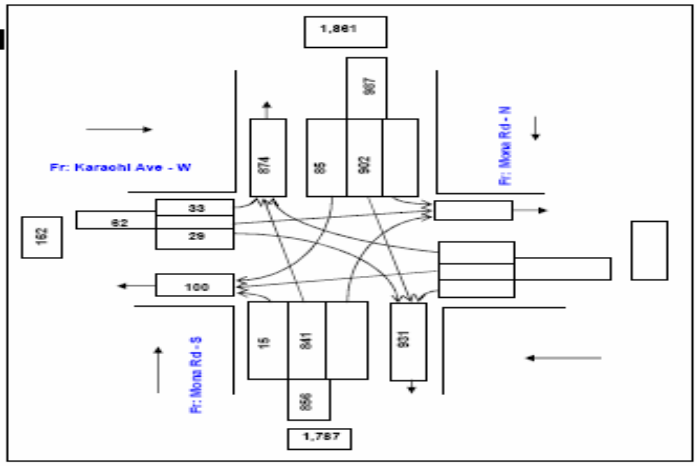
AM PEAK
7:00 - 8:00 AM



MID PEAK
12:00 - 1:00 PM



PM PEAK
4:30 - 5:30 PM

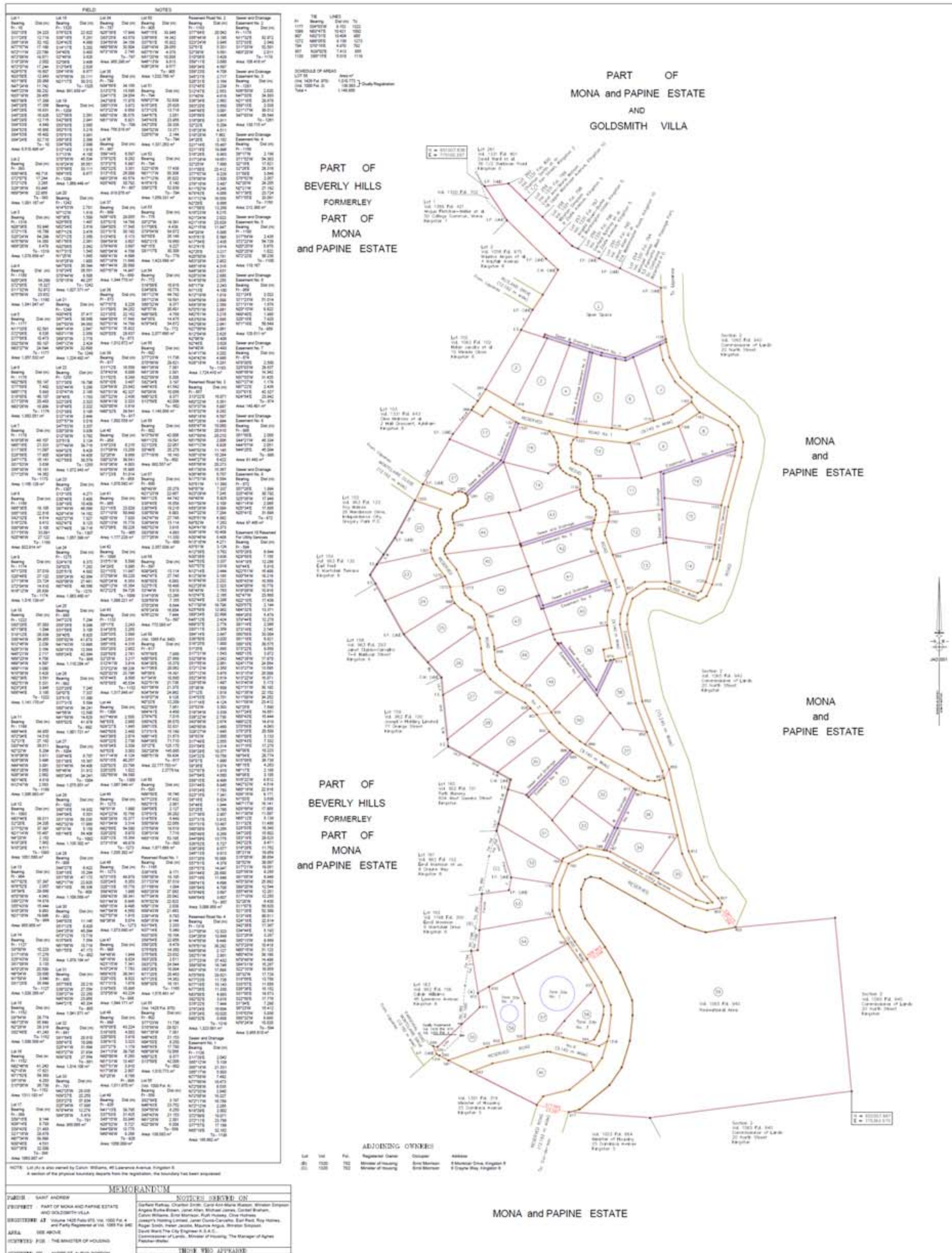


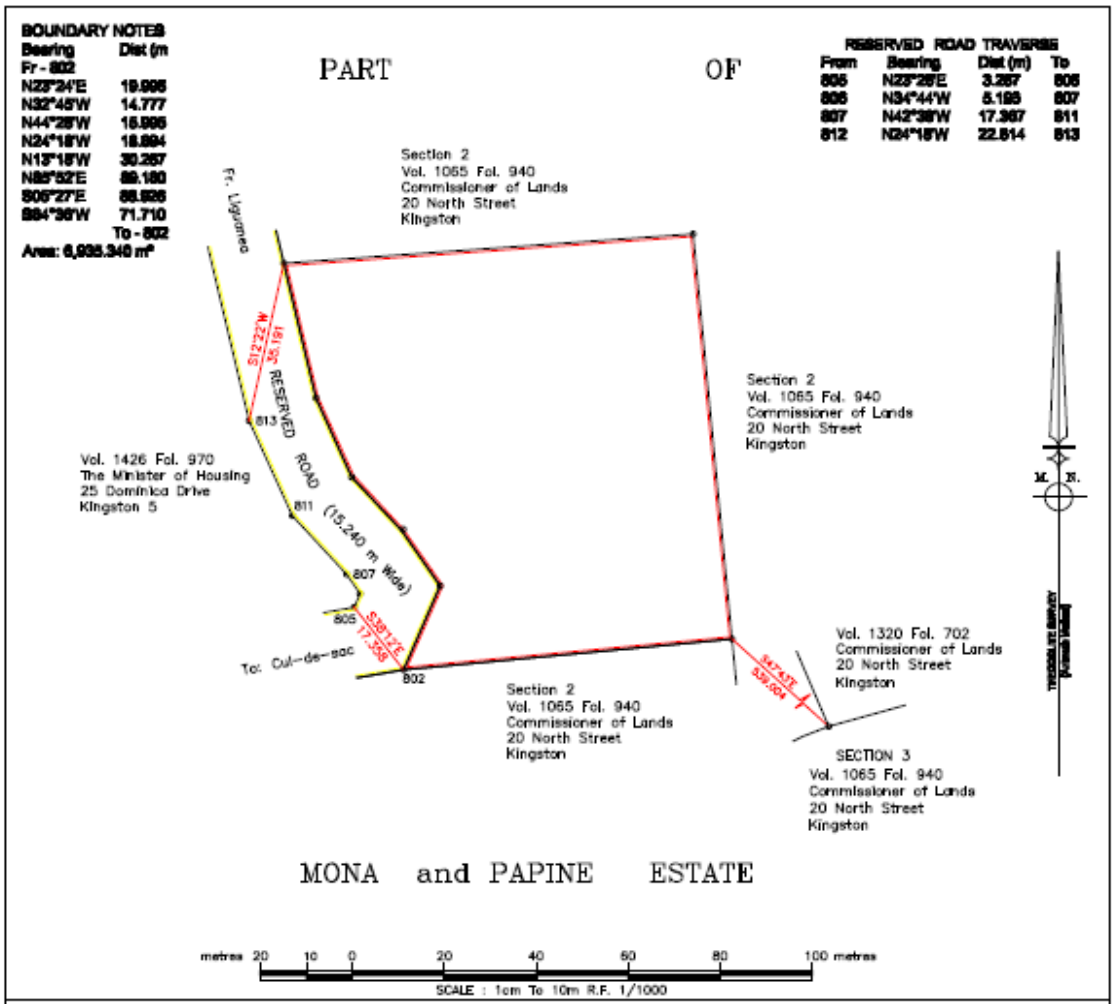
16.6

PHOTOGRAPHS, MAPS & PLANS/DIAGRAMS

MONA SECTION 1 SUBDIVISION

PE: 341857
R No. 47395





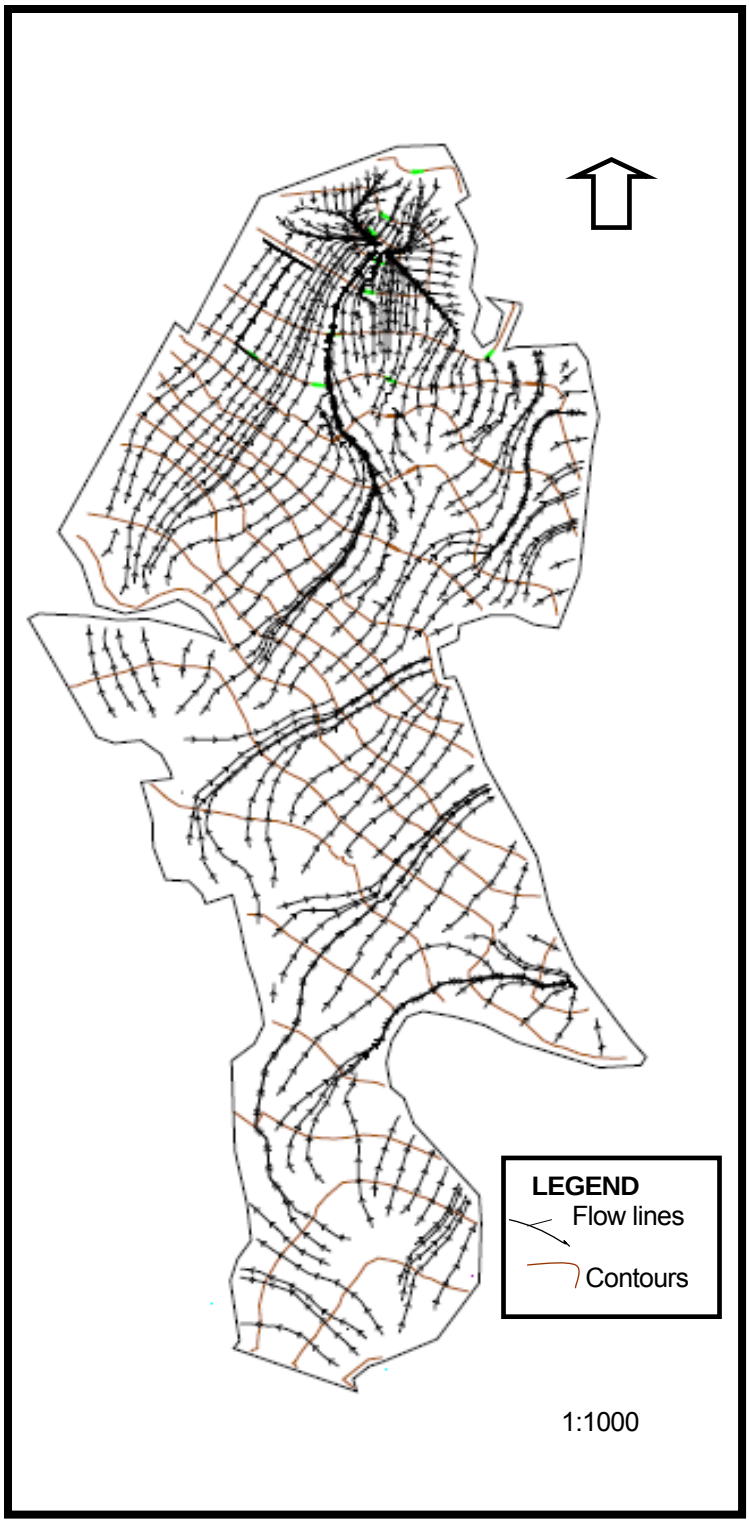
REMARKS: 1. Calculated and measured distances compare favourably.
2. All marks are Iron Pegs unless where otherwise stated.
3. All Boundaries are opened unless where otherwise stated.

PARISH: SAINT ANDREW	AREA 6,935.340 m²	*The names of the parties interested in the survey who were served with notices*	Commissioner of Lands, The Minister of Housing
The name of the party at whose instance the survey was made.	THE MINISTER OF HOUSING		
The name of the property surveyed or of the property of which the Land surveyed forms part	MONA AND PAPINE ESTATE		
	Regd. at Vol. 1065 Fol. 940	*The names of those who appeared either personally or by their representatives*	No one appeared.
The dates between which the survey was made.	January 15, 2010		
The grounds of objections to the survey if any.	None		
The grounds of the surveyors decision	Instructions, plans and marks on ground.		
Make and No. of Instrument.	TOPCON GTS 211D # LG 1491		
Make and S.D. No. of tape used.	N/A		
Date of last tape check. Result.	N/A		

