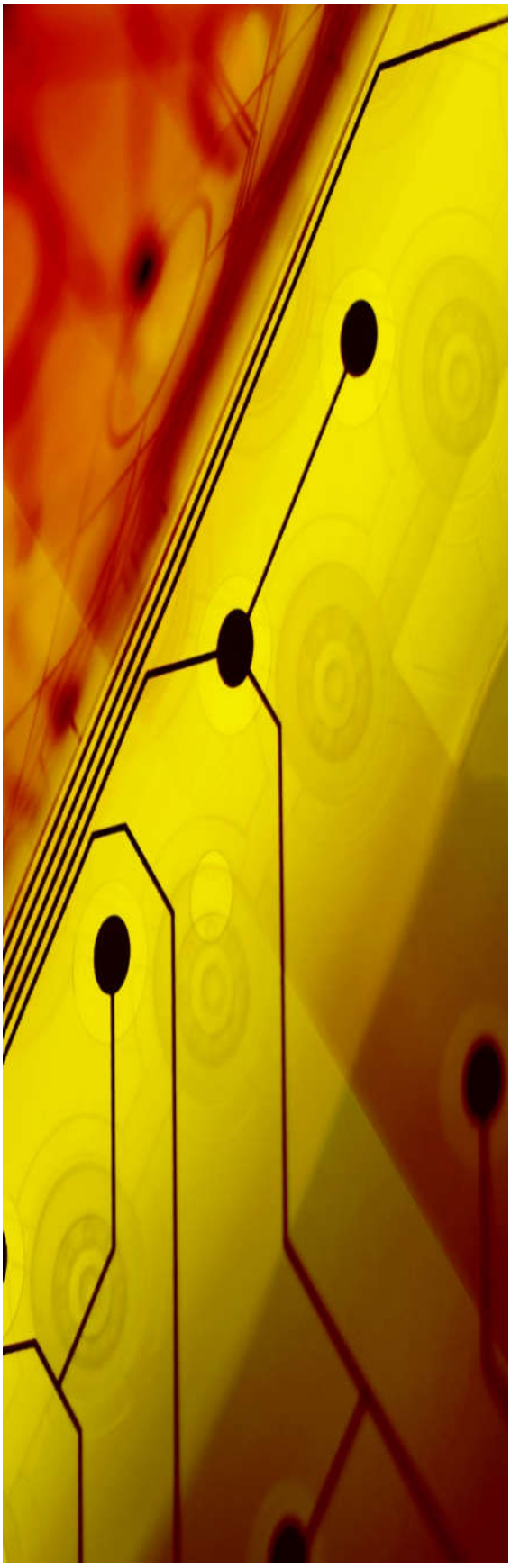

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED EXPANSION OF MEADOWREST MEMORIAL GARDENS, WHITTAKER'S MOUNTAIN,

ST. CATHERINE

FINAL DRAFT

Presented to the:
National Environment and Planning Agency (NEPA)

BY:

2018 JANUARY

REF #2014-14017-EP00022

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Presented to: National Environment and Planning Agency
10 & 11 Caledonia Crescent
Kingston 5

By: EPN Consultants Limited

2018 JANUARY

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LIST OF ACRONYMS

AAQS	Ambient Air Quality Standards Ambient Air Quality Standards
AIA	Archaeological Impact Assessment
AMSL	Above Mean Sea Level
CN	Curve Number
CO	Carbon Monoxide
dBA	Decibels
DEIA	Draft Environmental Impact Assessment
ED	Enumeration District
EHU	Environmental Health Unit
EIA	Environmental Impact Assessment
IFF	Intergovernmental Forum on Forest
JNHT	Jamaica National Heritage Trust
KMR	Kingston Metropolitan Region
MMG	Meadowrest Memorial Gardens
MOH	Ministry of Health
MOJ	Meteorological Office of Jamaica
NEPA	National Environment and Planning Agency
NLA	National Land Agency
NMIA	Norman Manley International Airport
NO^2	Nitrogen Dioxide
NRCA	Natural Resources Conservation Authority
NSWMA	National Solid Waste Management Authority
NWA	National Work Agency
NWC	National Water Commission
O^3	Ozone
ODPEM	Office of Disaster Preparedness and Emergency Management
PCQ	Point Centered Quarter
PM	Particulate Matter
RCN	Runoff Curve Number
SDC	Social Development Commission
SIA	Social Impact Assessment
SO^2	Sulphur Dioxide
STATIN	Statistical Institute of Jamaica
TOR	Terms of Reference
UDC	Urban Development Corporation
UNCCD	United Nations Convention to Combating Diversification
WRA	Water Resource Authority

1.0 EXECUTIVE SUMMARY

This EIA is a response by the Directors of Meadowrest Memorial Gardens (MMG) to the National Environment and Planning Agency (NEPA)/Natural Resource Conservation Authority (NRCA) due to their stated requirement for an environmental permit in order that the Developers might proceed with the expansion of their cemetery facility located at Whittaker's Mountain in St. Catherine. The proposal is to increase the cemetery by approximately 19.8 hectares (49 acres), from the existing 12.15 hectares (30 acres). NEPA is the lead Agency in the project's environmental permit approval process. Building approval for the site was previously approved by the St. Catherine Parish Council in 1992.

This EIA will provide information on potentially significant impacts of the Proposed Project on the environment; the manner in which those significant impacts can be avoided or significantly reduced; the significant and unavoidable adverse impacts that cannot be mitigated; and any reasonable and feasible alternatives to the Proposed Project that would eliminate any significant adverse environmental impacts or reduce the impacts levels to insignificant. This process also includes a Community Survey within the required 1 km radius assessment area.

The Proposed Project

Meadowrest Memorial Gardens (The United Church Corporation) Cemetery is located at Whitaker's Mountain in St. Catherine. The Project Site lays in close proximity the Green Acres community to the south and the Fraser's Content community to the east off the Fraser's Content to Paul Mountain Class C road. This cemetery also lies to the north-east of the adjacent Dovecot Cemetery that lies off the Kitson Town Road. The MMG cemetery is, an outreach project of the United Church in Jamaica and the Cayman Islands, provides inter alia burial facilities in St. Catherine comprising single, double and urn vaults (in earth).

At MMG the site improvements include burial vaults with Zoysia grass planted in topsoil. The proposal is for the construction an average of 1,000 single vaults and 1,500 double vaults annually on the basis that the 19.02 hectares (47 acres) are for burials only and that the remaining acreage is for parking etc. and/or is not usable because of the hilly nature of the terrain the number of vaults proposed. Development will occur in phases of 5 years and the life of the cemetery is estimated at 43 years.

The steeper slopes on the site are to be left undisturbed, in natural vegetation. The current practice and construction method for burial at MMG is 'cut and cover' where the site is excavated in phases to the required depth; vaults are constructed and then covered with the excavated material. If a plot is to be prepared for burial, the layer of filling is removed to expose the vault so that burial can be conducted. Double vault burial sites are generally chosen where soil depth is at its maximum which allows for ease of excavation to minimize cost. Double and

single vault are built after excavations of up to 5 metres (16.5 ft) and 1.8 - 2.4 metres (6-8 ft) respectively.

Excavation works of limestone bedrock have already been conducted on the western slope of the north-south elongated limestone hill near the southern section of the property to extend the area to accommodate the construction of vaults for burial. The cemetery project applies traditional irrigated, manicured cemetery landscaping. The existing cemetery site is drained by a system of subsurface drains while on the proposed expansion area there are no defined waterways. The northernmost half of the existing site currently drains to the existing Parish Council road. The north-western section of the site drains to a sinkhole at the northernmost section of the site. The central and southern half the existing site drain to the major gully which runs east of MMG in a north to south direction. A second sinkhole was noted in the southern section of the existing site that receives flows from sections of the internal roads.

The monthly consumption of water from an unreliable public water supply system is currently 450 thousand litres. An existing septic tank currently serves the MMG cemetery; no increase in demand for waste water treatment is anticipated. The Jamaica Public Service Company Limited currently supplies electric power and FLOW and Digicel supply telephone service. The Project provides a location for interment and the Project Proponents have projected that given the present demand and the low capacity level of the MMG cemetery, there is urgent need for the expansion of the facility.

The Physical Environment

The recently acquired land adjoins the Project Site along the west and south western boundaries is an area of subdued karst topography consisting of low, elongated limestone hills in the south and south east and flat to gentle slopes towards the south western section of the property. A slope analysis of the National Land Agency's 12,500 map contours revealed that the expansion area has slope gradients that vary from 15 degrees (28% slope) to less than 4 degrees (7% slope) on the flat to gentle sloping section of the site. The subdued limestone hills make up approximately 40-45 % of the land to be released for burial expansion. The strength, structure and weathering characteristics of the limestone vary across the site. The elongated limestone hill on the south and south eastern section consists of rock partially recrystallized of moderate strength. Removal of limestone material for the preparation of burial site was achieved by blast excavation.

The thickness of the lateritic soil varies over the site. The limestone hills consist of very thin soil (a few cm thick) to non-existent. Observation from test pits and recent excavated areas show soils up to 3 metres thick near the south western boundary of the site. The results of the percolation tests indicate that the soils at MMG have a low to very low percolation rate.

The Project Site falls within the Lower Rio Cobre sub-watershed. The Rio Cobre is the primary surface water feature within the hydrologic basin. The reliable surface water resources for the Lower Rio Cobre Basin have been quantified as 146 $\times 10^6$ m^3 per year (WRA, 2006). An

unidentified surface water feature runs along the eastern edge of the property. The Cut Throat Gully is located 2.59km to the south while the Rio Cobre River lies approximately 4.69km east of the site. The Rio Cobre is the primary surface water feature within the hydrologic basin. The proposed expansion site has no clear drainage feature associated with it.

The peak storm water flows from the proposed site presently, is estimated to vary from 0.4 to 0.8 m^3/s. The total runoff volume from the proposed site will vary from 2,619 to 18,911 m^3. The development of the site will increase the peak flows to the gully by 2.9 to 0.6 percent from the 2-year to 100-year storm event. The peak and total runoffs are not expected to have any significant impact downstream of the site.

The Project Area is located within the limestone outcrop region of the basin. The Walderston Browns Town Formation that underlies the Project Site has been characterized as a Limestone Aquifer under Jamaica's hydro stratigraphic suite. Depth to groundwater in the vicinity of the Project Site is approximately 30 metres below ground level.

There are no observed geological faults on the site. The nearest mapped fault is located 1.5 kilometres northwest of the Project Site and trends northwest-southeast. Groundwater flow is in a south and south easterly direction towards the coast. This area represents a major ground water pumping depression within which groundwater levels are historically below sea level. The closest pumping wells to the site are the Fraser's Content and the Dovecot Park wells. The Green Acres well which is located 1.51km south of the site and the Brown's well located 1.78km east of the site are both National Water Commission (NWC) production wells which provide potable water supply to the Green Acres and Dovecot Park communities respectively.

Air Quality

Sensitive air quality receptors in the vicinity of the Site are limited to local residential land uses at Green Acres to the south west and Frasers Content to the east. Sampling conducted for noise at Station 1 (on the property) and Station 2 (near the boundary between the cemetery and the receptor community of Green Acres) showed that noise impact on the adjacent receptor community of Green Acres is insignificant. Potential environmental noise sources are machinery, traffic and burials ceremonies. Based on the results of the analysis of particulate samples (10 microns) their levels at the site and the receptor communities were also found to be fall within NEPA's minimum standards.

Carrying Capacity

Carrying capacity as it relates to the expansion of the MMG cemetery refers to the intensity of the development and the capacity of the immediate ecosystem to absorb further development. The general findings indicate degraded conditions (flora) while site fauna did not suggest potentially significant impacts. With respect to the social and economic impacts of the project, job creation within the existing community is an ongoing positive element of the project.

In the general layout of the cemetery site, the plan is to segment the site into large plots separated by walkways. It is necessary that the burial sites are grassed as soon as each plot is completed. Where access roads to burial sites will be used as conveyance for storm water, the access roads should be paved and kerb and channel structures used to control storm water to minimize erosion.

Disaster Risk Reduction

The proposed site is generally flat to but slopes gently towards the south. The potential for slope failures is low. Currently, storm water is removed from the site mainly by sheet and overland flow. Given existing conditions, the potential for flooding of the Green Acre residential community is limited during intense storm events given the capacity of the storm water conveyance system to remove excessive flows efficiently from the site.

Runoff models calculated for the peak flows to the Eastern Gully estimate an increase of 2.9 % to 0.6 % for the 2 year to 100 year return period events after the cemetery site is developed. The post development period therefore shows insignificant increases from pre-development to post-development in storm water drainage. Similarly, increase in total runoff volume after the site is developed ranges from 1.9% to 0.7% for the same return periods.

Overland flow will be discharged into drainage systems provided they are designed using appropriate design return periods for the cemetery site and that there is no blockage within the on-site or off site drainage system due to debris and high sediment load.

With respect to wind damage from a hurricane, the only permanent building structures that are connected to the burial site are the chapel and the office located on the existing cemetery site, hence the likelihood of large scale damage is minimal.

Social Impact Assessment

The MMG is located in the suburban area of Spanish Town, the administrative capital of the parish of St. Catherine. The three (3) parishes of St. Catherine, Kingston and St. Andrew combined comprise a population of 1,097,644 in 2011 (STATIN) or 40.7% of the island's population. Land use planning in St. Catherine is covered under the Town and Country Planning (St. Catherine Area) *Draft* Development Order, 2017 (*material consideration*). The Project Area falls under the jurisdiction of the St. Catherine Parish Council. The socio-economic, physical planning and spatial implications of the proposed cemetery expansion is significant within the context of the KMR due to the general low capacity of facilities for burials within the region.

Within the Enumeration Districts that align with the site of the proposed project the population at the 2011 Population Census was 1,214 (STATIN, 2012). The residential communities (travelling towards the south from MMG) are Red Pond, Johnson Pen, Lower Fraser's Content and Upper Fraser's Content. Socio-economic conditions, based on housing quality, in these communities, appear to fall below those of the more affluent Green Acres community to the

south. The Fraser's Content Development Foundation oversees the affairs of the community. The Social Development Commission (SDC) that promotes community development is also active in the area. Within the receptor community, the community survey data shows mean household size of 4.7 persons.
With respect to social services and amenities these are the findings:

- The Project Site is located within Area III of the four (4) administrative zones of the Jamaica Fire Brigade (JFB) with the Spanish Town Fire Brigade Station serving the Project area.
- St. Catherine has the largest number of public educational institutions.
- The National Water Commission (NWC) is the main institution responsible for all major water and sewage operations including: production of water collection, water treatment and disposal of urban sewage. Potable water supply in the parish is supplied primarily by wells of which there are three within the general area of the project.
- At MMG the existing waste water solution is by way of an onsite septic system.
- Solid waste generated at the Project Site include paper and plastics disposed of by mourners, vegetation cuttings from site clearance, earth from excavation works and rocks from blasting activities.

Traffic

The MMG access road (Fraser's Content Boulevard) runs north off the St. John's Road as a Parish Council (St. Catherine Parish Council) road that provides access to residents of the neighboring community. Parish Council roads allow communications and contact with or between communities/districts. The traffic survey attempted to capture the cemetery bound traffic. The St. John's Road (East - West) Traffic flow totaled 19,748 vehicles. The proposed MMG development would continue to bring a significant volume of vehicular traffic entering and exiting the cemetery especially on week-ends. The level of service "C" at the St. Johns Road/Frasers Content Boulevard intersection signifies *Steady Traffic but Limited* which indicates effects, such as, drivers being affected by the presence of other vehicles at the intersection

Visual Assessment

This section provides an analysis and assessment of the aesthetics and open space at the proposed expansion area at the Project Site. The primary views at the site of the proposed expansion are the residential subdivision of Green Acres to south and the disturbed open woodlands to the south and to the west. The existing land use and its proposed expansion create open space views because of its design as a garden cemetery. The other immediate land use is residential as the Northern boundary of the Green Acres subdivision abuts on to the cemetery lands and Upper Frasers Content road and community from its eastern boundary.
The visual impact of the cemetery is most notable on entering the facility impacting only a few adjacent residences in Green Acres. A coherent landscape design provides linkage between the

topographical elements at the site and at the proposed expansion area. The proposed expansion would have a visual impact. There would be major land clearance that would be the most significant visual impact.

Stakeholder Consultation

A community survey was conducted within the Project Area over the period 2014 November 24 to 27. In general, except for the overall concern for the poor road conditions and unreliable water supply, responses to the questionnaire on potential impacts of the proposed project were generally positive. In addition, respondents did not consider impacts land values as significant. However, the impact of the proposed project on the local economy is considered positive as the cemetery is a regular source of employment for the community.

Environmental Impacts and Mitigation

A summary of the environmental consequences associated with construction and operations of the Proposed Project are shown below:

Geology and Soils: Impacts on Structures

ENVIRONMENTAL ISSUES	IMPACT (L/M/H)	SIGNIFICANCE L/H	DURATION OF IMPACT (S/M/L)	DIRECT/INDIRECT IMPACT (D/I)
I. Geology and Soils Would the project:				
b) Result in substantial soil erosion or the loss of top soil?	M	L	M	D

Geology and Soils: Specific Impacts

INDICATOR	IMPACT	MITIGATION
Construction/Implementation		
Erosion	The process of the removal of vegetation and excavation works (earthworks) for land readjustment will create open spaces with exposure of soils which could cause a subsequent increase in surface runoff which may in turn result in soil erosion. This could result in sediment loading of waterways.	Appropriate management of the construction process to ensure that excavation activities are aligned with vault and access road construction and the building of terraces so that exposed areas are not left for unnecessarily long periods.

Hydrology/Water: Impacts on Eco-systems

ENVIRONMENTAL ISSUES	IMPACT (L/M/H)	SIGNIFICANCE L/H	DURATION OF IMPACT (S/M/L)	DIRECT/INDIRECT IMPACT (D/I)
III. Hydrology Would the project:				
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?	M	L	L	D

Hydrology/Water: Specific Impacts

INDICATOR	IMPACT	MITIGATION
Construction/Implementation		

Hydrology Surface water hydrology and channel morphology *Water ways*	Pollution could occur from suspended materials in storm water and from spills or leaks of fuel oil and construction materials. Potential for increased sedimentation and turbidity of waterways from site preparation and preparing ground for vault construction,	Peak flows and total volume runoff estimated from the runoff models should be used to assist in the design of the internal drainage system and other drains that may connect to the Eastern Gully.
INDICATOR	**IMPACT**	**MITIGATION**
Operation/Maintenance		
Hydrology Surface water hydrology and channel morphology	Potential for increased sedimentation of waterways .	The blocked culvert on the Eastern Gully must be cleared and properly maintained.

Local Climate: Impacts on Ecology and the Public

ENVIRONMENTAL ISSUES	**IMPACT (L/M/H)**	**SIGNIFICANCE L/H**	**DURATION OF IMPACT (S/M/L)**	**DIRECT/INDIRECT IMPACT (D/I)**
VI. Local Microclimate Would the project:				
b) Substantially reduce the number of trees in the project area?	H	H	L	D

Local Climate: Specific Impacts

INDICATOR	**IMPACT**	**MITIGATION**
Operation/Maintenance		
Local Climate	It is likely that the microclimate at the project site will be altered from its present condition due to the need to extensively remove the vegetation.	Landscaping of the lawn using drought resistant grass, such as, zoysia grass limit the possible effects of heat trapping. The planting of and ornamental plants and trees would also mitigate the negative effects on microclimate.

Social Infrastructure: Impacts on Public Services within the Development area

ENVIRONMENTAL ISSUES	**IMPACT (L/M/H)**	**SIGNIFI-CANCE L/H**	**DURATION OF IMPACT (S/M/L)**	**DIRECT/ INDIRECT IMPACT (D/I)**
Social Infrastructure Would the project:				
b) Provide a substantial number of employment opportunities for neighbouring community members throughout the project lifecycle?	H	H	L	I

Social Infrastructure: Specific Impacts

INDICATOR	**IMPACT**	**MITIGATION**
Construction/Implementation/ Operation/Maintenance		
Social Infrastructure	The demand for interment facilities for the KMR is high and is expected to remain so given annual population increase in the Region	N/A
Employment	MMG is the source of employment for the adjacent communities, priority for employment is given to the residents within the immediate community.	N/A

Land Use and Planning: Impacts on Community Conservation and Habitat Conservation

ENVIRONMENTAL ISSUES	IMPACT (L/M/H)	SIGNIFI-CANCE L/M/H	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
Land Use and Planning Would the project:				
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.	M	M	L	D

Land Use and Planning: Specific Impacts

INDICATOR	IMPACT	MITIGATION
Construction/Implementation		
Land Use and Land Value	The potential effects on existing communities and the compatibility of land use	Application of best practices to minimize impacts. Adequate screening methods should be used to minimize visual impact.

Transportation and Traffic: Impacts on Public Safety and Travel

ENVIRONMENTAL ISSUES	IMPACT (L/M/H)	SIGNIFI-CANCE L/M/H	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
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)?	M	M	L	I
b. Exceed, individually or cumulatively, the level of service standards established for the designated roads or highways?	M	M	L	I

Transportation and Traffic: Significant Impacts

INDICATOR	IMPACT	MITIGATION
Operation/Maintenance		
Traffic	There are increased traffic flows on weekend and the accompanying noise and dust. Driver indiscipline	Urgent attention needs to be made to the improvement of the access road. Need for regular police patrols in the area on week-ends. A turn lane at the intersection with St. Johns Road and Frasers Content Boulevard would facilitate smoother traffic flow towards MMG

Aesthetics: Impacts on the Landscape and Visual Resources

ENVIRONMENTAL ISSUES	IMPACT (L/M/H)	SIGNIFICANCE L/H	DURATION OF IMPACT (S/M/L)	DIRECT/INDIRE CT IMPACT (D/I)
Aesthetics Would the Project:				
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	M	H	L	D

Aesthetics: Specific Impacts

INDICATOR	IMPACT	MITIGATION
Construction/Implementation		
Landscape /Scenic Vista	Construction of the proposed development warrants removal of the majority of tree species currently on the site. This would negatively affect the scenic vista of the area	Although some re-vegetation will occur the impact will be long term. There would also be a permanent change in the landscape.
Operation/Maintenance		
Landscape/ *Scenic Vista	It is not anticipated that there will be any negative impacts associated with the scenic vista of the site during the operation/ maintenance phase.	Based on the development proposal the area of expansion will be aesthetically pleasing.

Air Quality: Impacts on Public Health

ENVIRONMENTAL ISSUES	IMPACT (L/M/H)	SIGNIFICANCE L/H	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
Air Quality Would the Project:				
c) Expose sensitive receptors to substantial pollutant concentrations?	M	M	N/A	N/A

Air Quality: Specific Impacts

INDICATOR	IMPACT	MITIGATION
Construction/Implementation		
Air Quality	The operations of heavy-duty vehicles and equipment are likely to produce increased combustion emissions. Atmospheric dust from bare soils, stockpiles, uncovered, overloaded trucks and storage equipment.	Stockpiles should be covered or sprinkled daily to reduce particulate count especially in the vicinity of sensitive receptors. Besides a permanent boundary structure a vegetation screen would be a buffer from gaseous and particulate emissions.
INDICATOR	**IMPACT**	**MITIGATION**
Construction/Implementation		
Air Quality	Ongoing use of heavy machinery, such as, backhoe result in exhaust emissions Traffic on week-ends result in an increase in levels of particulates and emissions	As above

Noise and Vibration: Impacts on the Public

ENVIRONMENTAL ISSUES	IMPACT (L/M/H)	SIGNIFI-CANCE L/M/H	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
Noise and Vibration Would the project:				
d) Create a substantial temporary or periodic increase in ambient noise levels in excess of noise levels existing without the project?	M	M	M	I

Noise and Vibration: Specific Impacts

INDICATOR	IMPACT	MITIGATION
Construction/Implementation		
Noise & Vibration	Impacts will invariably be generated, as access road is cut and vaults are built. These impacts include: Noise nuisance and vibration that could likely to result from periodic controlled blasting and use of heavy equipment.	Establish a timetable for the use of heavy equipment ensuring that activities to generate noise and vibration are conducted within the workday between 9.00 am and 5.00 p.m.

Residual Impacts

Soils, Geology and Hydrogeology – Construction is ongoing so new drainage pathways will be developed order to manage storm water flows as the development proceeds.

Water quality – Within the immediate ecosystem the most significant impact could be that on ground water resources, however, the practice of sealing vaults offers protections from this impact.

Employment – Continuous source of employment for community members.

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2.0 INTRODUCTION

2.1 HISTORY AND BACKGROUND OF THE PROJECT

Meadowrest Memorial Gardens Cemetery which is owned and operated by The United Church Corporation) is located at Whitaker's Mountain in St. Catherine. The Project Site is located in close proximity the Green Acres community to the south and the Fraser's Content community to the east off the Frasers Content to Paul Mountain Class C road (Figure 2.1). This cemetery also lies to the north-east of the adjacent Dovecot Cemetery, along the Kitson Town Road. Generally, study area was set at a 1 kilometer radius which includes the adjacent communities of Fraser's Content, Johnson Pen and Green Acres.

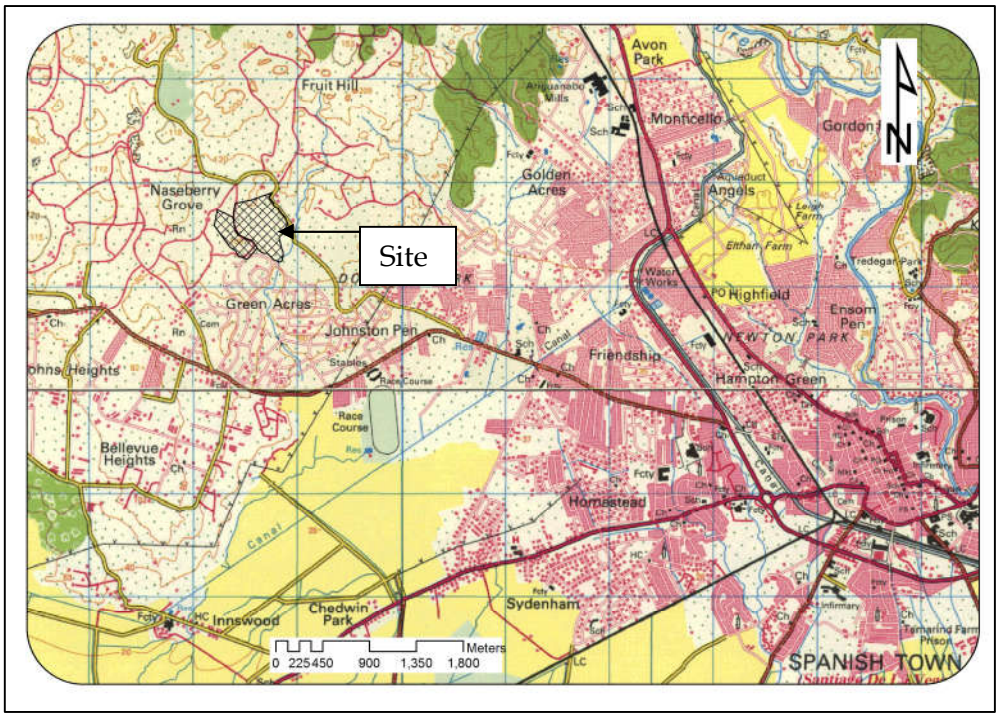

Figure 2.1: Site location for Meadowrest Memorial Gardens (Taken from 1:50,000 metric topographic map of Spanish Town)

The subject site is oriented east – west. Its subdued karst topography consists of low, elongated limestone hills in the south and south east and flat to gentle slopes towards the south western section of the property. The area the elevation of the site ranges from 100m to 115m (328ft-377ft) above mean sea level (amsl). The expansion area was previously designated Agricultural Lands but the section owned by the Project Proponents has since been released by the St. Catherine Parish Council to be used for the cemetery expansion.

2.2 THE PROPOSED PROJECT

This EIA is a response by the Directors of Meadowrest Memorial Gardens (MMG) cemetery to the National Environment and Planning Agency (NEPA)/Natural Resource Conservation Authority (NRCA) stated requirement for an environmental permit to expand its cemetery at Whittaker's Mountain in St. Catherine by approximately 19.8 hectares (49 acres), from the existing approved 12.15 hectares (30 acres) (see Figure 2.1). The existing facility comprises 5 lots as follows:

Volume 1044 Folio 283	*30 acres*	*- approved for cemetery use*
Volume 1044 Folio 284	*5 acres*	*- environmental permit being sought*
Volume 1231 Folio 979	*5 acres*	*- environmental permit being sought*
Volume 1231 Folio 980	*5 acres*	*- environmental permit being sought*
Volume 1231 Folio 981	*10 acres*	*- environmental permit being sought*

The development lies outside of the urbanized area of St. Catherine and therefore does not require development approval under the Town and Country Planning Act. However, the Project would require building approval from the St. Catherine Parish Council under the Building Act, for any construction activity, such as the building of vaults.

This EIA Report addresses the potential environmental impacts associated with the proposed development. This Report, therefore serves to inform the NEPA and NRCA decision-makers, regulatory authorities and the public-at-large of the nature and environmental effects of the Proposed Project. The EIA has been prepared in accordance with, and in fulfillment of, Section 10 of the Natural Resources Conservation Act and the Licences and Permits Regulations 1991. NEPA is the lead Agency in the project's permit approval process. Building approval for the site was previously approved by the St. Catherine Parish Council in 1992.

2.3 ENVIRONMENTAL PROCEDURES AND SCOPE OF ENVIRONMENTAL REVIEW

NEPA's letter dated 2013 February 11 was a response to a letter from the Directors dated 2013 December 17 (please see Appendix 13.1). They had written requesting the Agency's support for the release of an additional 25 acres of land for the expansion of the cemetery. The Agency advised them that they were in breach of Section 9 of the NRCA Act as they were proceeding without an environmental permit. The Directors of MMG were therefore required to submit an application for an environmental permit. The Agency requested that a Technical Report should accompany the application and indicated that it should satisfy the statutory requirements of other relevant government agencies, such as, the Ministry of Health, Water Resources

Authority, National Works Agency, Mines and Geology Division and the St. Catherine Parish Council. The developer was also asked to be guided by the Restrictive Covenant and Discharge Modification Act, 1960.

A response to the application for the environmental permit that was submitted 2014, January 28, was made in letter dated 2014, May 27, indicating that the environmental screening results indicated that given the nature and scope of the proposed development, the existing vegetation cover, the expected loss of biodiversity and the potential negative environmental impacts, an EIA was required pursuant to Section 10 of the Natural Resources Conservation Act, 1991. The Terms of Reference (TOR) is attached in Appendix 13.3. It was recommended that the general outline of the EIA should include the following:

1. Executive Summary
2. Introduction
3. Legislation and Regulatory Considerations
4. Project Description
5. Description of the Environment
6. Socio-economic Environment
7. Public Participation
8. Environmental Impacts and Mitigation
9. Residuals
10. Analysis of Alternatives
11. Environmental, Health, Safety, Management and Monitoring Plan
12. List of References
13. Appendices
14. Activities
15. Outline of a Typical EIA Report

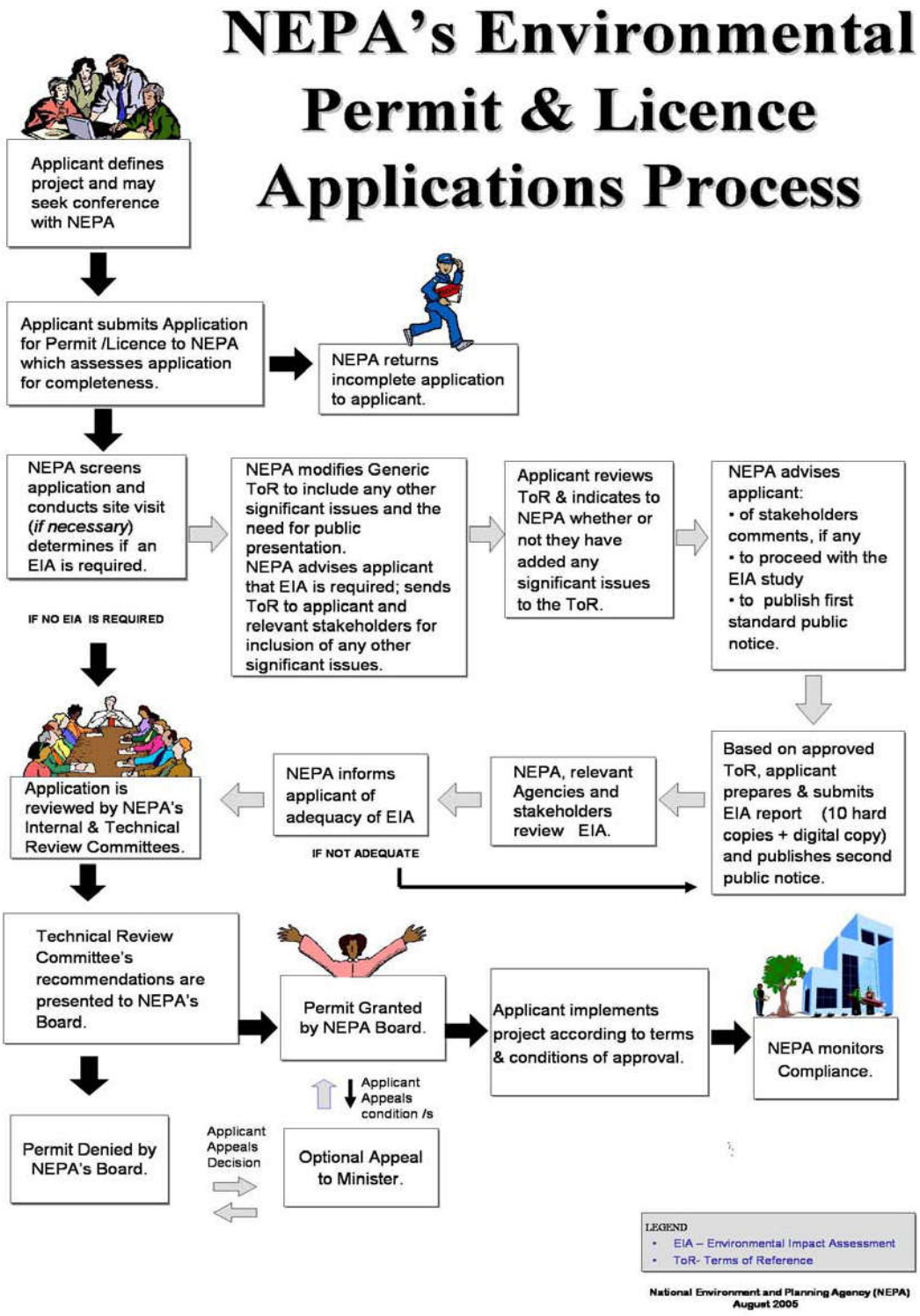

Figure 2.2: NEPA's flow chart for the Environmental Permit and Licences process.

This EIA will provide information on potentially significant impacts of the Proposed Project on the environment; the manner in which those significant impacts can be avoided or significantly reduced; the significant and unavoidable adverse impacts that cannot be mitigated; and any reasonable and feasible alternatives to the Proposed Project that would eliminate any significant adverse environmental impacts or reduce the impacts levels to insignificant. Once approved, the EIA will provide baseline environmental conditions at the proposed site and assist the Agency during decision making. Other agencies may also use this EIA in their assessment of the application. The environmental permitting process is illustrated in Figure 2.2.

2.4 THE PUBLIC CONSULTATION PROCESS

In accordance with NEPA, a good faith effort has been made during the preparation of this EIA to contact affected agencies, organizations, and persons who may have an interest in this Project. This process also includes a Community Survey within the required 1 km radius of the site. In addition, a public consultation will be held to which the public will be invited to attend to offer oral comments on the EIA. The date of the public consultation will be published in a daily newspaper along with the locations of where the EIA can be reviewed by the public and interested parties, agencies and organizations. Comments may be made on the EIA before the end of the comment period.

Following the close of this public comment period, a Final EIA will be prepared in order to respond to all comments from the relevant agencies and the public.

2.5 REPORT FORMAT AND ORGANIZATION

The content and format of this EIA are designed to meet the requirements of NEPA. The report is organized into the following chapters:

Chapter 1, Executive Summary, summarizes the project; it's Impacts and available Mitigation Measures.

Chapter 2, Introduction and describes the EIA process; the public review process; and, report format.

Chapter 3, Legislation and Regulatory Consideration, considers all the relevant agencies, legislations and international agreements and conventions.

Chapter 4, Project Description, describes the Proposed Project, its objectives and the approvals necessary for project implementation.

Chapter 5, Description of the Environment, describes the existing conditions and environmental setting before project implementation.

Chapter 6, Socio-economic Environment (within the receptor communities).

Chapter 7, Public Participation, outlines the outcomes of efforts to engage the community before project implementation.

Chapter 8, Identify Potential impacts that would result from the Proposed Project and proposed mitigation measures to reduce those impacts.

Chapters 9, Residual Impacts that outlines impacts that remain after the mitigation measures have been implemented.

Chapter 10, Analysis of alternatives, assesses possible alternatives to the proposed project and, mitigation measures that would eliminate or reduce significant environmental impacts.

Chapter 11, Outlines an Environmental, Health, Safety, Management and Monitoring Plan to be followed during project implementation.

The EIA ends with the List of References (12) and Appendices (13).

2.6 GENERAL METHODOLOGY

The National Environment and Planning Agency (NEPA) in following its framework for environmental permitting, through its 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. The 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 within the vicinity of the proposed development, environmental data and other findings were used to strengthen the of baseline data collected.