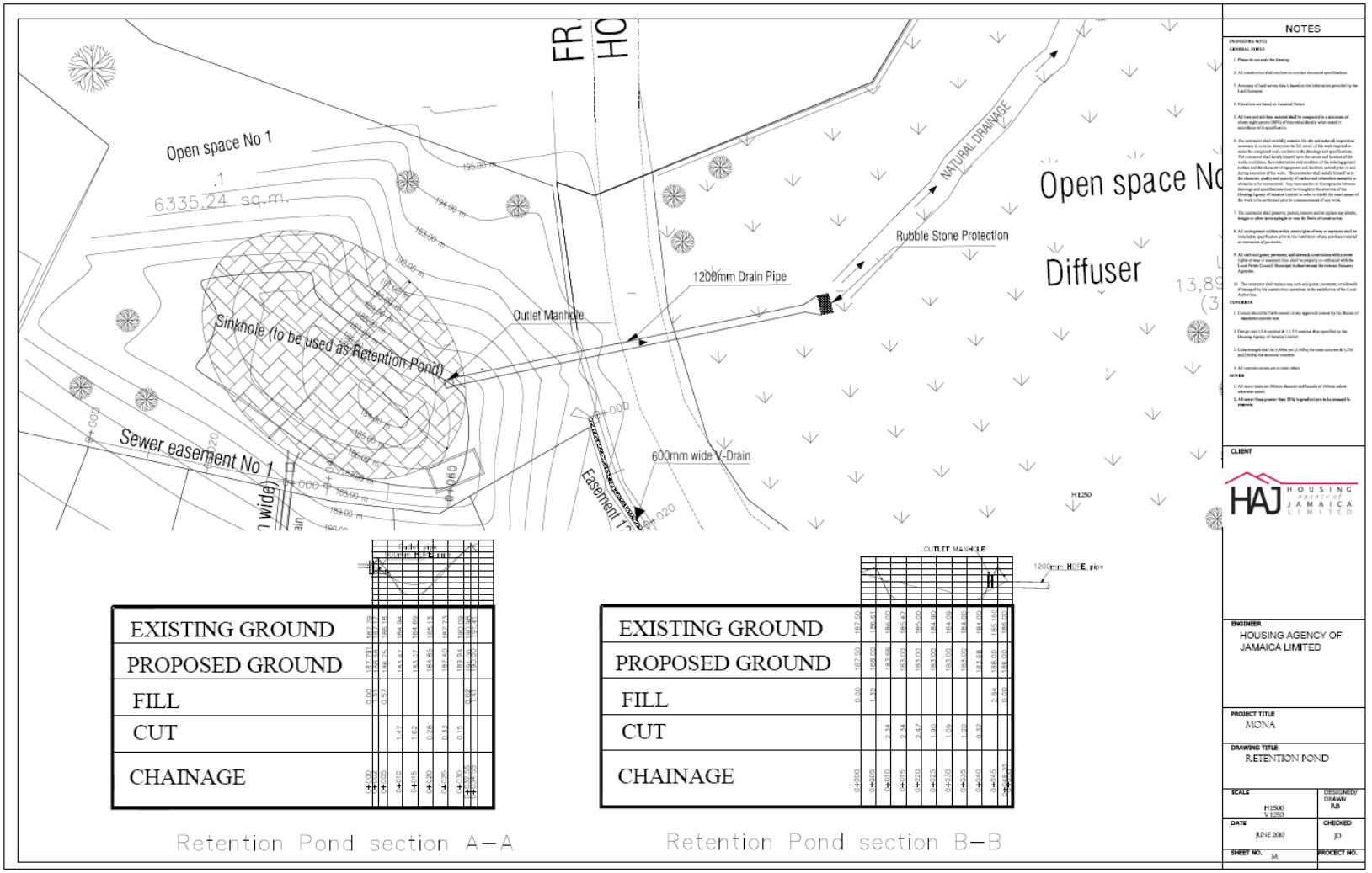
Surveyed by:.....
ANDRE ST. AUBYN GORDON BSc. (Hons)
Commissioned Land Surveyor
Registration No.: 102317565
GORDON & COMPANY SURVEYS
Shop C5, Browns Town Mall
Browns Town, St. Ann
Jamaica, W.I.
Tel: 975-9406 Fax: 975-2621
Website: www.gordonsurveys.com