3.0 LEGISLATIVE AND REGULATORY CONSIDERATIONS

Chapter 3 covers the relevant regulatory authorities, legislations and regulations and some applicable international conventions and

Table 2.1: Relevant Regulatory Authorities

Regulatory Authorities	Description
The National Environment and Planning Agency	Under the Natural Resources Authority Act and the Permits and Licences 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 and the Building Act, 2011. 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 St. Catherine 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 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 road design for proposed subdivision 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 the development proposal.
St. Catherine Parish Council	The St. Catherine Parish Council 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
Office of the Prime	This ministry has responsibility for coordinating the functions of the local authorities such

Minister (Local Government Division)	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 2.2: Relevant Regulatory Legislations

Relevant Legislations	Description
The Natural Resources Conservation Authority (NRCA) Act, 1991	The NRCA Act (1991) is the over-riding 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 fourteen (14) 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 area affected by the discharge of effluent.
Natural Resources Conservation	Water treatment facilities including sewage and industrial wastewater require permits.

(Permits and License) Regulation, 1996	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
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 stipulated that the developer had the responsibility to dispose solid waste from the facility at an NSWMA approved disposal site.
The Wild Life Protection Act, 1945 and The Wildlife Protection (Amendment) Act Order 1998	The Wild Life Protection Act and Regulations are administered by NEPA which: • Establish two types of protected areas which are: Game Reserves (Private Lands) and Game Sanctuaries (Crown Lands) • Provide a list of protected species (which include all birds) for which protection is given. • Regulate the bird shooting season. • Allows exemptions to keep protected species. • List protected animals and species which include turtles, crocodiles, Jamaican Iguana and West Indian Manatee Designated personnel under the Act [s.15] are: Game Wardens Fishery Inspectors Constables These designated personnel are given responsibility of and the required power to ensure compliance with the legislations. For example, the Game Warden/Constable/Fishery Inspector may enter and inspect land where it is suspected that an offence took place or is about to be committed.
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	There is a current Town and Country Planning (St. Catherine Area) *Draft* Development Order, 2017 (*material consideration*) however under the existing St. Catherine Coast Confirmed Development Order, 1965: 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.
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 requires 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.
Fire Brigades Act, 1988, Amended 1990, 1992	Section 5.- (1) The act states that it shall be the duty of the brigade to protect life and Property in the case of fire or other disaster and, without prejudice to the generality of the foregoing.
Burial within Towns Limit Act, 1875	Section 3: It shall not be lawful to bury a dead body within the limits of any town or village which may have been defined for the purposes of this Act, in any ground or place not being a parish, or vault in a church, chapel or place of worship wherein burials may lawfully be made, or a burial ground belonging to any such church, chapel or place of worship, or ground habitually used as a place of burial by members of any sector congregation, without licence from the Local Board of Health or without such precautions as such Local Board of Health, or without such precautions as such Local Board of Health may prescribe.
Public Cemeteries Management and Regulations Act, 1894	12 Assignment of portion of the cemeteries to churches or congregations The Council, on the application of any church or congregation within the parish made by a minister duly authorized to officiate in such church or congregation, or recognized as such by the religious community or society to which he belongs, or by any relevant body of trustees or other persons who may be authorized to represent such church or congregation, shall set apart a portion of the cemetery to be used as a burial ground for purposes of interment according to the rites of such church or congregation; and any portion so set apart may be consecrated or dedicated according to the rites of the church or congregation to which it shall be assigned, and shall be used only for burials according to the rites of such church or congregation.

Table 2.3: 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	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

Biological Diversity	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.
United Nations Convention to Combating Diversification (UNCCD)	The United Nations Convention to Combat Desertification (UNCCD) was adopted in Paris on 1994 June 17 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. The 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.
The Sendai Framework for Disaster Risk Reduction 2015–2030 (the successor to the Kyoto Protocol)	At the global and regional levels the Sendai Framework for Disaster Risk Reduction aims to develop effective global and regional campaigns as instruments for public awareness and education, building on the existing ones. Priority 1: Understanding disaster risk Priority 2: Strengthening disaster risk governance to manage disaster risk. Priority 3 Investing in disaster risk reduction for resilience. Priority 4: Effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction.

Other relevant policies and guidelines include:

1. Town and Country Planning (St. Catherine Area) *Draft* Development Order, 2017 (*material consideration*) *The Manual for Development* – proposes to offer guidance to Architects, Planners, Engineers, Land Surveyors, Developers, other Consultants and the public in general so that they can contribute to good environmental planning and project design.
2. *Vision 2030 Jamaica Development Plan* by the Planning Institute of Jamaica (PIOJ)
3. *World Health Organization (WHO) standards*

4.0 PROJECT DESCRIPTION

The Proposed Project, the expansion of the MMG cemetery, will add additional gardens to the south west on the MMG. The facility is an outreach project of the United Church in Jamaica and the Cayman Islands. It provides, inter alia, interment facilities in St. Catherine comprising single, double and urn vaults. The proposal is to expand the cemetery by approximately 19.8 hectares (49 acres), from the existing approved 12.15 hectares (30 acres) (Figure 4.1). The expansion has the support of the Ministry of Agriculture, Industry, Commerce and Fisheries (MICAF) as in their letter dated 2013, February 8, they offered no objection to the proposal (see Appendix 13.2. Each developable acre has the capacity to accommodate 1,470 single and 2,800 double vaults.

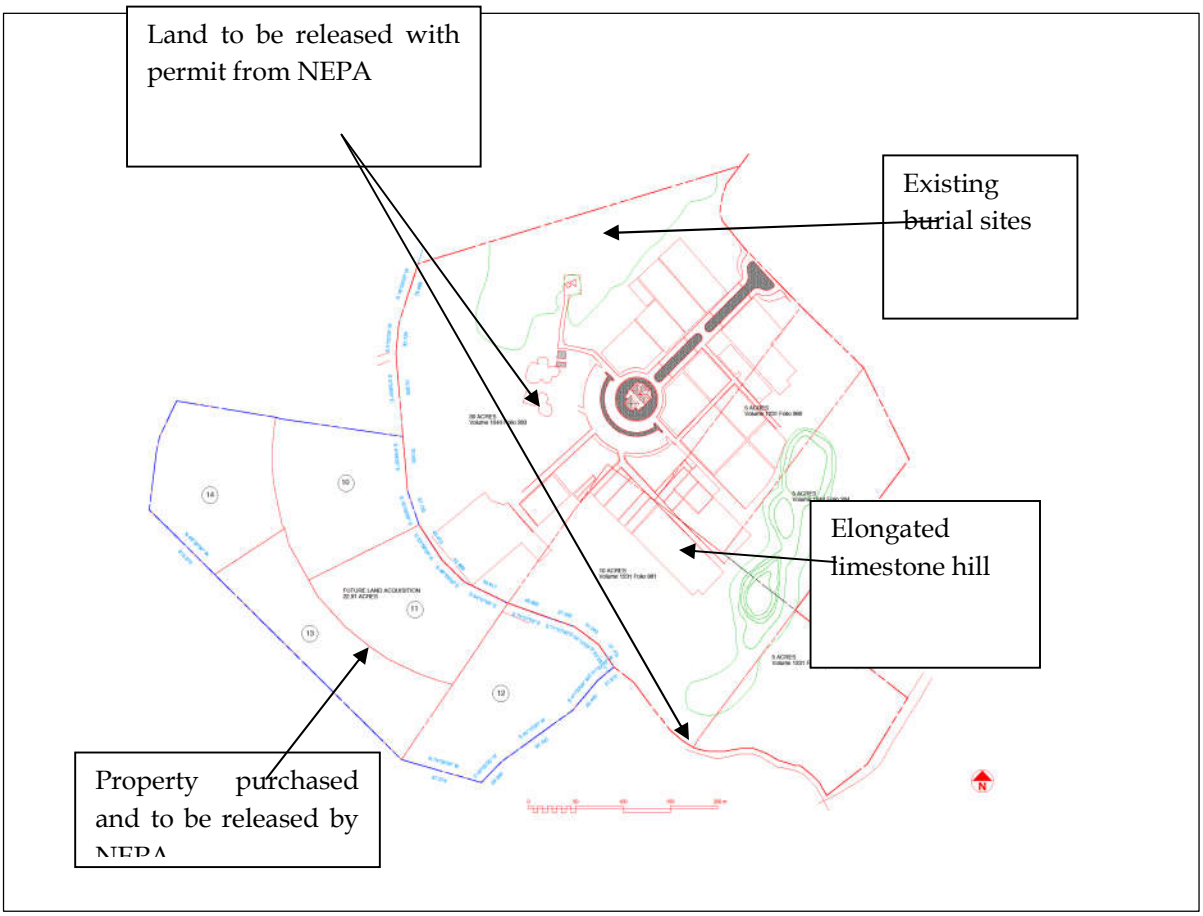

Figure 4.1: Site Layout- Meadowrest Memorial Gardens showing the existing Memorial Gardens

4.1 GENERAL OPERATIONS SCHEDULE AND STAFFING

The cemetery will continue to be operated as a high quality traditional service oriented

cemetery, to provide an eternal resting place for all faiths. The main administrative office is located at 12 Carlton Crescent, Kingston 5. The facilities are normally open from 10.00 am to 6.00 pm seven days a week to accommodate burials. However, from 8.00 am to 5.00 pm Mondays to Fridays the schedule involves site preparation, vault construction, laying of plaques (headstones) and landscaping among other activities. At the Head Office in Kingston all relevant arrangements for the utilization of the cemetery are made. The staff comprise the Managing Director (who reports to a Board of Directors) and five (5) full-time and three (3) part-time staff members.

A Superintendent and an Assistant Superintendent are directly responsible for the management of the day-to-day operation of the MMG cemetery. In addition, there are eight (8) full time grounds men and a watchman. Other workers are added on a temporary or casual basis and can be as many as thirty-five (35) on extremely busy days (Saturdays and Sundays). Vault construction is undertaken by two (2) contractors who are responsible for the employment their own workers. Most of those employed are from the surrounding areas, many of whom can multitask. A security firm is also on location at the week-ends.

4.2 EXISTING SITE CHARACTERISTICS AND PROPOSED IMPROVEMENTS

4.2.1 Existing Site Characteristics

The proposed expansion area is characterized by open, rolling, grassland with scattered trees. The entrance to the cemetery complex is a single landscaped dual carriage way off the Frasers Content road. MMG fits into the lawn cemetery concept that was developed to minimize maintenance problems. Primary aims are to achieve visual simplicity, and ease of maintenance. These cemeteries feature no upright headstones but rows of uniform graves marked by identifying plaques. The lawns can be mowed as if it were a football field as the effect is much the same. These cemeteries were designed to facilitate alternative uses when full[1]. At MMG the site includes the following improvements:

- A chapel with a reception area and restrooms
- Burial vaults with Zoysia grass planted in topsoil

[1] Merrit, Nigel (1986) A study of historical cemeteries throughout New Zealand, their value and significance to our culture and means of future restoration, renovation and maintenance.
http://researcharchive.lincoln.ac.nz/bitstream/10182/3246/4/morritt_dippr.pdf Retrieved 2014 November 6

- Landscaped area along entrance/exit road and the front boundary of the property
- Site administrative office
- Digicel Jamaica cellular base station
- Parking
- Precast concrete slab preparation areas
- A storage area

4.2.2 Construction and Phasing

There will be no need for the construction of new buildings as the existing ones will be able to accommodate the expansion area as it is not expected that the existing capacities will be exceeded. Vault development will occur on approximately 19.02 hectares (47 acres) as no construction will occur on the steep slopes and on areas reserved for road/walkways and parking. The cemetery would be developed contiguously in phases. It is expected that once the capacity at an existing location is exceeded, construction will continue with a similar schedule at another location (see Appendix 13.2). Each phase would accommodate approximately 5 years of burial capacity over the approximately 43-year life of the cemetery. Those vegetated areas suitable for the construction of vaults will be developed. There will be some tree buffers and forested areas on the higher slopes will be left undisturbed, this will also serve to retain the character and serenity of the site. The estimated capacity is as follows:

1. The capacity per acre for burials is	- Single Vaults	= 1,470
	- Burials (1400 x 2)	= 2,800
2. Projected annual burial usage	- Single Vaults	= 1,000 (40%)
	- Doubles	= 1,500 (60%)
3. Total burials (singles) that can be accommodated on 47 acres=47x1,470		= 69,090
4 Total burials (doubles) …… on 47 acres=47x2,800		= 131,600
5. Number of burials (singles) as well as doubles 40% of 69,090		= 27,636
6 Number of burials (doubles) as well as singles 60% of 131,600		= 78,960
		=106,596
7. Total number of years that burials can be accommodated	106,596	= 42.6 Years
	2,500 vaults per annum	

The construction programme is influenced by demand, as well as, the need to maintain a reasonable inventory. In addition, it is necessary to provide some flexibility in terms of spacing. The aim is to ensure that interments take place at a reasonable distance from each other in order to minimize congestion and avoid disturbance between different groups of

mourners. This is especially important on Sundays and Saturdays when there is usually a "bunching" up of funerals at around the same time in the afternoons.

4.2.3 Proposed Grading

One of the objectives of MMG's Project Proponent is to maintain a minimally disturbed look. Therefore, the landscaping programme is planned so that after grading and re-vegetation, the there is obvious improvement featuring undulations and smooth transitions to the contours. The grades on the cemetery lawns are either flat or very gently sloping. Where there are terraces they facilitate easy movement across the cemetery for visitors, mourners and maintenance/lawn mowing equipment.

4.2.3.1 Excavation Method for Burial

The current practice and construction method for burial at MMG is 'cut and cover' where the site is excavated in sections to the required depth; vaults are constructed and then covered with excavated material. If a plot is to be prepared for burial, the layer of filling is removed to expose the vault so that burial can be conducted. Double vault burial sites are generally chosen where soil depth is at its maximum which allows for ease of excavation at minimal cost and where percolation into the soil is a slow process. It is also ideal to maintain natural gradients as far as possible. During the construction of double vaults, the area is excavated to up to 5 metres (16.5 ft) while those for single vault burials are excavated up to a depth of 1.8 - 2.4 metres (6-8 ft).

Where the bedrock is close to the surface and additional land is required for burial, the limestone is excavated using a hammer (heavy duty equipment) to remove small amounts of material, or by controlled blasting to excavate where the limestone bedrock material is to be removed to attain the required depth for burial. Blasting is also necessary in some areas in order to facilitate the required rectangular layout of vaults and optimum land utilization.

4.3 MODIFICATION OF LIMESTONE TERRAIN FOR BURIAL

Excavation of limestone bedrock has been conducted on the western slope of the north-south elongated limestone hill near the southern section of the property to extend the area to accommodate the construction of vaults for burial. The extended area was prepared by leveling a section of the land which eventually created a 4.5-5m high wall of limestone. The limestone hill covers approximately 40-45 percent of the Project Site; however most of this area is not expected to be used for burials and is not recommended because of the large volume of limestone material, which has to be removed by blast excavation, as well as, the cost to undertake such an exercise. The amount of waste material to be generated from blast excavation

would also be a concern especially with respect to storage. In addition, noise nuisance and the potential negative impact of blasting require that excavation of the limestone by that method is kept to a minimum. The potential effect of blasting is discussed further in Section 5.4.4.

There are sections on the property, especially on the western side where terracing can be accommodated to prepare the site for the construction of vaults for burial. This can be done where the terrain is gentle to moderately sloping and the area excavated. Where there are terraces they should be designed to accommodate the construction of vaults on the various terrace levels.

4.4 LAND ACQUIRED FOR CEMETERY EXPANSION

The additional land purchased by MMG is generally flat to gentle sloping. Based on field observation of tests pits constructed for percolation tests, soil thickness above bedrock varies from depths exceeding 2 metres to a few centimeters in the centre of the property; particularly where limestone is exposed on the flat surface. If double vaults are proposed, the preferred areas at the locations are areas where the depth to bedrock is greatest. The depth to bedrock at the eastern section of the property is not known, but test pit dug in that area indicates it is greater than 2 metres. For double vaults, depth of excavation up to 4.5 metres may be required, therefore exploratory test pits or trenching should be done to determine bedrock depth in this area.

Towards the centre and western sections of the property, bedrock will be encountered at shallow depths, from a few centimeters to a possible maximum of 1.5 metres. Single vault burials would be the preferred choice in this area based on the depth to limestone bedrock and the cost to be incurred for bedrock excavation. In addition, the amount of rock waste generated from bedrock excavation increases with depth and the volume of materials to be removed can add significantly to the cost for removal and disposal.

4.4.1 Proposed Buildings / Facilities

There are no plans for the construction proposal for new buildings. However, an area for the management of solid waste where a skip will be placed is planned.

4.4.2 Proposed Roads and Parking

Presently, a dual carriageway is the main access/exit road on the property. Regular allocated parking, including those for the less able, are located at the rear of the 200-seat chapel. There is

also an area to the north in the vicinity of the office that is reserved for overflow parking and buses. The existing access road to the burial plots will be extended into the expansion area, however, all necessary drainage facilities, pavement transitions, and any necessary safety related improvements will be constructed.

There is no anticipated traffic volume increase; therefore, the existing approved parking allocation one (1) parking bay for every seven (7) seats in the chapel (or a required 29 parking bays), however, there are actually over 100. The required 5% of the maximum number of parking bays has not only been met but has been exceeded as there are three (3) allocations.

4.4.3 Proposed Landscaping

The cemetery applies traditional irrigated, manicured cemetery landscaping. Landscaping elements will continue to include lawns, gardens and ornamental plantings.

4.4.4 Drainage

4.4.4.1 Site Drains and Sinkholes (Depressions)

While there is no major surface storm water channel on the property there are number of mainly underground drains that facilitate the transport of storm water. The northernmost half of the site currently drains to the existing Parish Council road. The north-western section of the site drains to a sinkhole at the northernmost section of the site. The central and southern half of the site drains to the major gully which runs east of MMG in a north to south direction. Unlike Swale 1, Swale 2 (see Figures 4.2 & 4.3) is presently not clearly defined in most areas and, therefore, has the potential to cause flooding of neighbouring properties. It is, therefore, recommended that it be clearly defined especially along the southern boundaries and that the design complies with the requirements of the NWA. A sinkhole observed in the southern section of the existing site receives flows from areas on the internal roads (see Figure 4.3).

Drainage features also include berms which intercept/divert rainfall run-off to drains across the property. The fill behind each terrace is well drained through "weep holes" in the supporting buttress walls

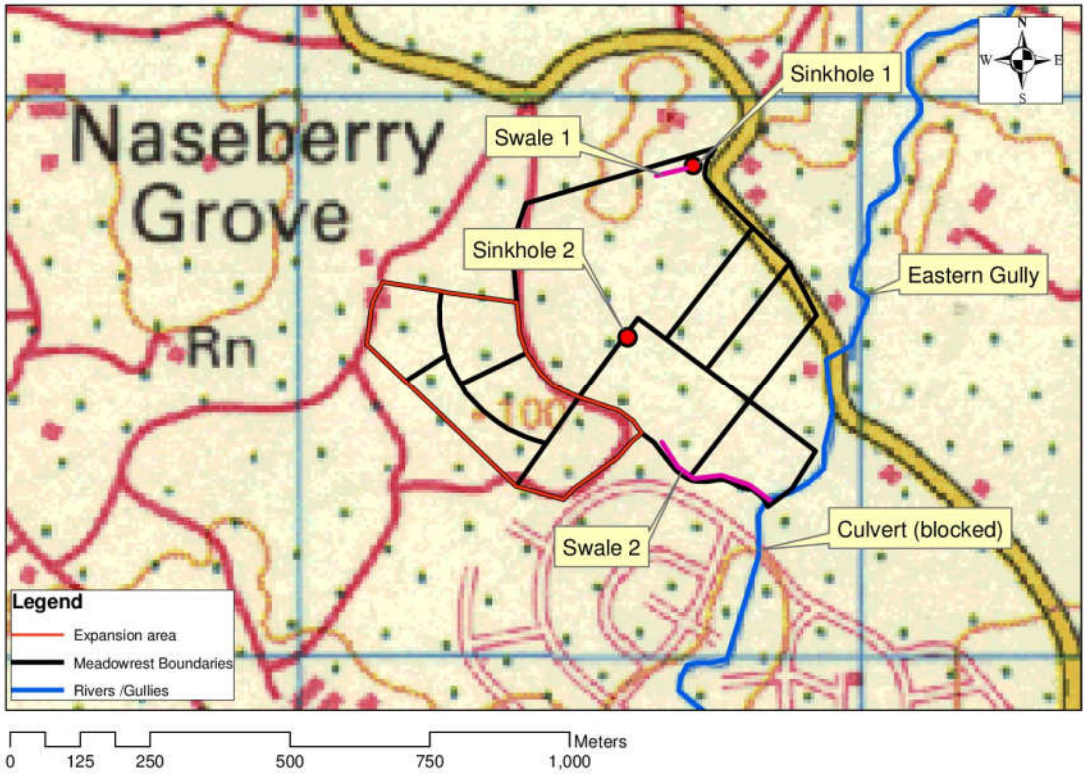

Figure 4.2: Existing drainage features contiguous to the Meadowrest Memorial Gardens

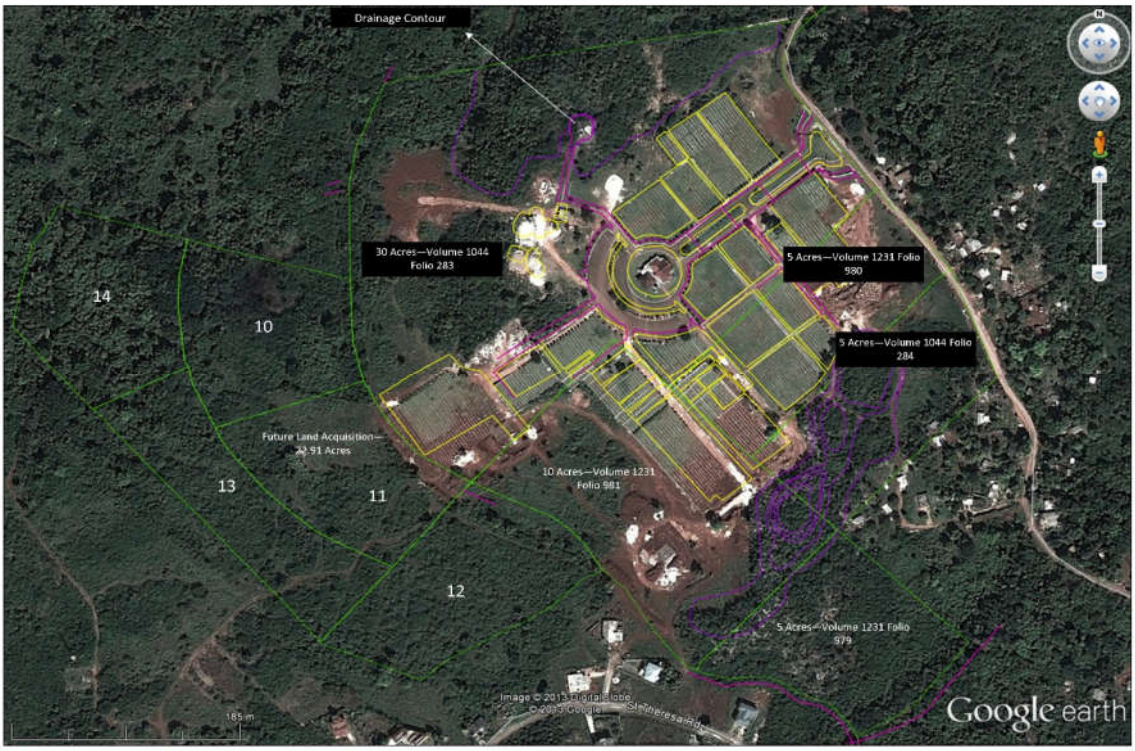

Figure 4.3: Showing drainage contours in identified catchment areas

. 4.4.4.2 The Eastern Gully

The eastern gully originates in Fruit Hill approximately 2km north of MMG. The channel is not well defined until it crosses the road and enters the Green Acres subdivision. This has resulted in the placing of structures in the flood plain of the gully, north of the main road by informal settlements. Where the gully enters the Green Acres subdivision, there is a culvert crossing that is currently blocked with silt and other debris. Residents who have lived in the area for more than twenty (20) years have indicated the opening is approximately 1.5m in diameter. As the drain enters the subdivision it widens significantly and does not appear to be a flood hazard to properties within the Green Acres Subdivision.

4.4.5 Potable Water

The monthly consumption of water from an unreliable public water supply system is currently 450,000 litres. This is used for the usual municipal purposes, including the construction of vaults, burials and irrigation of the lawns. In addition to an underground tank, there are seven (7) roof top plastic water storage drums. Given the unreliability of the public potable supply, the facility has been forced to purchase water. The only potential increase in usage would be occasioned by the additional areas that will need to be landscaped. This could eventually double the current water consumption.

4.4.6 Existing and Proposed Waste Water Treatment

An existing septic tank currently serves the MMG cemetery; no increase in demand for waste water disposal is anticipated.

4.4.7 Proposed Electric/Utility Service

The Jamaica Public Service Company Limited currently supplies electricity and FLOW supplies landline telephone service. Electricity service is delivered to the site via overhead power and telephone lines on joint utility poles along the Fraser's Content Boulevard road. Cellular and Internet services are also provided by FLOW, as well as, Digicel.

Current monthly electricity current monthly usage is 1500 KWh costing approximately $85,000 per month. Electricity is consumed by (a) computers and air-conditioning and office equipment at the Cottage in the Gardens (b) the Chapel for lighting and the Public Address (PA) system (c) the pump which pumps water as necessary from the underground storage facility beneath the Reception Area at the back of the Chapel, (d) security lighting.

As vault construction proceeds, more poles will be established as necessary to provide lighting to facilitate burials for funerals during dusk hours especially in the latter months of the year. It is not envisaged that consumption will increase significantly; but electricity rates will most likely increase. There is a standby generator in the Reception Area which provides power to the Chapel and to the pump when necessary. Cemeteries by their nature typically close at dusk

which virtually eliminates the need for interior, exterior, landscape or roadway lighting outside of daylight hours. There are no immediate plans to install renewable energy systems.

Existing and future operational aspects of the cemetery have been designed and managed to ensure sustainability because of the long period of time over which cemetery operations will continue and the inherent requirement that a cemetery will need to exist in perpetuity.

4.5 PROJECT NEED

It is well known that there is an increasing shortage of suitable burial space in Kingston and St. Andrew and this was foreseen in the early 1990's by members of the Meadowbrook United Church. Given the number of burials that MMG has been able to accommodate over the years, the need for such a project is self-evident. The Project provides a location for interment. The Project Proponents have projected that given the present demand and the existing capacity of the MMG cemetery there is urgent need for the expansion of the facility. There are no plans to establish a crematorium.

4.5.1 Population to be served

Figure 4.4 graphically illustrates the relationship of MMG with existing cemeteries in Kingston and St. Andrew and St. Catherine and the population centres of the Kingston Metropolitan Region (KMR). The cemeteries (Dovecot and MMG) in the area are the main ones that serve the KMR. According to the STATIN, the projected 2012 combined population of the three parishes was approximately 1,184,386 and at a 5-year (2008-2012) average death rate of 6.28 deaths per thousand (based on the mid-year populations); there would be approximately 7,438 deaths in the three parishes in 2012.

Table 4.1: Showing Total Burials for the 9-month period December 2013 to August 2014

MONTH	MONDAY – FRIDAY	%	SATURDAY /SUNDAY	%	TOTAL
August, 2014	10	5.5	171	94.5	182
July, 2014	20	11.3	157	88.7	177
June, 2014	8	5.2	146	94.8	154
May, 2014	5	3.1	155	96.9	160
April, 2014	7	5.0	134	95	141
March, 2014	5	3.1	158	96.9	163
February, 2014	9	6.6	128	93.4	137
January , 2014	9	5.5	156	94.5	165
December, 2013	20	10.8	165	89.2	185
TOTAL	**93**	**6.4**	**1,370**	**93.6**	**1,464**

Based on the current estimation of 2,000 interments annually (see Table 4.1), approximately 27 % of all deaths in the three parishes are interred at MMG cemetery. This number does not include the population of other parishes and overseas mourners who use the facility. It is estimated by the Project Proponents that 90 per cent of all burials originate in the Kingston and St. Andrew, 9% from St. Catherine and the remaining 1 % from other parishes or overseas. Given the need also for the proposed expansion of the nearby Dovecot Park cemetery it is evident that without the expansion, cemetery space could become increasingly difficult to find in the near future due the existing lack of capacity in existing facilities (see Figure 4 .4). The Project Sponsor, therefore, believes there is significant demand for a new cemetery. Given the available land adjacent to the site, the developer considers this is the prudent and practical business decision to take.

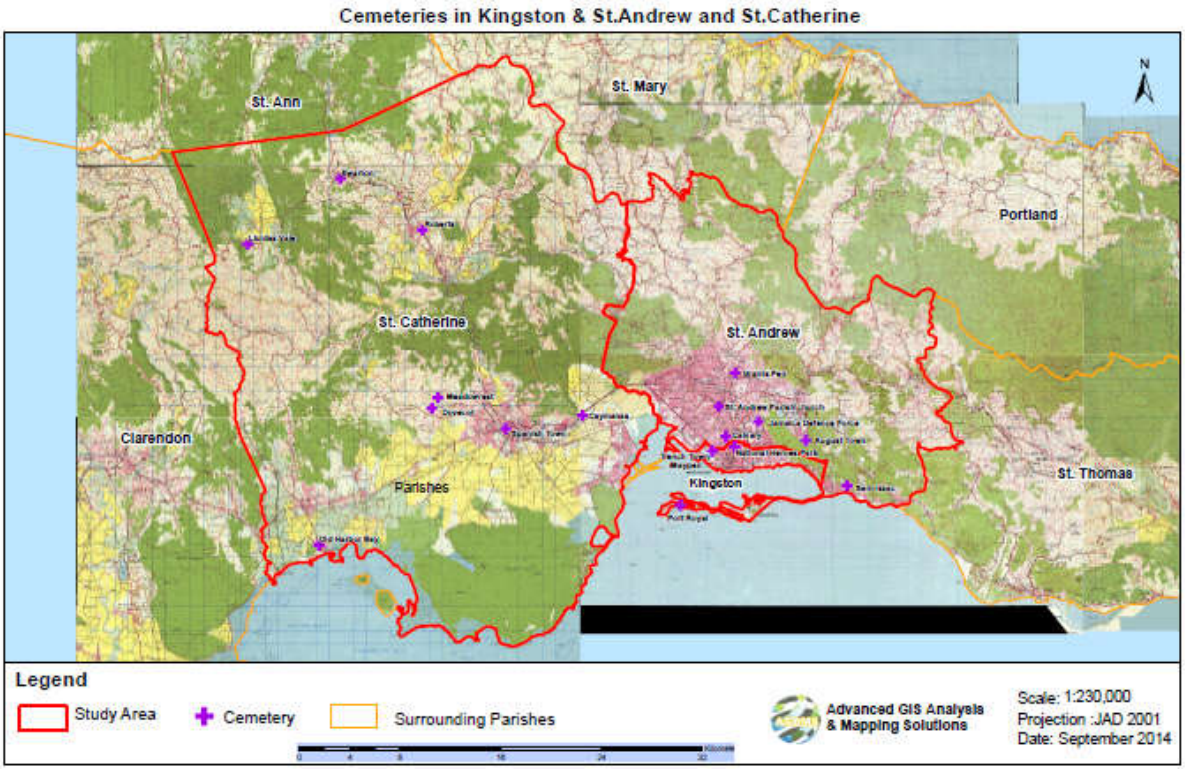

Figure 4.4: Showing the location of cemeteries in Kingston, St. Andrew and St. Catherine

4.5.2 Historical Pattern of Interments

Over the nineteen-year period 1994 to 2013, there were 20,778 interments at MMG. Average annual interments have grown steadily over the years. As shown in Table 4.1, burials in the initial years (1991-2001) averaged 741 annually, however, over the last 5-year period, with a total of 7,766; the average had increased to 1,553. It is projected by the Project Proponents that the annual average could increase to 2,500 over the next 5-year period.

Table 4.1: Showing the Number of Interments at MMG over the period 1994 to 2012

Period	# Interments	Average # of Interments
2009-2013	7,766	1,553
2004-2008	5,599	1,120
2004-2013	13,365	1,336
1994 – 2003	7,413	741

The site provides an opportunity to meet the long term social needs of the KMR by creating and offering a final resting place for loved ones with a choice of burial type, cultural correctness and a range of pricing. The proposed site contains a sufficiently large area to accommodate the proposed expansion and as it falls outside the Spanish Town Urban Fence, is located at the limit of the suburban area, and is easily accessible.

4.6 PROJECT OBJECTIVES

The MMG project is seen as an important outreach activity of the United Church. The project seeks to meet social needs of the public and the economic needs of the entity by providing affordable burial services while offering grief counseling and contributing to the mission of the Church. The MMG cemetery also seeks to continue the enhancement of the social and economic well being of the communities surrounding the Gardens.

5.0 DESCRIPTION OF THE ENVIRONMENT

This chapter describes the existing conditions/environmental setting; and Project baseline. Chapter 4.0 is organized into the following environmental resource or issue areas:

5.1 Physical Environment
5.2 Carrying capacity
5.3 Natural Hazards
5.4 Biological Environment
5.5 Heritage

5.1 THE PHYSICAL ENVIRONMENT

Methodology

Baseline conditions at the proposed site were assessed following site visits, literature reviews, interviews and consultations to determine site baseline characteristics in regards to the following. Maps and photographs are included as necessary. Specifically, the assessment covered:

- Site topography (including discussion of terrain, landforms, surface drainage, soil)
- Meteorology (rainfall distribution, temperature/humidity, winds),
- Regional and site geology (including superficial bedrock, faults, cover, such as, soils)
- Hydrology (groundwater including regional groundwater, controls and water demand and supply issues)
- Natural hazards affecting the site.
- Calculation of peak and total runoffs
- Conduct analysis to determine size and adequacy of the proposed ponds and drains.

5.1.1 Topography and Geomorphology

The physical attributes are is best described as subdued karst topography consisting of low, elongated limestone hills in the south and south east and flat to gentle slopes towards the south western section of the property. The elongated hills stretch from north to south over the eastern boundary of the property where the slopes become gentle on the northern side of the hill (Figure 5.1). A slope analysis of the National Land Agency's 12,500 map contours revealed the proposed site has slope gradients that vary from 15 degrees (28% slope) to less than 4 degrees (7% slope) on the flat to gentle sloping section of the site. The subdued limestone hills make up approximately 40-45 percent of the land to be released for burial expansion.

The flat to gentle sloping area is located on the west and south-western section is covered with trees and scrubland vegetation. A review of Imperial 1:12,500 Topographic Sheet 85D and supported by field work shows that there are depressions or sinkholes on the site. These

features were observed near the northern border and towards the south. They are used as storm water outfalls. The additional land acquired adjoins the Project Site along the west and south western boundaries.

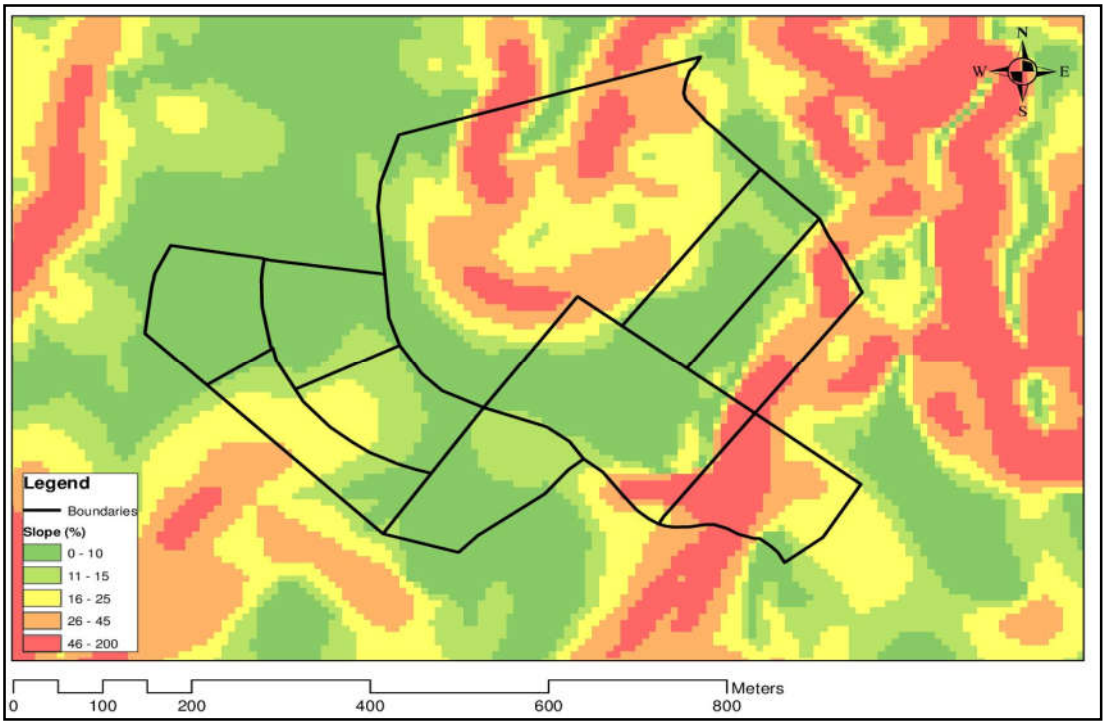

Figure 5.1: Spatial variation of slopes in the area based on Survey Department 12500 Map contours

5.1.2 Geology

The proposed cemetery expansion area is underlain by the Walderston-Brown's Town Limestone Formation which is characterized as massive, soft calcarenites and bedded microsparites. It can also be described as buff to pink, moderate to thickly bedded soft limestone (Figure 5.2). In some instances, 'case hardening' occurs on the surface within this limestone formation, creating a hard thin layer (1-2 metres thick), however when this layer is removed it exposes the softer limestone. This white limestone is heavily faulted and exhibits extensive interconnectivity. Weathering over time has also produced secondary porosity which promotes increased ground-water flow, thus the limestone can be considered beneficial for the development of groundwater use in the area.