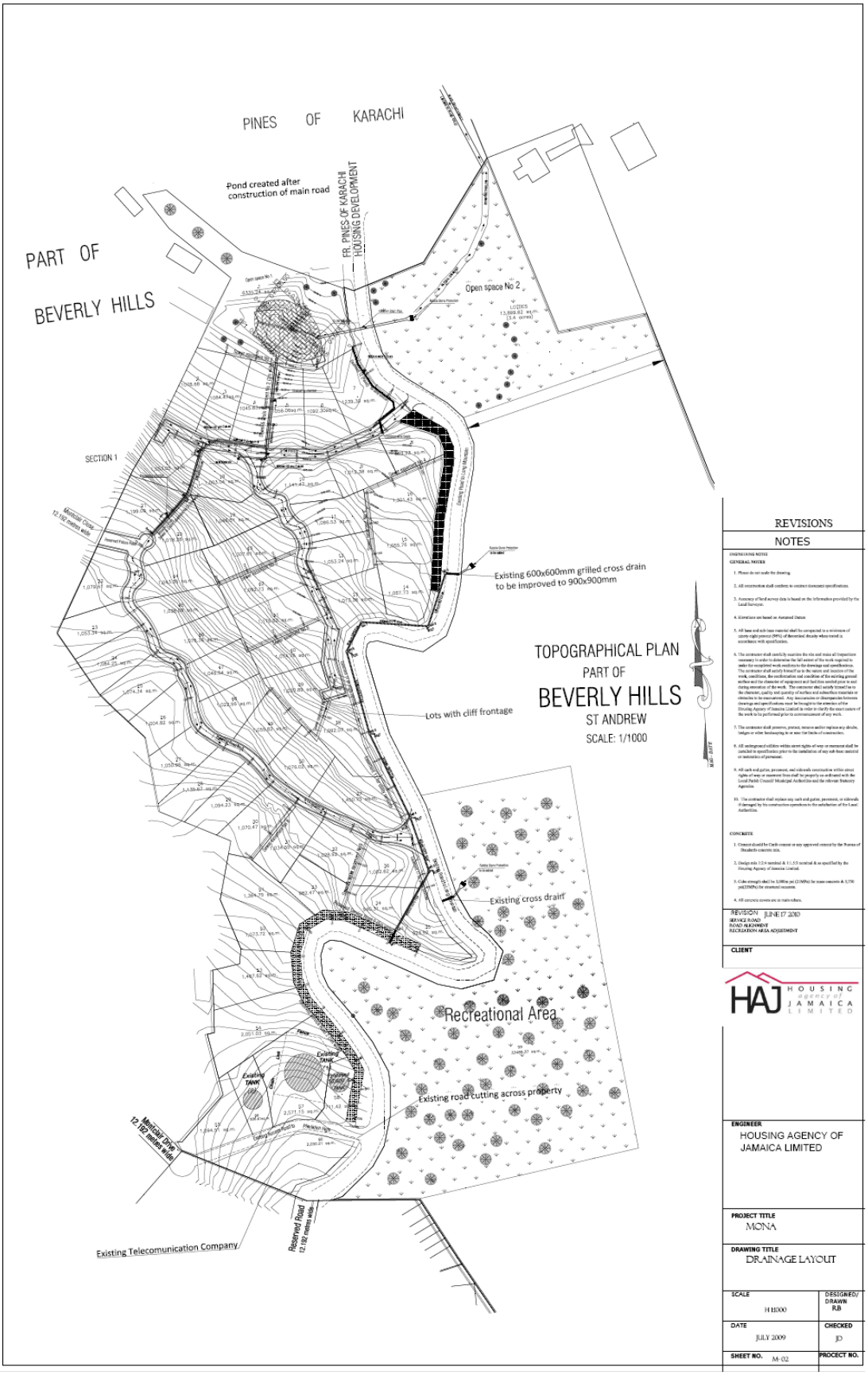
Date amended:.....

FIGURE SHOWING DIRECTION OF STORM WATER FLOW AT THE SITE OF THE PROPOSED MONA SECTION ONE RESIDENTIAL DEVELOPMENT



Source: EPN Consultants Limited


Open space No 1
6335.24 sq.m.
Sinkhole (to be used as Retention Pond)
Outlet Manhole
1200mm Drain Pipe
Rubble Stone Protection
NATURAL DRAINAGE
Open space No
Diffuser
600mm wide V-Drain
Sewer easement No 1
EXISTING GROUND
PROPOSED GROUND
FILL
CUT
CHAINAGE
Retention Pond section A—A
Retention Pond section B—B
NOTES
CLIENT
HAJ HOUSING AGENCY OF JAMAICA LIMITED
ENGINEER
HOUSING AGENCY OF JAMAICA LIMITED
PROJECT TITLE
MONA
DRAWING TITLE
RETENTION POND
SCALE
H:1500
V:1250
DESIGNED/ DRAWN
RB
DATE
JUNE 2010
CHECKED
JD
SHEET NO.
PROJECT NO.


PINES OF KARACHI
Pond created after construction of main road
FR. PINES OF KARACHI HOUSING DEVELOPMENT
PART OF
BEVERLY HILLS
Open space No 2
SECTION 1
Existing 600x600mm grilled cross drain to be improved to 900x900mm
Lots with cliff frontage
Existing cross drain
Recreational Area
Existing road cutting across property
Existing Telecomunication Company
Reserved Road 12.192 meters wide
Municipal Drive 12.192 meters wide
TOPOGRAPHICAL PLAN
PART OF
BEVERLY HILLS
ST ANDREW
SCALE: 1/1000
REVISIONS
NOTES
REVISION JUNE 17 2010
SERVICE ROAD
ROAD ALIGNMENT
RECREATION AREA ADJUSTMENT
CLIENT
HAJ HOUSING AGENCY OF JAMAICA LIMITED
ENGINEER
HOUSING AGENCY OF JAMAICA LIMITED
PROJECT TITLE
MONA
DRAWING TITLE
DRAINAGE LAYOUT
SCALE
H 1:1000
DESIGNED/ DRAWN
RB
DATE
JULY 2009
CHECKED
JD
SHEET NO.
M-02
PROCECT NO.