There are no observed geological faults on the site. The nearest fault is approximately 1.5 km away which has no impact on the cemetery expansion.

5.1.3 Lithology

The strength, structure and weathering characteristics of the limestone vary across the site. The elongated limestone hill at the south and south eastern section consists of rock partially recrystallized of moderate strength. Joints and fractures were sealed during the recrystallization process resulting in its increased strength. Removal of limestone material for the preparation of burial site is achieved by controlled blast excavation.

In other areas on site, nodular and fractured limestone is observed and is at different stages of rock weathering. The limestone in this area is generally soft and is typical of the Walderston – Browns Town Formation.

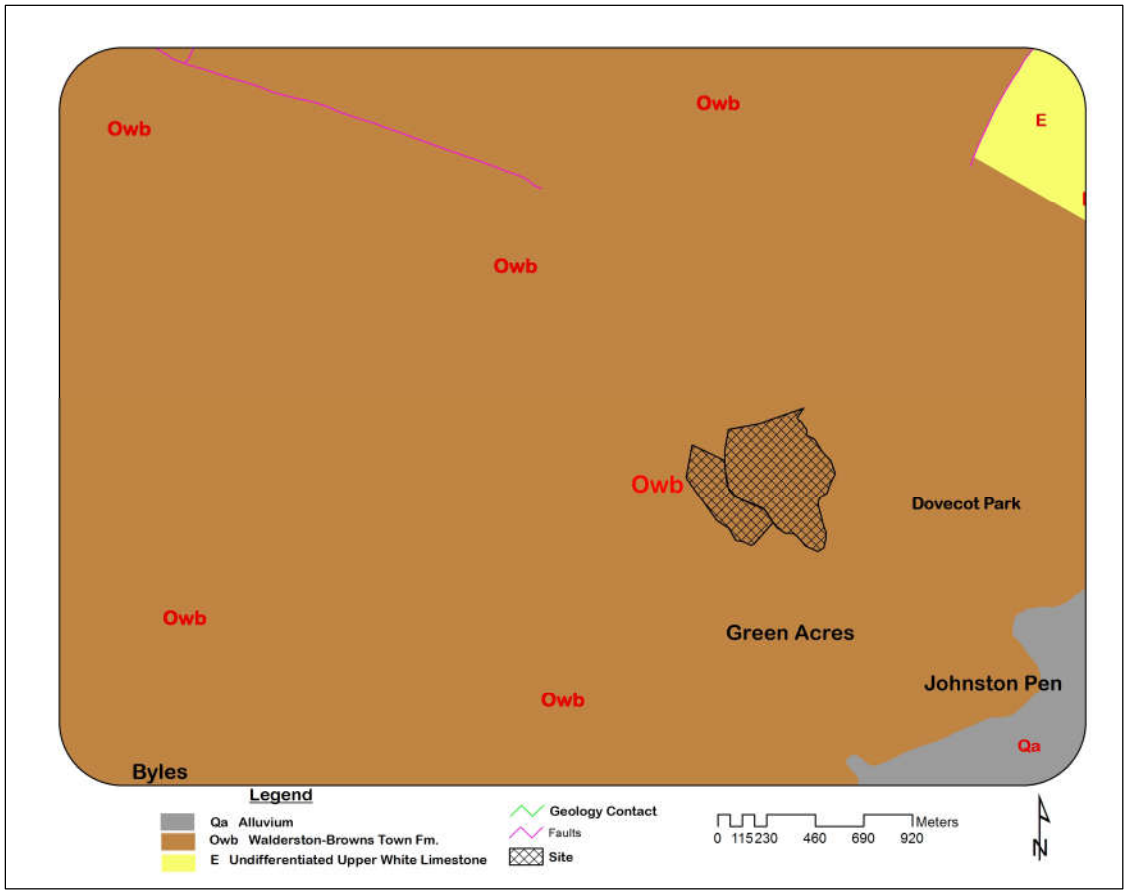

Figure 5.2: Geology map of study area

5.1.4 Soil

The lateritic soil on the property consists of dark, reddish brown silty clay and clayey silt derived from the weathering of the parent limestone bedrock, with occasional patches of limestone rock exposed near the centre of the property. During the dissolution of limestone (calcium carbonate) by rainwater containing carbon dioxide, silicate minerals are generally leached out to form a residue rich in iron and aluminum oxides. The iron in the residue gives

the lateritic soil its deep reddish brown colour. The thickness of the lateritic soil varies over the site. Within the Project Site, the limestone hills consist of very thin soil (a few cm thick) to non-existent. These contrasts with the flat to gentle terrain towards the west and south-west where the soil varies in thickness from a little over 3 metres to less than 1 meter in some sections. Observation from test pits and recent excavated areas show soils up to 3 metres thick near the south western boundary of the site. The section purchased for burial expansion consists of soil with estimated thickness varying from a few centimetres near to the limestone outcrop on the flat surface to over 2.25 metres.

5.1.4.1 Percolation Test

A layer of pea gravel, approximately 2 inches (5cm) thick was placed at the bottom of each test pit in order to prevent scouring at the bottom of the holes. Clean water was then poured into each hole until partially filled and then left overnight to ensure full saturation. Percolation tests were conducted the following day by pouring clean water into the test pits and observing the fall of each 3 inches (7.6 cm) of water until a constant drop in water level was attained. Clean water was again poured in each hole and measurement taken to determine the time taken for the water level to fall by 3 inches (0.91m) in each test pit. The final percolation rate is determined by the time taken for the water to fall 3 inches (0.7.6cm) into the pit and dividing by 3. The results of the percolation test are shown in Table 5.1

5.1.4.2 Soil Percolation Test Pits Results

A total of six (6) test pits were dug using a backhoe. The soils contained in the pits are essentially lateritic soils consisting of dark reddish brown clay silt and silty clay soils. However,

The results indicate that the soils at MMG have a low to very low percolation rate.

Table 5.1: Results of Percolation Tests

TEST PIT	DEPTH		PERCOLATION RATE	
	Ft	m	MIN/INCH	MIN/CM
1	6	1.80	90	300
2	5.7	1.72	45	112.5
3	5.2	1.60	41	102.5
4	5.6	1.70	40	100
5	5.3	1.60	23	57.5
6	3.8	1.15	30	75

at the base of test pits 2 and 6, limestone was encountered. The depths of the test pits vary from 3.8ft (1.15m) to 6ft (1.80m) (Table 5.1). The test pit logs and test pit locations are shown in

Appendix 13.2 where variations exist in the soil profile they are shown. In the case of test pit #3 there was no significant variations.

5.1.5 Surface Hydrology

The Project Site falls within the Lower Rio Cobre sub-watershed. Most of the precipitation in the upper reaches of the watershed on the Cretaceous formations (to the north and west) is quickly converted into surface flows. The area north of the site is mostly devoid of surface drainage due to the karstic nature of the underlying white limestone, surface water is readily lost through sink holes to the groundwater system. Principal variations in the character of storm water flow result from variations in the underlying geological formations.

Further to the south of the proposed cemetery development however, where the white limestone comes into contact with the alluvial deposits (clayey materials) of the alluvium aquiclude, groundwater is discharged to the surface via springs that give rise to numerous streams which flow south towards the coast.

The Rio Cobre is the primary surface water feature within the hydrologic basin. It originates from surface flows draining the Cretaceous Inlier to the north. This upfaulted region constitutes the longitudinal axis of the island that results in drainage to the north and south coasts. The Rio Cobre flows from a topographic high of the Cretaceous Central Inlier to traverse the Tertiary limestone via the Bog Walk-Spanish Town Gorge. Natural aquifer outflow and irrigation return flow in the southern plains allowing for perennial drainage of this source.

The Rio Cobre tributaries are the Rio D'Oro, Rio Pedro, and Thomas River. Of these, Rio Pedro is the largest contributor. The reliable surface water resources for the Lower Rio Cobre Basin have been quantified by the Water Resources Authority (WRA) as 146 $\times 10_6$ m^3 per year (Water Resources Development Master Plan, Draft, 2006). Cut Throat Gully is located 2.59km to the south of the property and the Rio Cobre River lies approximately 4.69km east of the site. The Rio Cobre River is base flow controlled and is an important economic resource; it is the only perennial stream that traverses the limestone outcrop. Several ephemeral streams and irrigation canals exist within a 5km radius of the site (Figure 5.3 below) The Rio Cobre River Hydrological Basin receives a total mean annual rainfall of 1250mm/yr.

5.1.6 Water Supply from Surface Resources

The area north of the site is mostly devoid of surface drainage due to the karstic nature of the underlying white limestone. Surface water is readily lost through sink holes to the groundwater system. To the south of the proposed cemetery development, however, where the white limestone comes into contact with the alluvial deposits (clayey materials) of the alluvium aquiclude, groundwater is discharged to the surface via springs that give rise to numerous

streams which flow south towards the coast. The Rio Cobre, as mentioned above, is the primary surface water feature within the hydrologic basin.

5.1.7 Drainage

The proposed expansion site has no clear drainage feature associated with it. However, an unidentified ephemeral waterway runs to the east of the MMG property. The contours indicate that the property drains to the south-west by overland shallow concentrated sheet flows (Figure 5.3) where water is not channeled underground through centrally located sinks or laterally draining caverns.

5.1.8 Peak and Total Runoff

5.1.8.1 Meteorological Office of Jamaica Rainfall Data

The Meteorological Office of Jamaica (MOJ) provides 24-hour intensity rainfall data for over 200 stations across Jamaica. The closest station to the site is the Dam Head Station which is located approximately 4.5 kilometres to the north east of the site. The MOJ supplied data (shown in Table 5.2) for this station is used to calculate the hydrological model.

Table 5.2: Meteorological Office of Jamaica 24-hour intensity rainfall data for the Dam Head Station in St. Catherine

RETURN PERIOD (YR)	2	5	10	25	50	100
Intensity (mm/24hr)	166	201	228	263	295	330

5.1.8.2 WRA IDF Curves (extreme rainfall)

The Intensity Duration Frequency Curves data set; was analyzed in 1995 by the Water Resources Authority (WRA). Rainfall data for the closest station, Norman Manley International Airport (NMIA), obtained for the determination of rainfall intensities for events less than the 24-hour rainfall. The IDF curve used is shown below in Table 5.3 and the corresponding regression equations are also shown in Table 5.3.

Table 5.3: Regression equations for Norman Manley IDF curves

Return Period	Regression Equation	
2 years	$i = 370.96\ t^{-0.618}$	Where: i = intensity (mm/hr)
5 years	$i = 487.57\ t^{-0.597}$	t = duration (minutes)
10 years	$i = 566.27\ t^{-0.590}$	
25 years	$i = 666.43\ t^{-0.583}$	
50 years	$i = 741.03\ t^{-0.579}$	
100 years	$i = 815.23\ t^{-0.577}$	

The Catchments

The two main catchments of concern that will be directly impacted by the development are the East Gully catchment (Figure 5.3) and the expansion area catchment. The areas south of the expansion area are also expected to be impacted; therefore, a cut-off drain will need to be constructed on the outer south-west to southern boundaries to mitigate this. The overall area of the site catchment is approximately nine (9) hectares and is delineated by its boundaries.

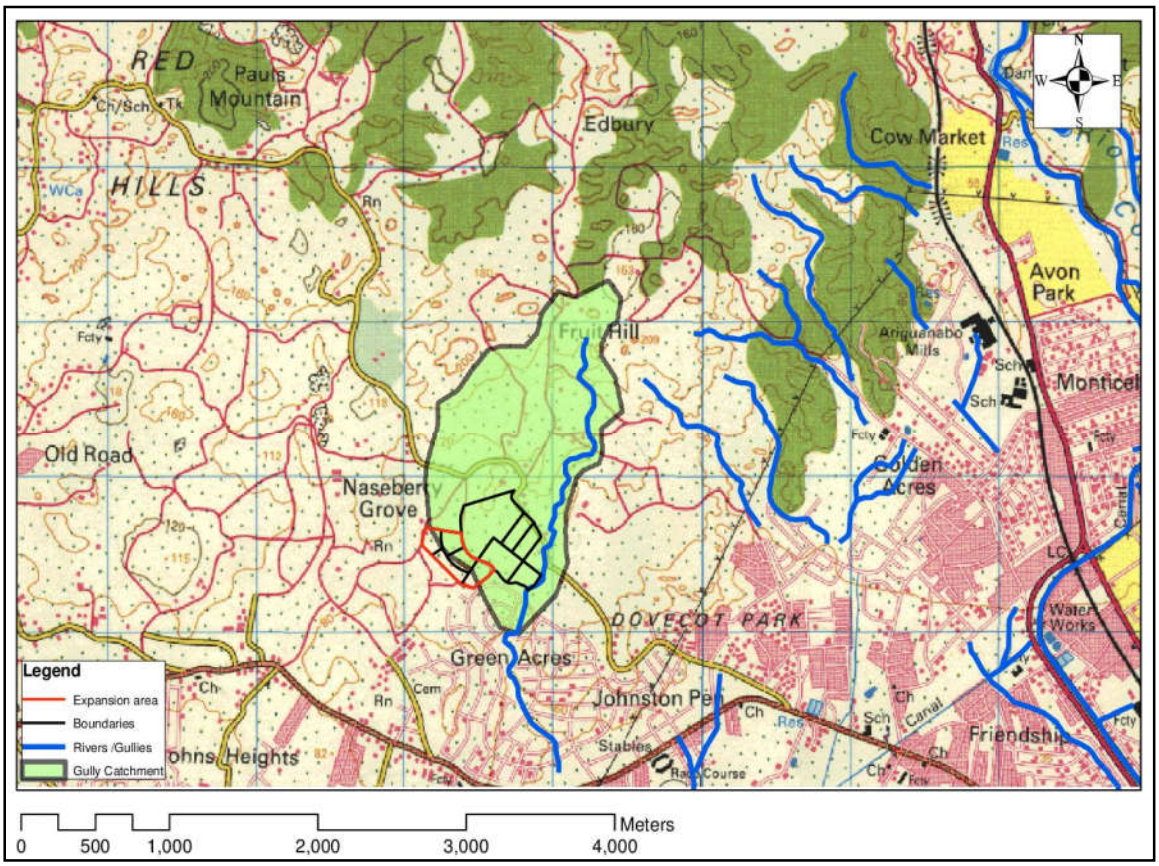

Figure 5.3: Catchment area of the gully superimposed on the survey department 1:50000 map

5.1.8.3 Runoff Model (SCS)

The SCS method is an empirical model for rainfall runoffs which is based on the potential for the soil to absorb a certain amount of moisture. On the basis of field observations, this potential storage S (millimeters or inches) was related to a 'curve number' (*CN)* which is a characteristic of the soil type, land use and the initial degree of saturation known as the antecedent moisture condition. Hydrological modeling of the watersheds encompassed three main elements:

- Precipitation
- Rainfall abstraction model (Curve number method)
- Runoff model (Dimensionless unit hydrograph)

Description of Land Use	**Hydrologic Soil Group**			
	A	**B**	**C**	**D**
Paved parking lots, roofs, driveways	98	98	98	98
Streets and Roads:				
Paved with curbs and storm sewers	98	98	98	98
Gravel	76	85	89	91
Dirt	72	82	87	89
Cultivated (Agricultural Crop) Land*:				
Without conservation treatment (no terraces)	72	81	88	91
With conservation treatment (terraces, contours)	62	71	78	81
Pasture or Range Land:				
Poor (<50% ground cover or heavily grazed)	68	79	86	89
Good (50-75% ground cover; not heavily grazed)	39	61	74	80
Meadow (grass, no grazing, mowed for hay)	30	58	71	78
Brush (good, >75% ground cover)	30	48	65	73
Woods and Forests:				
Poor (small trees/brush destroyed by over-grazing or burning)	45	66	77	83
Fair (grazing but not burned; some brush)	36	60	73	79
Good (no grazing; brush covers ground)	30	55	70	77
Open Spaces (lawns, parks, golf courses, cemeteries, etc.):				
Fair (grass covers 50-75% of area)	49	69	79	84
Good (grass covers >75% of area)	39	61	74	80
Commercial and Business Districts (85% impervious)	89	92	94	95
Industrial Districts (72% impervious)	81	88	91	93
Residential Areas:				
1/8 Acre lots, about 65% impervious	77	85	90	92
1/4 Acre lots, about 38% impervious	61	75	83	87
1/2 Acre lots, about 25% impervious	54	70	80	85
1 Acre lots, about 20% impervious	51	68	79	84

Figure 5.4: NRCS Curve number table

The SCS curve number method was used to determine the rainfall excess P_e using the following equation:

$$P_e = \frac{(P^2 - I_a^2)}{P - I_a} + S$$

Where, P = precipitation

I_a = initial abstraction

S = Potential retention which is a measure of the retention capacity of the soil.

The Maximum Potential retention, S, and the watershed characteristics are related through the Curve number CN.

$$S = \frac{25400 - (254 \times CN)}{CN}$$

Curve Numbers have been tabulated by the NRCS on the basis of soils group, soil cover or land use, and antecedent moisture conditions (initial degree of saturation) as shown on Figure 5.4.

The peak runoffs are generally calculated using the type III rainfall distribution for catchments in Jamaica. The primary inputs into the model are as follows:

- Drainage area size (A) in square miles (square kilometers);
- Time of concentration (Tc) in hours;
- Weighted runoff curve number (RCN);
- Rainfall distribution (see Figure 5.4);
- Total design rainfall (P) in inches (millimeters).

Runoff Coefficient and Curve Numbers

The curve numbers used were based on those determined by the NRCS for varying soils types and land use conditions. The plots are expected to experience build out in most areas over the next few years. The curve numbers used for the predevelopment and post development conditions were 65 and 73 respectively. This is given the soil type was silty clays whereas the land uses are meadows and terraced lawns respectively (see Figure 5.4).

Time of Concentration

The time of concentration for a particular catchment is normally described as the time it takes for the hydraulically most distant part of the catchment to contribute to the flow at the design point. Surface flows normally pass through three stages; time of entry, shallow overland flow and channel flow. The sum of these will determine the overall time of concentration (see Table 5.4) below.

Table 5.4: Time of concentration components

Stage	Model
Time of entry	Mannings Kinematic equation (MKE) $t_1 = \frac{5.48\ (nL)^{0.8}}{P^{0.5}\ S^{0.4}}$ L = length of flow to 300 ft (91m) P_2 = 2 year, 24 hour rainfall (in) n = manning's roughness coefficient S= slope of hydraulic grade line -m/m or m/m-(Land slope).
Time of Shallow overland flow	NRCS equations of shallow concentrated flow **$V = 4.9178\ S^{0.5}$** for an unpaved surface **$V = 6.1960\ S^{0.5}$** for a paved surface **$t_2 = L/(60V)$**
Time of travel (Channel flow)	Mannings equation for the applicable drainage channel for each catchment. $Q = VA = \left(\frac{1.49}{n}\right) AR^{\frac{2}{3}}\sqrt{S}$ [U.S.] $Q = VA = \left(\frac{1.00}{n}\right) AR^{\frac{2}{3}}\sqrt{S}$ [SI] Where: Q = Flow Rate, (ft^3/s) v = Velocity, (ft/s) A = Flow Area, (ft^2) n = Manning's Roughness Coefficient R = Hydraulic Radius, (ft) S = Channel Slope, (ft/ft)
Time of Concentration	$Tc = T_e + T_s + T_t$

5.1.8.4 Rational Method

The rational method was developed primarily for estimating peak runoff according to the formula:

Q = CIA, where

C = runoff coefficient

I = rainfall intensity and

A = area of the catchment

Runoff coefficients were chosen based on the Urban Water Resources council 1992 recommended values (Table 5.5). Composite runoff coefficient numbers were generated bases on the areal extent of the different runoff surfaces across the catchments. The equation used was as follows:

$$C = \frac{\sum_{1}^{i} AC}{\sum_{1}^{i} A}$$

The runoff coefficients were estimated for three scenarios to include preconstruction and post construction scenarios when the land would have been fully utilized. The runoff coefficients used were 10 and 30 percent respectively.

Table 5.5: Urban Water Resources council 1992 recommended Runoff coefficients

City Centre	0.7-0.95
Suburban Business	0.5-0.7
Industrial	0.5-0.9
Residential	0.3-0.7
Parks and Gardens	0.05-0.3
Asphalt and concrete paving	0.7-0.95
Roofs	0.75-0.95
Lawns	0.05-0.35

5.1.8.5 Results

Site Runoff

The peak storm water flows from the proposed site presently, is estimated to vary from 0.4 to 0.8 m^3/s. There is an expected 50 to 51 percent increase in these peak flows for 2 to 100yr events when the site is fully developed. It should be noted however that even though the increases are in the order of 50 percent they are not significantly large to be of any great concern to downstream developments. The total runoff volume from the proposed site will vary from 2,619 to 18,911 m^3. The increases in total runoff volume are expected to be in the order of 15 to 47 percent. The results are summarized in Tables 5.6 and 5.7 below.

Table 5.6: Peak storm water runoff from proposed expansion site

Site Catchment	*2*	*5*	*10*	*25*	*50*	*100*
Predevelopment Peak Runoff (m^3/s)	0.40	0.44	0.53	0.63	0.72	0.80
Post-development Peak Runoff (m^3/s)	0.61	0.66	0.80	0.95	1.09	1.20
	0.21	0.22	0.27	0.32	0.37	0.40
Increase (%)	51%	50%	50%	51%	51%	50%

Table 5.7: Total runoff volume from proposed expansion site

SITE CATCHMENT	*2*	*5*	*10*	*25*	*50*	*100*
Predevelopment total Runoff (m^3)	2619	6361	9198	13006	15922	18911
Post-development total Runoff (m^3)	3843	8212	11363	15484	18588	21737
	1224	1851	2165	2478	2666	2826
Increase (%)	47%	29%	24%	19%	17%	15%

Gully Runoff

The estimated peak runoff to the gully is in the order of 7.1 to 67.6 cubic metres per second for the 2 to 100-year return storm event. The development of the site will increase the peak flows to the gully by 2.9 to 0.6 percent from the 2-year to 100-year storm event. The trend is similar for the total runoff volumes from the site where the increases vary from 1.9 down to 0.7 percent. The peak and total runoffs are not expected to have any significant impact downstream of the site. The culvert entering the green acres subdivision is already significantly undersized for the 25-year peak flows. The relevant authorities should be lobbied to clear the culvert as well as to improve the culvert capacity. The runoff results are summarized in Tables 5.8 and 5.9 below.

Table 5.8: Peak runoff from the eastern gully catchment

Gully Catchment	*2*	*5*	*10*	*25*	*50*	*100*
Peak Runoff	7.1	21.0	31.6	45.8	56.6	67.6
Increase from Development of Site						
m3/s	0.21	0.22	0.27	0.32	0.37	0.40
Percent (%)	2.90%	1.05%	0.84%	0.70%	0.65%	0.60%

Table 5.9: Total runoff from the eastern gully catchment

GULLY CATCHMENT	*2*	*5*	*10*	*25*	*50*	*100*
Total Runoff	63587	142059	199638	275629	333193	391792
Increase from Development of Site						
m3/s	1224	1851	2165	2478	2666	2826
Percent (%)	1.9%	1.3%	1.1%	0.9%	0.8%	0.7%

Gully Capacity

The gully cross section was checked at two key locations to determine its ability to accommodate the existing and post development flows (Figure 5.5).

Location 1 is at the main road leading to the Meadowrest cemetery and Location 2 is at the point where the gully/drain enters the Green Acres subdivision. At location 1 the gully is

approximately 10m wide at the base and 1.2m deep and receives flows from the northern section of the drain crossing the road. At this location the gully crosses the surface of the main road as there is no culvert to conduct the flows across.

Table 5.10: Capacity of gully in the Location 1 and Location 2 both downstream of the development

Drain Capacity	Location 1	Location 2	Units
Slope	1.730%	1.730%	
Manning's Coefficient	0.035	0.035	
Side slope	2	3	
Width of channel (at top)	16.00	20.00	m
Flow Depth	1.20	2.50	m
Depth + freeboard	1.50	3.13	m
Width of channel (at base)	10.00	1.25	m
R	1.4	3.2	m
P	14.33	10.26	m
A	19.50	33.20	m2
Velocity	4.62	8.22	m/s
Flow	90.00	272.93	m3/sec

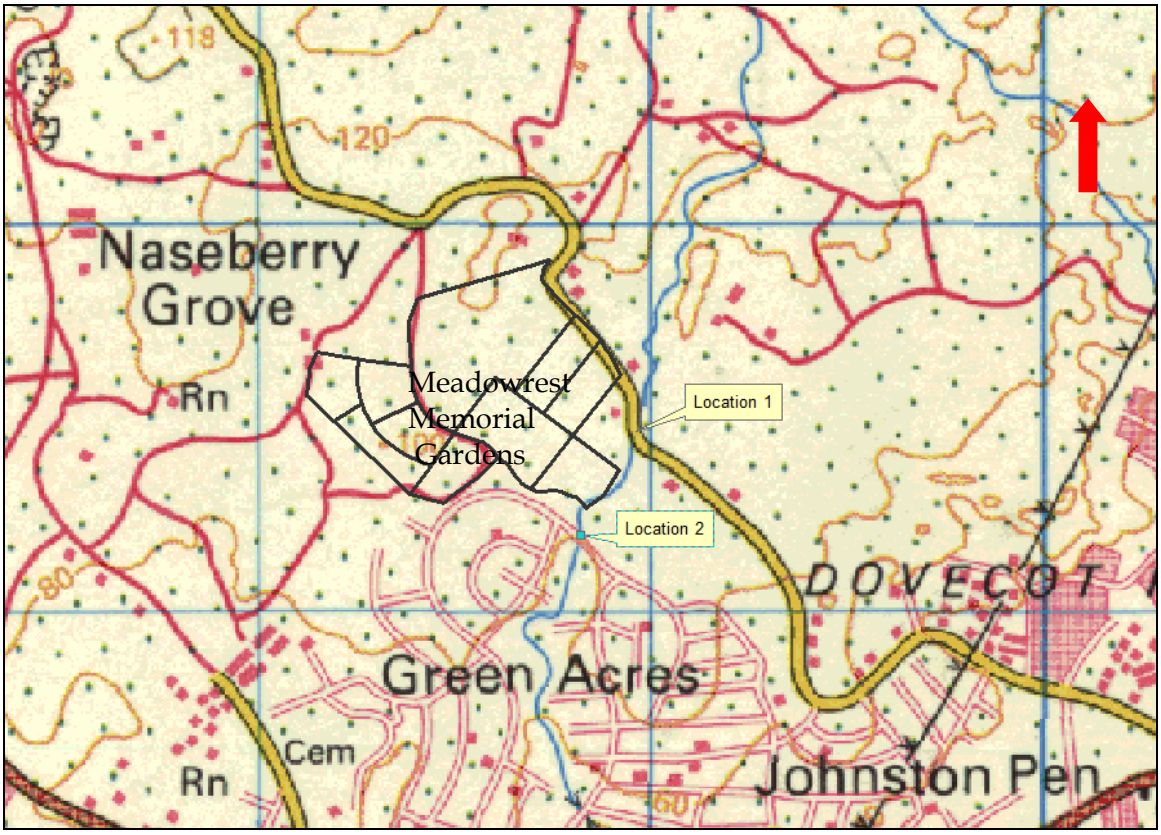

Figure 5.5: Locations assessed along Gully, downstream of the development

Location 2 has a small culvert crossing that appears to be blocked with sediments leading to an overflow during extreme events. This is evident in the scour observed on the road at this location. Downstream of the road the drain is significantly large, having a top width of approximately 20 meters. The capacity of these drains is in the order of 90 and 270 cubic meters per second, significantly more than is expected from the catchment (Table 5.10).

5.1.9 Groundwater Hydrology

The Project Area is located within the limestone outcrop region of the basin. This area is noted for the absence of a well-developed surface drainage pattern. Instead there are many closed depressions within which water is channeled underground through centrally located sinks or laterally draining caverns and eventually infiltrated to the groundwater system. Practically all of the precipitation on the karstified limestone in the lower mountains (in the immediate project area and environs) is consumed by vegetation or passes into an extensive subterranean system, without causing surface runoff. The Project Area is, therefore, one of primary recharge.

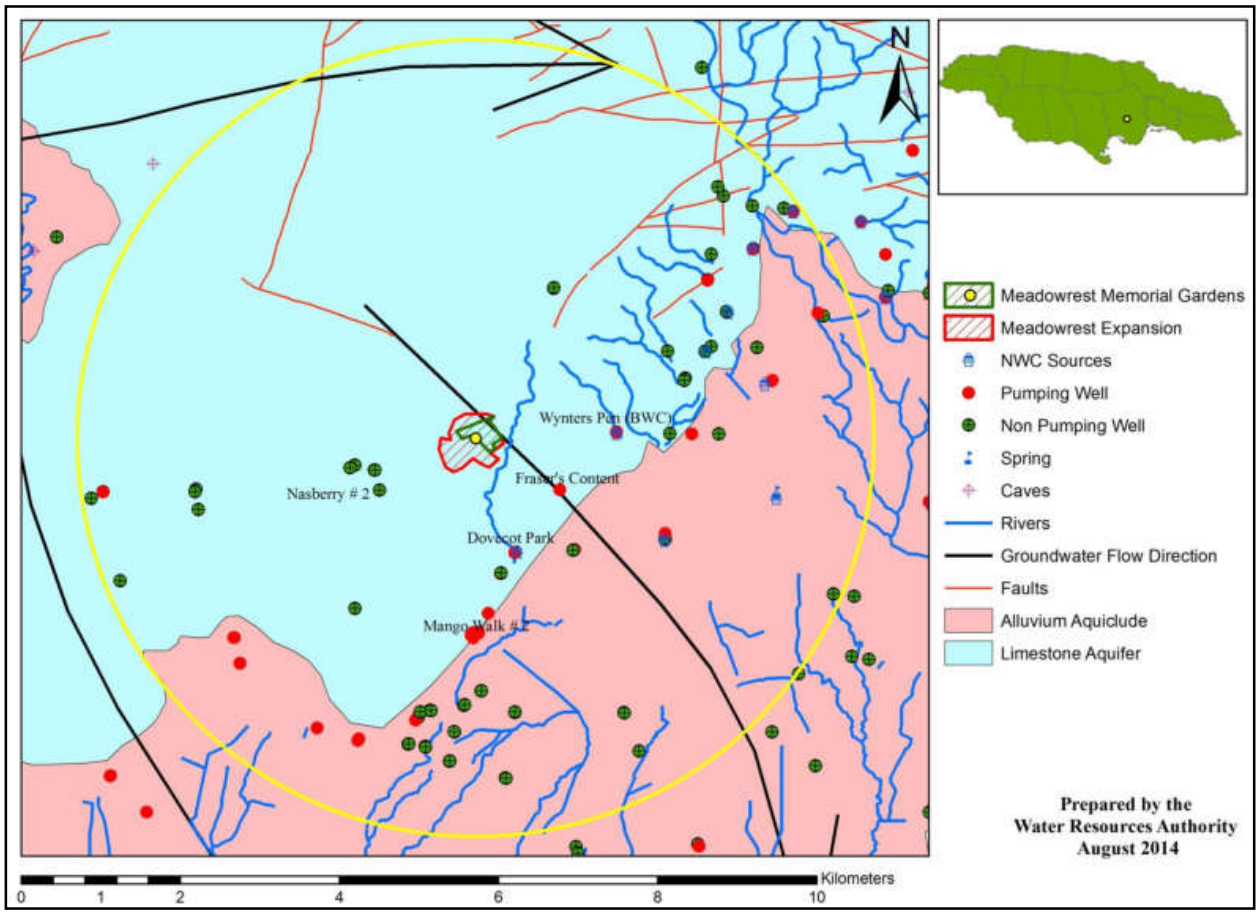

Figure 5.6: Showing the Hydrostratigraphy and hydrologic features encompassing the Meadowrest Memorial Gardens Cemetery

The Walderston Browns Town Formation that underlies the Project Site has been characterized as a Limestone Aquifer under Jamaica's hydro stratigraphic suite (Figure 5.6). It is mainly rubbly or chalky and consequently more likely to develop secondary permeability through solution than fracturing. This results in a more even distribution of permeability rather than supporting massive conduit type flows. There may be some primary permeability in the Walderston Browns Town Formation and the occurrence of diffuse flows across hydraulic gradients.

Where the limestone crops out, the water table is under atmospheric conditions and the aquifer is unconfined. Depth to groundwater in the vicinity of the Project Site is approximately 30 metres below ground level.

The nearest mapped fault is located 1.5 kilometres northwest of the Project Site and trends northwest-southeast. It is expected that the dominant fault orientation is a structural control on groundwater movement to the southeast and subsequently discharges to sea.

5.1.9.1 Water Supply from Ground Water Resources

There has been substantial groundwater exploration in the area. Generally, the limestone aquifer has proven to produce a high yield due to faulting and the development of secondary porosity. Groundwater flow is in a south and south easterly direction towards the coast. The proposed property sits within the Rio Cobre River Hydrological Basin which has a reliable groundwater yield of 337.7 × 10_6 m^3/yr (337.7 million cubic meters per year (WRA Master Plan, 2005).

Well Name	Distance From	Well Use	Coordinates	Owner
Fraser's Content	1.23km SE	Public Supply	E 749715 N 651295	Kemtek Development and Construction Ltd.
Dovecot Park St. John's Road Green Acres	1.51km S	Public Supply	E 749166 N 650508	De La Vega Investments
Wynters Pen Browns Water Commission	1.76km W	Public Supply	E 750597 N 651994	Dr. G. C.T Brown
St. Johns Road Melvin Park	1.87km S	Public Supply	E 749914 N 650641	Black Brother's Incorporation
Mango Walk # 1	2.21km S	Irrigation	E 748835 N 649745	Innswood Estates Limited
Mango Walk # 3	2.44km S	Irrigation	E 748707 N 649501	Innswood Estates Limited
Mango Walk # 5	2.45km S	Irrigation	E 748644 N 649501	Innswood Estates Limited
Mango Walk # 4	2.47km S	Irrigation	E 748623 N 649468	Innswood Estates Limited
Mango Walk # 2	2.51km S	Irrigation	E 748638 N 649432	Innswood Estates Limited

Non-Pumping wells within a 2.5km radius of Meadowrest Memorial Gardens Cemetery

Well Name	Distance From	Well Use	Coordinates	Owner
Nasberry Grove # 1	1.35km W	Monitoring	E 747394 N 651538	G. Kingsley Rose
Nasberry Grove # 2	1.38km SW	Monitoring	E 747463 N 651287	G. Kingsley Rose
Nasberry Grove	1.56km W	Monitoring	E 747150 N 651598	G. Kingsley Rose
Bellevue Corehole	1.73km SE	Monitoring	E 748989 N 650236	Mr. Harold Williams
Fruit Hill	2.13km NE	Monitoring	E 749650 N 653829	National Water Commission
OTooles # 1	2.45km W	Monitoring	E 751726 N 651992	C. OToole

Figure 5.7: Showing pumping wells within a 2.5 km radius of Meadowrest Memorial Gardens Cemetery

The safe groundwater yield from the Lower Rio Cobre sub-watershed was determined to be 337.7× 10^6 m^3 per year by the WRA (2006) (Water Resources Development Master Plan, Draft). There has been substantial groundwater exploration in the area. The closest pumping wells to the site are the Fraser's Content and the Dovecot Park wells (see Figures 5.6 and 5.7). The bore log lithologies of the Dovecot Park well and the Wynters Pen (BWC) well record the thickness of the limestone as ranging from approximately 175m (574.18ft) to approximately 240m (787.40ft). It is, therefore, important to note that no well has been drilled through the limestone formation to its base.

Groundwater abstraction for the Dovecot Park and the Wynters Pen (BWC) pumping wells were 141.12m^3/day and 52.40m^3/day respectively, in 2013. These wells both supply domestic water for the communities of Green Acres, Johnston Pen and Dovecot Park respectively. Groundwater level data for the Mango Walk # 2 pumping well and the Naseberry # 2 non-pumping well indicates that the depth to groundwater for the region ranges between 21.71m BGL (below ground level) to 60.76m BGL in 2014. The closest non-pumping wells to the site are the Naseberry #1 and the Naseberry # 2 wells.

The Green Acres well which is located 1.51km south of the site and the Brown's well located 1.78 km east of the site are both NWC production wells which provide potable water supply to the Green Acres and Dovecot Park communities respectively. This area represents a major ground water pumping depression within which groundwater levels are historically below sea level. These groundwater levels are theorized to be as a result of the general mining of the ground water resources in the basin. As such, a moratorium has been enforced by WRA which restricts the development of new wells in the Lower Rio Cobre Basin.

5.1.9.2 Ground Water Quality

Pollutants derived from human corpses occur as dissolved and gaseous organic compounds and dissolved nitrogenous forms. There is also the potential for increased pH due to the high level of calcium present. Where pathogens occur these die off naturally and quickly reduce in concentration with increasing distance from the grave. Formaldehyde used in the embalming process is another potential source of contaminant; however, about half degrades rapidly during the decomposition process while there is also natural degradation in the ground[2].