16.7

COMPOSITION AND DETAILS OF STUDY/RESEARCH TEAM

MONA SECTION 1 SUBDIVISION

The primary Consultants for the Environmental Impact Assessment are:

Team Leader/Project Manager:	Beverline Brown Smith, MURP, B.A (Hons), Dip-Mgmt of the Env.
Project Design:	Charles Ximinnies, B.Sc. Physical Planning & Environmental Resources Development; Diploma, Physical Planning Barrington Brown, B.Sc. [Eng.] Civil Engineering. Desmond Flowers, B.Sc. (Eng.) Civil Engineering
Physical Resources & Risk Assessment:	EPN Consultants Limited Peer Review - Michael White, Hydrogeologist
Biological Resources:	Marlon Beale, PhD Candidate, Zoology; M. Phil, Zoology; B.Sc., Zoology
Landscape and Visual Assessment:	Michael Gyles, B. Arch; Certificate, Architectural Drawing & Construction Beverline Brown Smith, MURP, B.A (Hons), Dip-Mgmt of the Env.
Socio-economic Survey:	Charles Ximinnies, B.Sc. Physical Planning & Environmental Resources Development; Diploma, Physical Planning
Archaeological Assessment:	Jamaica National Heritage Trust
Rapid Traffic Impact Assessment:	EPN Consultants Limited and National Works Agency

16.8

NOTES OF PUBLIC CONSULTATION SESSIONS

MONA SECTION 1 SUBDIVISION

SUMMARIES OF SELECTED DISCUSSIONS IN THE PUBLIC DOMAIN

ARTICLE	ISSUES RAISED	ARTICLE/ REBUTAL	ISSUES RAISED
Tension Mounts in Beverly Hills The Gleaner Saturday August 03, 2002	• The prolong dispute between the Long Mountain Country Club and the BHCABS has impacted negatively on the lives of advocates. • The developers were accused of not following protocol thus, being a nuisance in the upscale neighbourhood while denying all accusations upon intervention of the Office of the Prime Minister and the Minister f Water and Housing. • Members of BHCABS were adamant that developers (Selective Homes Development Limited) had to cease using Beverly Hills roads as a liaison to the Country Club housing scheme. • The use of Beverly Hills roads was a mechanism to influence buyers into believing that the gated Country club was a part of the upscale residential Beverly Hills community. • Allegations are that the continued blasting resulted in structural damages to houses in the Bevely Hills community. • Selective Homes Construction Company have been reluctant in blocking the road use through Beverly Hills despite the functionality of the access road. Additionally, they promised to construct a stone-cut wall to separate both communities never materialized. • Construction of a collection depot for sewage in the buffer zone green area reserved was not discussed with residents.		
Long Mountain and Pines of Karachi feud heats up The Gleaner	• A growing dispute between residents from Long Mountain and Pines Karachi, resulted in attempts being made by residents of Pines of Karachi to erect a fence, so as to		

Tuesday, December 15, 2005.	prevent access to their community. • The residents of Long Mountain were accused of dumping garbage on open lots, creating unnecessary traffic flow on the roads in Pines of Karachi. • Residents of Pines of Karachi complained about sewage being directed through their community, which often overflows their homes; thereby affecting their investment and their health. • Pines and Karachi residents claimed they were given and empty promise by NHDC, with regards to a gated community which was never realized. • Poor design of sewage system. • Acting managing director dismissed claims made by residents of Pines of Karachi, with regards to a gated community. • Minister of Water and Housing, Donald Buchanan granted temporary access to the roads through Pines of Karachi, to residents of Long Mountain; pending the construction of a new road. • The direction of sewage through the community of Karachi, is a permanent decision approved by the National Water Commission, and steps were being taken to address the problem		
NWC killing us softly Carolyn Cooper The Sunday Gleaner January 24, 2010	• In aiding and abetting short-sighted housing developers NWC runs counter to its motto, "Water is life" • Long Mountain (LM) is the primary watershed for the Mona Reservoir • HAJ is a threat to LM and Kingston's water supply • 50 per cent increase in surface run-off could "negatively impact the water quality". • Soil erosion resulting from "the removal of vegetative cover. • Discharge of additional storm water into	**NWCs Rebutal article** **Cooper's misplaced rage against NWC** Charles Buchanan Corporate Public Relations Manager, NWC. The Gleaner Thursday February 1,	• NWC is not and has never been the owner of the Long Mountain lands with the exception of the specific lands which form a part of the NWC's Mona reservoir complex regardless of the relatively close proximity. • NWC is not an approving or regulating agency for development, thus, they cannot legally dictate the use to which developers put their property. • Failure by Professor Cooper to distinguish between the initial design concept for the Mona reservoir which date back to the period between the 1930's and the 1950"s (earthen structure) to the present