It is important to note that the over abstraction of groundwater in the Rio Cobre Basin has lead to saline intrusion for areas closer to the coast in the past. However, based on data supplied by the NWC although there has been some nitrate intrusion, ground water quality in the Green Acres, Friendship and Brown's well is still within the limit for potability of 50 mg/L as shown

[2] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/290462/scho0404bgla-e-e.pdf retrieved 2015 September 30

in Appendix 13.1. Also included in Appendix 13.1 are Potability Certificates and sampling results for total and faecal coliform, suspended solids and orthophosphate for these wells.

It is unlikely that the MMG cemetery has any significant effect on the water quality of wells in the area as the practice since project implementation is the sealing of the base of the vaults with concrete . The likelihood of leachate entering ground water is, therefore, negligible. This is in addition, to the fact that the wells are located over 1 km from the Project Site

5.1.9 Climatic Conditions

5.1.9.1 Precipitation

Jamaica's rainfall pattern is described as bimodal, consisting of two (2) peak periods, with higher values of rainfall (May to June & September to November) and corresponding periods of months of lower rainfall. The island's primary peak is in October (202mm), while the secondary peak is in May (109 mm) as shown in Table 5.11 for the Bernard Lodge data for the period 1937-2008. Jamaica experiences the lowest rainfall levels during the period February to March and the month of July.

Table 5.11: Monthly Rainfall Totals in Millimeters 1937-2008 – Bernard Lodge Station

Station name:	**Bernard Lodge (Met)**	**Operator:**		Bernard Lodge Ests.
Grid reference:	E257407 N146678 (E5743 N3891)	**Altitude in metres:**		17.0
Station #:	1.8E+08	**Year started:**		1937

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
MEAN	31	25	21	35	109	76	39	84	95	202	109	38	900
MAX	242	157	73	137	452	470	149	277	248	701	789	121	1,675
MIN	0	0	0	0	0	0	0	3	4	52	1	0	387

Source: Metrological Service of Jamaica

5.1.9.2 Temperature

Table 5.12: Daily Maximum and Minimum Temperatures (°C) for Tulloch Estates Automatic Weather Station in St. Catherine

	YEAR	
MEAN	**2012**	**2013**
MIN	19.81	19.86
MAX	31.96	32.49

Source: Metrological Service of Jamaica

Table 5.12 shows an increase in temperature in 2013 over 2012 at the Tulloch Estates Automatic Weather Station. This trend, however, is not necessarily an anomaly as shown in Figure 5.8 below.

	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

Figure 5.8: Norman Manley International Airport Climatic Data (1992 - 2002)
Source: Metrological Service of Jamaica

5.1.9.3 Wind

Winds at Bernard Lodge Automatic Weather Station for the period January to October 2013 predominantly blow from the south as shown in Table 5.13. Daytime wind, direction was predominantly from the south east while in the evenings; wind direction trended towards the south west.

Table 5.13: Mean Values for Hourly Wind Direction (0°-360°) and Wind Speed (knots) for Bernard Lodge Automatic Weather Station January – October 2013

Time (Hours)	Wind Direction (Knots)
12.00 am – 8.00 am	**W**
9.00 am – 10.00 am	**SSW**
11.00 am – 4.00 pm	**SE**
5.00 pm – 6.00 pm	**SSE**
7.00 pm	**SSW**
8.00 pm	**SW**
9.00 pm – 10.00 pm	**WSW**
11.00 pm – 12.00 am	**W**

There is predominantly an east-southeasterly Trade wind with an average speed of 18 knots (21 miles per hour) along the South Coast. However, during the months of December to March, the Trades are lowest and the local wind regime becomes a combination of trades, sea breeze, and a northerly or northwesterly influence associated with cold fronts and high-pressure areas from the United States of America as shown in Figure 5.9.

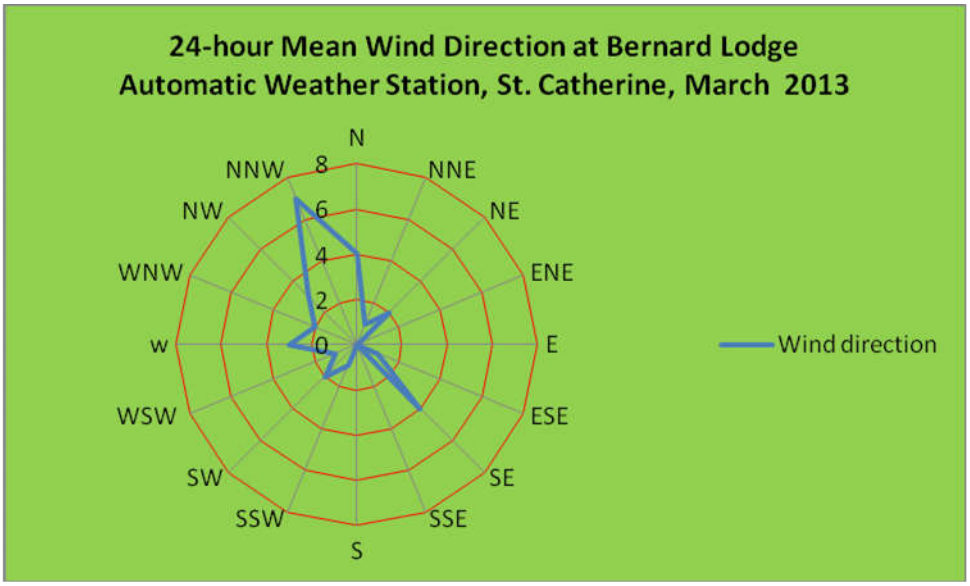

Figure 5.9: Showing the 24-hour mean wind directions at the Bernard Lodge Automatic Weather Station in March, 2013.

5.1.10 Air Quality

This section addresses the Project Site's characteristics with respect to air quality that includes the physical and regulatory setting, a description of the potential baseline conditions which determine potential impacts to existing air quality due to Project construction, operation and maintenance.

The section attempts to evaluate possible impacts of the existing operation on local and regional air quality due to any changes that might occur with respect to site related emissions due to an expansion of the facility. The analysis was conducted based on guidance provided by the Ambient Air Quality Guideline Document (Guidelines Document) for the Natural Resources Conservation Authority (Air Quality) Regulations (2006) under the Natural Resources Conservation Authority (NRCA) Act.

5.1.10.1 Air Pollutants of Concern

Air quality is affected by the rate of pollutant emissions and by meteorological conditions such as wind speed atmospheric stability and mixing height which all affect the atmosphere's ability to mix and disperse pollutants in air. Variations in air quality may be influenced by changes in pollutant emissions or changes in atmospheric conditions. The pollutant of greatest concern in the area is and very small particulate matter (10 and 2.5 microns or less in diameter), referred to as PM_{10} $PM_{2.5}$. There is no available data from the monitoring of air pollutants in the area, however, the main sources of air pollutants are expected to occur during the processes of, land clearing, vault construction and grading. Another source of air pollution is from vehicular traffic transporting mourners who attend burials in buses and cars and other modes of

transportation. However, these are not considered major sources of air pollutants are vehicular traffic along the community road is primarily those associated with funerals that mostly occur on Saturdays and Sundays. There are no major sources of industrial pollution in the area.

5.1.10.2 Ambient Air Quality Standard

Ambient air quality standards (AAQS) have been promulgated for the island (The Jamaica Gazette, 1996) for six criteria pollutants which are particulate matter (PM) which have aerodynamic diameter of less than 10µm (PM_{10}), lead, Sulphur Dioxide (SO^2), Ozone (O^3), Carbon Monoxide (CO) and Nitrogen Dioxide. These are shown Figure 5.10 below while they are described in Table 5.14.

Pollutant	Averaging time	Standard (Maximum concentration in $\mu g/m^3$)
Total Suspended Particulate Matter (TSP)(a)	Annual 24 h	60 150
PM_{10} (b)	Annual 24 h	50 150
Lead	Calendar Quarter	2
Sulphur Dioxide	Annual 24 h 1 h	80 Primary; 60 Secondary (c) 365 Primary; 280 Secondary 700
Photochemical oxidants (ozone)	1 h	235
Carbon Monoxide	8 h 1 h	10,000 40,000
Nitrogen Dioxide	Annual	100

a) TSP – all particles and aerosols with aerodynamic diameter of 100 micrometres or less and can be measured by the high volume sampling method
b) PM_{10} refers to particles with an aerodynamic diameter of 10 micrometres or less as measured by the PM10 sampler.
c) The secondary standards for sulphur dioxide are designed to protect public health and welfare. They represent the long-term goal for air quality and provide the basis for an anti-degradation policy for unpolluted areas of the country and for continuing development of pollution control technology.

Figure 5.10: Ambient Air Quality Standards Regulations for Jamaica – August 1996

Table 5.14: Criteria Pollutants for Jamaica

Pollutants	Characteristics	Health Effects	Major Sources
Ozone (O3)	A highly reactive photo-chemical pollutant created by the action of sunshine on ozone precursors (primarily reactive hydrocarbons and oxides of nitrogen). Often called photochemical smog.	Eye Irrigation Respiratory function Impairment	The major sources of ozone precursors are combustion sources, such as, factories and automobiles, and evaporation of solvents and fuels.
Carbon Monoxide (CO)	Carbon monoxide is an odourless, colorless gas that is highly toxic. It is formed by the incomplete combustion of fuels.	Impairment of oxygen transport in the blood stream. Aggravation of cardiovascular disease. Fatigue, headache, confusion, dizziness. Can be fatal in the case of high concentrations.	Automobile exhaust ,combustion of fuels, combustion of wood in the woodstoves and fireplaces.

Nitrogen Dioxide (NO2)	Reddish-brown gas that discolors the air, formed during combustion.	Increased risk of acute and chronic respiratory disease.	Automobile and diesel truck exhaust, industrial processes, fossil-fueled power plants
Sulfur Dioxide (SO2)	Sulfur dioxide is a colorless gas with a pungent, irritating odor.	Increased risk of acute and chronic respiratory disease.	Diesel vehicle exhaust, oil-powered power plants, industrial processes.
Particulate Matter (PM10)	Solid and liquid particles of dust, soot, aerosols and other matter which are small enough to remain suspended in the air for a long period of time.	Aggravation of chronic disease and heart/lung disease symptoms.	Combustion, automobiles, field burning, factories and unpaved roads. Also a result of photochemical process.

5.1.10.3 National Noise Standard

The National Noise Standard sets recommended noise limits for the specific land use zone: Industrial, Commercial and Residential as shown in Figure 5.11. In the case of residential zones, this refers to family homes, hotels, religious facilities and forest preserves. The standard for residential areas is 55 decibels (dBA) from 7.00 am to 10 pm and 50 dBA from 10.00 pm to 7.00 am.

Jamaica National Noise Standards

(Extracted from the Recommendations for National Noise Standards for Jamaica, 1999)

The Recommended Zone Limits:

ZONE	7 a.m. to 10 p.m.	10 p.m. to 7 a.m.
Industrial	75 dBA	70 dBA
Commercial	65 dBA	60 dBA
Residential	55 dBA	50 dBA
Silence	45 dBA	40 dBA

Notes

The measurements are to be made at the property line from which the sound is emitted or at the nearest point possible beyond that line. If the source of the sound is on public property then measurements are to be made at a distance of between 3 m and 4 m from the source. This excludes the mechanical noise made by moving vehicles, but includes other noise (such as music) from such vehicles.

Figure 5.11: Jamaica National Noise Standard

5.1.10.4 Project Site Baseline Air Quality

Given the current land use, no sources of regulated air emissions exists (e.g. industrial activities with stacks). Sensitive air quality receptors in the vicinity of the Site are limited to local

residential land uses at Green Acres to the south west and Frasers Content to the east. There are no schools, hospital, nor health centers within the 1 km radius of the Site. This EIA presents data for PM_{10} emissions which would be the most significant parameter at the location. Sampling was conducted at Station 1 (on the property) and Station 2 (near the boundary between the cemetery and the receptor community of Green Acres) as shown on Figure 5.12. The results (9.17 and 8.05 $\mu g/m^3$) as shown in Tables 5.15 – 5.18 fell well within the National Ambient Air Quality Standard (NAAQS) standard of 150 $\mu g/m^3$ established by the United States Environmental Protection Agency under the authority of the Clean Air Act (42 U.S.C. 7401 et seq.) and the AAQS of Jamaica.

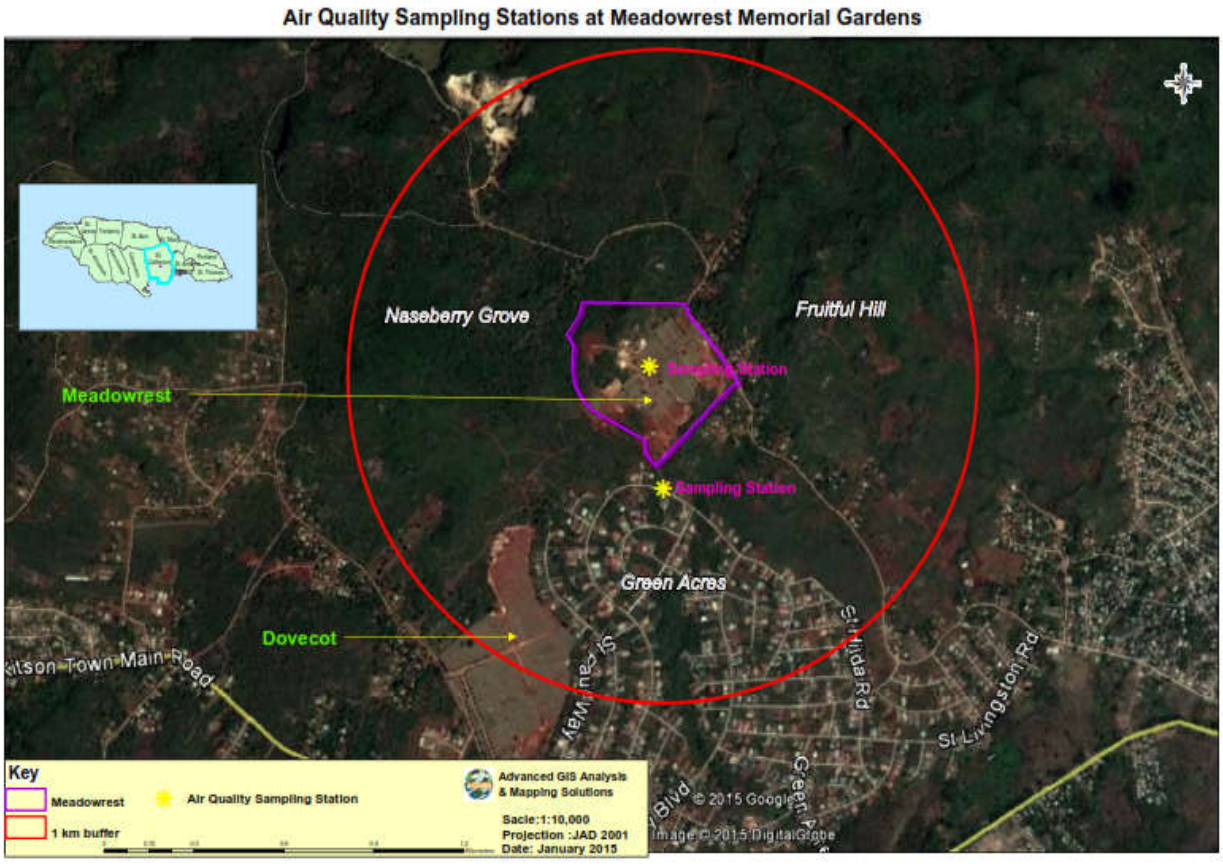

Figure 5.12: Location of Sampling Stations, Meadowrest Memorial Gardens

Table 5.15: Meadowrest Memorial Gardens Air Quality Monitoring (1)

ID No.	Location	Coordinates	Initial Wt (g)	Final Wt (g)	Sample Wt (µg)	Sample Vol (m3)	PM10 (µg/m3)
#1	Near Cemetery Gate	N 18^0 0.857" W77^0 0.687"	0.1396675	0.139723	55	7.2	7.6
#2	Green Acres	N18^0 1.097" W77^0 0.594"	0.1384225	0.138477	54	7.2	7.5
Date	2017 March 28						

Note: Sampler flow rate - 5 l/m

Sample time - 24 hrs

Table 5.16: Meadowrest Memorial Gardens Air Quality Monitoring (2)

STATION:	**#1**					
Parameter	Initial	Final	Initial - Final	Sample	Sample wt	PM10
	30/10/14	31/10/14		Volume (liters)	Sample - Blank	ug/m^3
Location(GPS)	N 18° 1.059' W 77° 0.712'					
Elevation (ft)	425'					
Temperature (^{0}C)	25.7	36.1				
Humidity (%)	80.5	46.1				
Wind Speed (mph)	5.6	0.8 - 1.5				
Wind Direction	WNW					
Elapsed Time (hrs)	11651.19	11627.2	23.99	7197		
Sample Wt.(g)	0.1529173	0.1530013	0.000084		0.000066	9.17
Blank Wt. (g)	0.1522198	0.1522373	0.000018			

Table 5.17: Meadowrest Air Quality Monitoring Result (3)

STATION:	**#2**					
Parameter	Initial	Final	Initial - Final	Sample	Sample wt	PM10
	3/11/2014	4/11/2014		Volume (liters)	Sample - Blank	ug/m^3
Location(GPS)	N18^0 1.097′ W77^0 0.594′					
Elevation (ft)	415'					
Temperature (^{0}C)	30.3	30				
Humidity (%)	59.9	57.1				
Wind Speed (mph)	0 - 3	0 – 4				
Wind Direction						
Elapsed Time (hrs)	15041.95	15065.94	23.99	7197		
Sample Wt.(g)	0.1535183	0.1535943	0.000076		0.000058	8.05
Blank Wt. (g)	0.1522198	0.1522373	0.000018			

Table 5.18: Summary of 24-hour PM_{10} monitoring at Meadowrest Memorial Gardens 2014 October 30 – 31

STATION	PM^{10} (MG/M^3)
1	9.17
2	8.05
NAAQS	150

Noise

The EIA considers the effects of environmental noise on receptors adjacent to the MMG expansion area. The possible environmental noises are from machinery, traffic and burials ceremonies. Fifteen (15) minute sampling was conducted at 4.05 pm at Station 1 and 4.39 at Station 2 on Sunday, 2014 November 16 for noise from burial ceremonies and traffic at the locations. A Sunday was selected as it is the most popular day for burials. The results of the noise sampling shows that noise impact on the adjacent receptor community of Green Acres is insignificant Table 5.19 and Figure 5.12a.