	drainage channel has the potential to erode the lower slopes facing the reservoir, particularly in areas where rocks are fractured and fragmented. • The potential for sewage from the development to be transported to the reservoir	2011	structure which comprised of a concrete and stone all around and which boasts capacity of 800 million gallons • The Long Mountain range is not a primary watershed for the Mona reservoir as the area is not used as a catchment, thus, its condition has no direct impact on the volume or quality of water contained in the reservoir. • Despite potential environmental implications that are associated with development projects, it is not the mandate of NWC to decide and pronounce on these matters.
NWC, don't rush to flush- Carolyn Cooper The Sunday Gleaner, February 28, 2010	A number of points raised by Mr. Buchanan were seen as half-truths. These include Mr. Buchanan's assertion that: • The condition of Long Mountain has no direct impact on reservoir. NWC is not, and has never been the owner of Long Mountain lands. In regards to this issue, the writer provides evidence to show that the NWC was once granted functional responsibility for the long mountain lands.		
Government Supporters getting preference in sale of prime lots H G Helps The Observer Sunday July 11, 2010	• Preferential treatment was extended to individuals based on political allegiance prior to the advertisement inviting the public to purchase lots. • Lack of transparency as lots were shrouded in secrecy thus; the public was not aware of the size or the prize of the lots. • Lots were located closely to the Mona reservoir thus, potential disturbance of water supply, wildlife and the existing solid waste needs to be properly assessed. • No development will commence until an environmental permit is granted. • Under the Housing Agency administration, there will be no cross representation of sectors in the selection process for lot allocation.		

HAJ rejects claims of permanent Gov't land allocation, Jamaica Observer, Tuesday, July 13, 2010.	• Potential buyers of 54 prime lots marked for the housing development have accused the government- run HAJ of potential bias in their imminent sale. • HAJ states, that if and when a permit is approved for the development, lots will be advertised for sale, to the public, based on the board- approved allocation policy. Returns from sales of lots are critical to the upgrading of informal settlements.		
NEPA in bed with 'developers'?- Carolyn Cooper, The Sunday Gleaner, February 6, 2011	• NEPA failed to exercise due diligence in determining the environmental suitability of the Long Mountain Development. • NEPA and HAJ willfully ignored the conclusion of the EIA(in favour of a less rigorous Environmental Assessment) even through the EIA "clearly states that permission should not be granted for any more houses to be built on Long Mountain". • The ESA which stated that there would be "No significant Negative Impacts", was itself fraught with contradictions between its conclusion and the actual negative impacts detailed in the report". For example, the report stated that, "it is technically feasible to tap into the NWC's facility", while on the other hand, it is unlikely that the NWC (which is already under pressure to supply neighbouring communities) would be able to satisfy the increasing demand. • Rainwater harvesting, the solution proposed to address water supply is an "entirely unreliable solution". • A survey conducted by NEPA to ascertain the perception of residents on the	**Rebutal NEPA not in bed with developers** Jamaica Gleaner February 18, 2011	• NEPA has not made any recommendation to NRCA for the granting of approval for the development of the subdivision for houses. • NEPA's review the process of the HAJ's application which highlighted the following: ✓ In February 2009, HAJ submitted an enquiry application for an environmental permit. In March 2009, HAJ was advised of the need for additional information so as to facilitate a review of the application. ✓ In June 2009, the Ministry of Water and Housing submitted an enquiry application. Within months, the Ministry was advised that feedback from NWA and the Mines and Geology Division (MGD) was needed to facilitate the application process. ✓ On September 7, 2009 a letter of objection was received from BHCABS to which a response was issued on October 6, 2009. ✓ On November 5, 2009, a multi-agency meeting was convened with the president and members of BHCABS, technical staff from HAJ, NWA, NWC, KSAC, and Member of Parliament Dr. St. Aubyn Bartlett. A number of documents were made available upon request.

	development was flawed, due to the small size of NEPA's sample(42) compared to the 150 signatures of residents opposed the development which was submitted to NEPA by the Beverly Hills Citizens' Association Benevolent Society.		✓ Application for the development of the subdivision was circulated to a number of commenting agencies: the Environmental Health Unit- Ministry of Health, NWA, Water Resources Authority and MGD. Comments received were not in objection to the subdivision on the land for housing with the inclusion of conditions for approval. ✓ On October 22, 2009, NWA advised HAJ in writing that its existing system can accommodate the additional water supply demands and sewerage services with preconditions to the connection. ✓ HAJ was then required to undertake an ESA for which the terms of reference developed included the issues raised by BHCABS. ✓ On October 7, 2009, HAJ was advised of the inadequacies after reviewing the ESA Report and the BHCABS independent review. Subsequently, they were further instructed to undertake an EIA in which nine broad areas were conveyed for inclusion in the ToR.
		Rebutal **NEPA misses the mark** Carolyn Cooper, The Sunday Gleaner, April 10, 2011	• NEPA misread the headline in a letter to the Editor, in which a question that was asked was misinterpreted as a declaration which was unfalteringly refuted. • NEPA failed to adequately answer the initial question in a letter to the editor. • The underlying truth to the editor was questioned: "on what basis was the sale of housing lots on Long Mountain advertised on August 2, 2009, under the signature of the Minister of Housing and Water, Dr. Horace Chang?" • NEPA demonstrated an attitude of pointing fingers on the basis that it is only because the BHCABS had doubts about the findings of the site assessment that NEPA requested from HAJ a detail EIA which, to date, is incomplete. • NEPA demonstrates an attitude of "profit over

			principle". • The findings of the EIA done in 2000, highlighted the negative impacts of construction although documented, were ignored In the afternoon of Tropical Storm Nicole, significant overflow resulted in dislodgement of huge boulders and deterioration of road surfaces.

16.9

INSTRUMENT USED IN COMMUNITY SURVEY

MONA SECTION 1 SUBDIVISION

QUESTIONNAIRE

SOCIOECONOMIC ASSESSMENT FOR PROPOSED MONA SECTION 1, (HOUSING DEVELOPMENT) ST.ANDREW

Interviewer:			
Interviewee:	**Male / Female:**	**Age:**	
Date:		**Time:**	
Location:			

1. Where do you live? _____
2. What is your occupation?_____
3. What do you think of the recent expansion / housing developments in the area?
   _____
4. What would be your main concern in the event of further housing construction/ developments? _____
5. What use would you recommend for the proposed housing development site?
   _____
7. What is the state of public services and amenities in your community? (bad, fair, good)
   a. Postal_____ b. bus _____ c. fire hydrants_____ d. police_____
   e. telephone_____ f. electricity_____ g. water supply_____
   h. recreational_____ i. garbage collection _____j. cable_____
8. How do you travel? car_____ buses_____taxi_____ other_____
9. Do you frequently use Karachi Avenue? _____Times/ day_____
10. Do you frequently use the Mona /August Town main road? _____Times / day_____
11. Are you aware of any waterways located in your immediate community?
    _____
12. Can you recall any past flooding events? If yes, where did they occur and what were their effects? _____
13. Are you aware of any disaster emergency plan for your community? _____
14. If yes who is responsible and what do you do in the event of a pending disaster?
    _____
15. Do you have traffic problems in your locality?
    When?_____where?_____

SOCIO-ECONOMIC SURVEY RESULTS

ED Code and Location	Population
East 035 Mona Heights	373
East 036 Mona Heights	591
East 038 Mona Heights	473
East 039 Mona Heights	902
East 046 Beverly Hills	663
East 047 Beverly Hills	316
East 048 Pines of Karachi	717
East 043 Beverly Hills	230
Total	**3,665**

What do you think about the recent housing expansion in the area?

GOOD	INDIFFERENT	OPPOSE	OTHER
50%	38%	2%	10%

What would be your main concern in the event of the construction of the proposed housing development?

TRAFFIC CONGESTION	ENVIRONMENTAL POLLUTION	OVERCROWDING	NONE	OTHER
40%	10%	10%	30%	10%

What would you recommend for the proposed housing development site?

HOUSING	GREEN AREA/REMAIN AS IS	SHOPS	COMMUNITY CENTRE	NOT SURE
57%	33%	2%	5%	2%

What (if any) do you consider to be the most urgent community needs?

ROAD REPAIRS	RECREATION AREA	IMPROVED SECURITY	COMMUNITY CENTRE	NONE	OTHER
30%	30%	10%	10%	10%	20%

What is the state of the Public Services and amenities in your community? (bad, fair, good)

SERVICES	BAD	FAIR	GOOD
POSTAL	30%	10%	70%
TRANSPORTATION	30%	-	5%
FIRE HYDRANTS	20%	5%	70%
POLICE	10%	5%	90%
TELEPHONE	-	-	40%
ELECTRICITY	-	-	100%
WATER SUPPLY	10%	5%	90%
RECREATIONAL	40%	5%	60%
GARBAGE COLLECTION	5%	20%	80%

CABLE	5%	5%	98%

Are you aware of any waterways located in your immediate community?

YES	NO	DON'T KNOW
43%	45%	12%

Can you recall any past flooding events? If yes, where did they occur and what were their effects?

YES	WHERE	NO	DON'T KNOW
47%	Mona Road	38%	15%

Do you have traffic problems in your locality? When and where?

YES	WHERE	NO
29%	Mona Road, Wellington Road, Pine Boulevard, Hopedale Avenue, Montclair Drive	71%