Table 5.19: Noise Levels at 15-minute periods and Stations 1 & 2 2014 November 16

STATION 1			**STATION 2**		
Item	**Value**	**unit**	**Item**	**Value**	**unit**
Date	11/16/2014		**Date**	11/16/2014	
Time	4:05:50		**Time**	4:38:52	
Run Time	00:15:00	hh:mm:ss	**Run Time**	00:14:59	hh:mm:ss
Leq	63.1	dBA	**Leq**	55.0	dBA
Lepd	48.1	dBA	**Lepd**	39.9	dBA
LAE	92.5	dBA	**LAE**	84.3	dBA
LAFmax	84.6	dBA	**LAFmax**	78.1	dBA
Peak	102.1	dBC	**Peak**	110.2	dBC
L1.0	74.0	dBA	**L1.0**	69.3	dBA
L10.0	65.0	dBA	**L10.0**	51.7	dBA
L50.0	59.7	dBA	**L50.0**	41.9	dBA
L90.0	54.3	dBA	**L90.0**	39.0	dBA
L95.0	53.3	dBA	**L95.0**	38.5	dBA
Lmin	49.6	dBA	**Lmin**	35.6	dBA
Range	40-110	dB	**Range**	40-110	dB
Overload	no		**Overload**	no	
Serial No.	C20054FF		**Serial No.**	C20054FF	
Recal Due	05/31/2015		**Recal Due**	05/31/2015	
Exp. Time	0:15	hh:mm	**Exp. Time**	0:14	hh:mm

Notes

Because noise levels often fluctuate over a wide range and over time, a single value descriptor like the Leq - Equivalent Level is essential. Another useful set of parameters are the Ln values (Statistical Noise Levels) which is described here.

If fluctuating noise levels is sampled and stored the results once a second, then at the end of an hour there would be 3600 samples. We can then use these samples to determine some helpful statistics. For example, if all the samples are added and divided by 3600 then the result would be the average or L50% value of the noise over the hour. In practice, modern sound levels meters sample at more than ten times a second to improve the statistical accuracy if the sound levels fluctuate widely over time or are intermittent.

Any statistical value between 0.01% and 99.99% may be calculated, but the most useful ones are the L10 and the L90 or L95.

It is also good practice to state the period of time over which the measurements were taken, for example 70 dBA L10(18-hour) ties it down well and shows the measurements were much more extensive and statistically more reliable than a 70 dBA L10 (5-minutes) sample.

The L10 has been found over the years to be a useful descriptor of road traffic noise as it correlates quite well

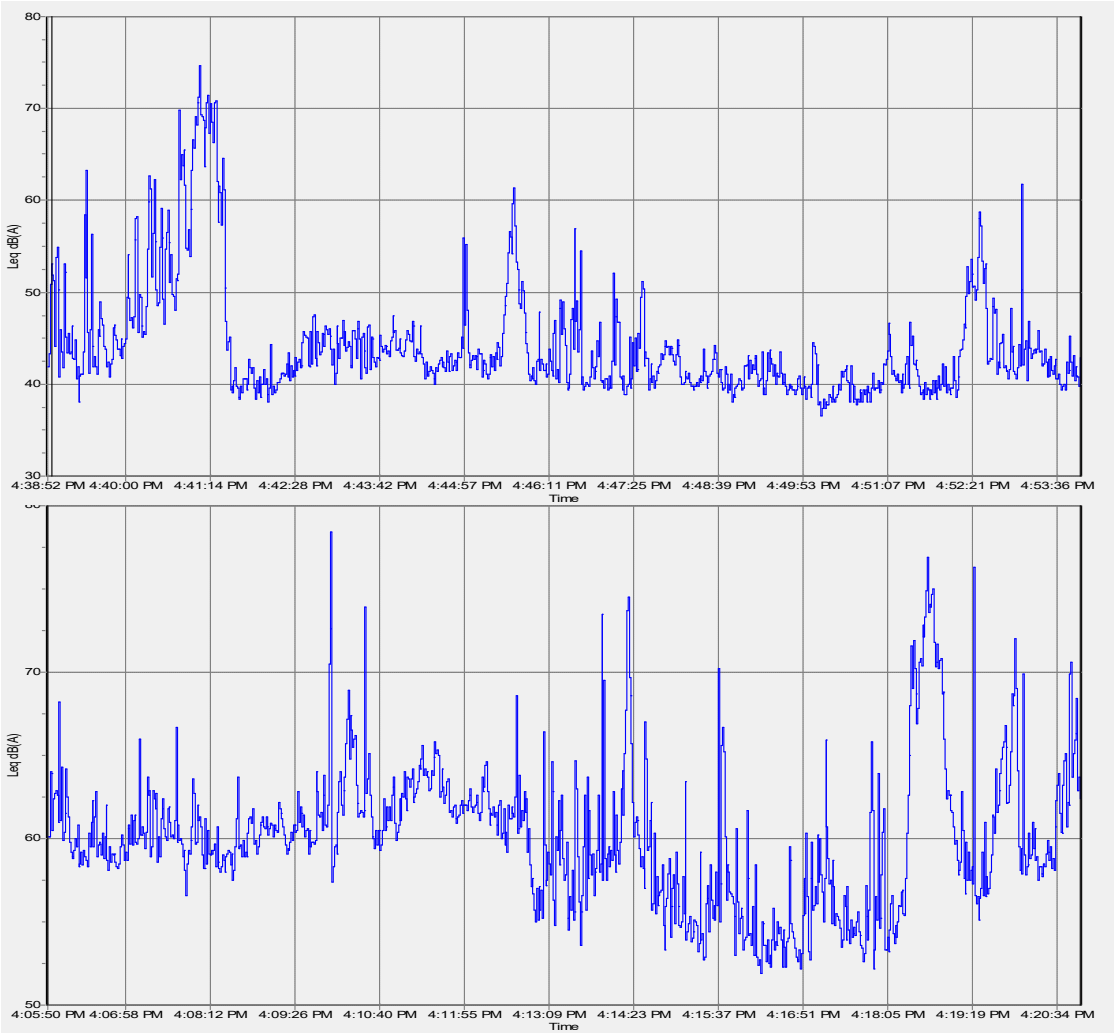

Figure 5.12a: Station 1 & 2 - Noise Levels 2014 November 16

5.2 CLIMATE CHANGE

With the effects of changing temperatures, precipitation and sea levels, amongst other factors, global climate change are already modifying hazard levels and exacerbating disaster risks. Therefore, development projects must take these effects into consideration and more so those in Small Island states (SIDS), such as, Jamaica where the potential impacts could be significant. The Caribbean Climate Online Risk and Adaptation (CCORAL) tool was used to assess the potential vulnerability of MMG to the effects of climate change and the relevant questions and their respective responses are shown below.

Answer all questions below by ticking the relevant box	
1.) Is your activity located in/ relevant to an urban, coastal or marine area, or any other environmentally sensitive or protected area?	Y ☐ N ☑
2.) Will the effects/outcomes of the activity last longer than 10 years?[1]	Y ☑ N ☐
3.) Does the activity involve the tourism, agriculture, forestry, fisheries, water, energy or health sectors?[2]	Y ☐ N ☑
4.) Are existing similar activities already experiencing impacts due to adverse weather effects?	Y ☐ N ☑
5.) Is the activity, once it is implemented, irreversible and inflexible (i.e. it cannot be reviewed and adjusted periodically)?	Y ☐ N ☑
6.) Does the activity focus on vulnerable population groups as a primary target?	Y ☐ N ☑
7.) Will this activity contribute to improving disaster risk management?	Y ☐ N ☑
8.) Is the activity focussed on the provision or dependent upon the availability of national or locally critical infrastructure?[3]	Y ☑ N ☐
9.) Will this activity require in a significant investment from your Ministry's/ organisation's annual capital and/or operational expenditure?	Y ☐ N ☑
10.) Will the activity deliver or make a significant contribution towards the achievement of a priority[4] national development plan objective?	Y ☐ N ☑

Note: Y=Yes, N = No

Based on the screening results it was concluded that the proposed project is a climate-influenced activity of medium priority which should require ongoing monitoring. One

potential area of concern is the demand for irrigation water to maintain the lawns of the cemetery.

5.3 CARRYING CAPACITY

5.3.1 The Concept of the Carrying Capacity

The concept of carrying capacity is based on a general statement that any form of development within the carrying capacity of ecosystem means that development is sustainable. A **Sustainable Development** is a form of development which uses the natural ecosystems as resources of production and consumption growth while leaving them unchanged for the future generation, or, in other words, it is a development within the Carrying Capacity of an ecosystem.

The ecosystem of an urban area like the Kingston Metropolitan Area (KMA) tends to extend beyond its urban boundaries as urban residents and enterprises depend for basic resources and ecological functions on an area significantly larger than the built-up area. This is illustrated by the concept of cities'" ecological footprints", developed by Rees (1992) and Wackernagel, Rees (1995), which refers to the large land area on whose production the inhabitants and businesses of any city depend on for a variety of services, such as, food, renewable resources and the absorption of carbon to compensate for the carbon dioxide emitted from fossil fuel use.

The size of a city's ecological footprint is typically several times the area of the city itself although its size as a multiple of the city area will vary considerably. This may be influenced by the wealth of the city and the energy intensity of its production base, as well as, by such factors as the basis on which the city boundary is defined. Although resources may be drawn from far beyond the city-region, for the urban areas of Kingston and St. Andrew, nearby resources are often utilized and the interment facilities, such as, the MMG cemetery fall into this group. The concept is linked to the idea of carrying-capacity, or the need to balance resource consumption and waste discharge with the preservation of the functional integrity and productivity of relevant ecosystems (UNCHS, 1996). The inability of the KMR to sufficiently provide interment facilities within its boundaries are being met by MMG where available land resource exist providing an ecosystem service that is a basic necessity for an urban area.

Ultimately, the success of the project proposal is measured in terms of its sustainability and it would have achieved its sustainability objectives if:

1. Members of the receptor communities are given priority for jobs created.
2. Public Occupational Health and Safety are assured.
3. The physical, economic, social and cultural environment is enhanced.

4. The development considers any uniqueness of the area in terms of biology, population, climate, geography, geology, hydrology, history and culture.
5. Conservation measures are implemented that help reduce the use of energy and natural resources.
6. There is a participatory attitude in the planning of the project.

5.3.2 Carrying Capacity and the Meadowrest Memorial Gardens

Carrying capacity as it relates to the expansion of the MMG cemetery refers to the intensity of the development and the capacity of the immediate ecosystem to absorb further development. Is the risk of full saturation resulting in an unsustainable development? Section 5.4 on the Biological Environment details the ecological characteristics of the project site as it relates to flora and fauna. The general findings indicate degraded conditions (flora) while site fauna did not suggest potentially significant impacts.

The potential impact on water resources are mitigated due to:

a. Limited exposure of receptors (water bodies and wells) due to the fact that there are no water bodies in the immediate vicinity.
b. There appears to be some protection to ground water as indicated by the Dovecot Park and the Wynters Pen (BWC) wells (Figure 5.5) that record the thickness of the limestone as ranging from approximately 175m (574.18ft) to approximately 240m (787.40ft).
c. The vaults are sealed reducing the risk of groundwater/potable water being contaminated by the decomposition products of corpses.

With respect to the social and economic impacts of the project, job creation within the existing community is an ongoing positive element of the project. The generally positive feedback from the community to the existing facility and its proposed expansion, which is addressed in Chapter 6, suggests an acceptance that might be related to the experienced benefits.

5.4 NATURAL HAZARDS

5.4.1 Slope Stability and Ground Movement

In general, the limestone hills on the south and east of the property can be considered to have low to moderate landslide susceptibility based on the Landslide Susceptibility Map of St. Catherine prepared by the Mines and Geology Division (2011). On-site observation indicates that the rock slope is stable in its natural state. However, if disturbed by deep excavation, the potential for failure will increase if the rock slope is extensively weathered and fractured. Slope and erosion protection measures would be necessary in such instances.

In areas of thick soil cover, excavation for the construction of double vaults will expose approximately 4-4.5 metres of silty clay soil and weathered rock on the face of the cut. These exposed cuts, if left unprotected will be exposed to erosion and possible failure. Structural protection of the exposed cut would be highly recommended.

The practice observed for protecting cuts for deep excavation is the use of reinforced block walls. In addition, the construction of vaults against the protected excavated cut acts as a structural unit which adds lateral support to the excavated slope. During the construction of terraces for burial sites, cuts and fills will be employed to achieve this objective. In such instances, and depending on the slope gradient for which terraces will be constructed, the difference in height between each terrace level will vary. The vaults and fill material at the end of each terrace level will become potentially unstable if it is not protected.

We note the commendable practice of protecting the end of each terrace level using buttress walls where terracing as a landscaping method is used for burial plots on sloping ground. If left uncontrolled, storm water from intense and prolonged rainfall will percolate into the lateritic soil consisting of silty clay which is likely to cause expansion or ground movement of the layer of fill resulting in shifting of the vaults. It is necessary that the burial sites are grassed as soon as each phase of burial is conducted. In addition the collection, conveyance and efficient removal of storm water are essential to ensure that ground movement is minimal to non-existence and this must be based on a properly designed drainage system.

5.4.2 Erosion Potential

The land to be released for burials at the Project Site and the land acquired for expansion of the burial site are covered with trees and scrubland vegetation. The vegetation will be removed when burial plots are being prepared which exposes that particular area to erosion. While no area of major erosion concern was identified, it is recommended that burial plots are built in segments instead of totally stripping the area of vegetation. Where access roads to burial sites will be used as conveyance for storm water, the access roads should be paved and kerb and channel structures used to control storm water to minimize erosion. In instances where access roads are constructed on sloping ground, cross drains should be used, in addition to kerb and channel structures to reduce storm water velocity to allow for efficient removal and minimal erosion.

5.4.3 Land Subsidence

There are two depressions on the site, however, the potential for the underground features to cause collapse or subside is generally low is the area.

5.4.4 Blasting Hazard

Excavation of the limestone will be necessary to remove material for the purpose of burials based on the shallow depth to bedrock. This is expected to occur mainly on the central and southern sections of the site. The most likely method to be used to excavate the rock is controlled blasting. In the general layout of the cemetery site, the plan is to segment the site into large plots separated by walkways. If a plot area is completed with burials, and excavation is to be conducted adjacent to a closed burial plot area, then there are negative potential impacts to the vaults from blast vibration.

The blast energy generated from excavation generally releases body and surface waves which could cause major damage to the vaults due to bending motion or shearing of the vault structure. Where this occurs, cracks could develop along the sides and base of the vaults which could possibly lead to leakage of fluids, such as, Formaldehyde from the damaged vaults into the sub-surface.

There are residential developments which are close to the south and south eastern boundaries of the proposed site. Energy released from blast excavation can cause damage to adjoining building structures and facilities in the immediate environs, create noise nuisance and cause personal injury due to 'fly rock' from air blast. This can be management by controlled blasting along with technically appropriate safeguards to avoid negative results.

5.4.5 Landslide hazard

The proposed site is generally flat to gently sloping and therefore, the potential for slope failures is low. Information from Landslide Susceptibility Map for St. Catherine prepared by the Mines and Geology Division (2011) also confirms that the site has low landslide susceptibility.

In instances where deep excavation (4-4.5m) into soils is required for double vault construction within a plot area, the sides of the excavation cuts could become unstable if exposed to erosion and is unprotected. Based on the practice observed at the existing MMG, the sides of deep excavation are normally protected using reinforced block walls. The construction of vaults against the excavated cut also aids in further reinforcing the slope to increase stability. This method has proved to be effective and is recommended as the practice to be used for the new burial site.

5.4.6 Earthquake Hazard

Seismic data from the Earthquake Unit in Jamaica indicates that the nearest source area to the MMG site for generating damaging earthquakes is the Rio Minho–Crawle River Fault. This fault passes approximately 15 km north of the site and is associated with the Gonave micro-plate, which includes the Plantain Garden – Enriquillo Fault Zone (Figure 5.13). The Kingston Seismic Hazard Assessment Study (1999) indicates that the slip rate of the Rio Minho–Crawle River approximately 5mm/year.

The most recent damaging earthquake associated with the Rio Minho–Crawle River Fault is the Aenon Town, Central Jamaica Earthquake on 2005 June 12, with a magnitude of 5.1. This earthquake caused some structural damage to a number of houses in the Aenon Town and Alston Area in Northern Clarendon and also caused rock falls in Frazier, SW St. Ann.

Figure 5.14 shows data on the number of earthquake events for different localities in Jamaica for 3 year period between the years 2010-2012. The Rio Minho-Crawle River Fault shows 14 earthquake events in 2012 and is only surpassed by the Blue Mountain region for that year.

Shepherd and Aspinall (1980), constructed a damage frequency map of Jamaica based on felt earthquakes (MMVI or greater) from 1880 – 1960 and established a damage frequency rate of 5-9 per century for the study area (Figure 5.15). Based on the available data for the area, it implies a low to moderate earthquake risk as a result of historical seismicity and recent studies on Jamaica's seismo-tectonics.

Areas on the site that are to be excavated and then filled with suitable material for the construction of vaults are likely to be more exposed to significant seismic forces as the fill is not

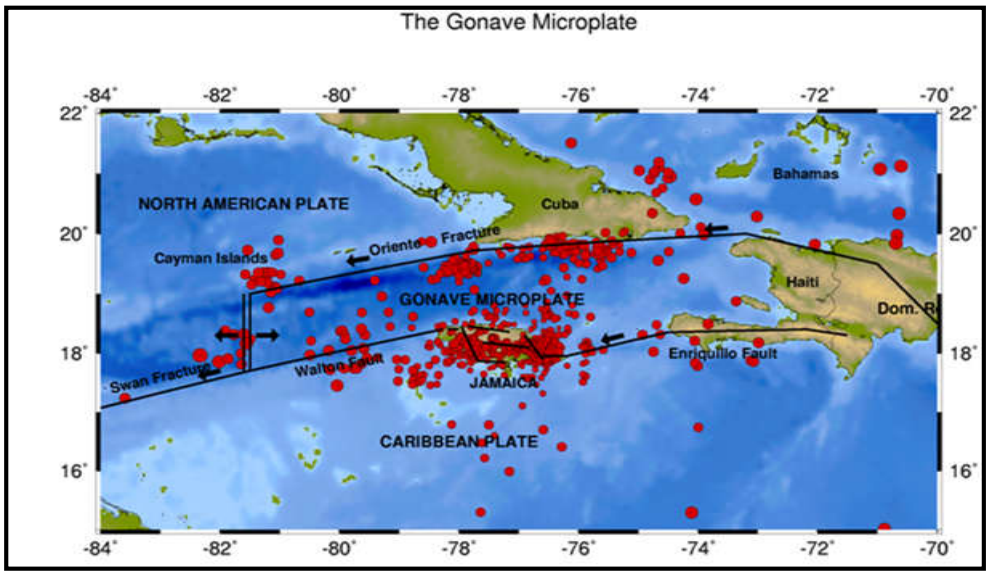

Figure 5.13: The Gonave microplate which shows strike-slip faults across Jamaica including the Rio Minho-Crawle River Fault

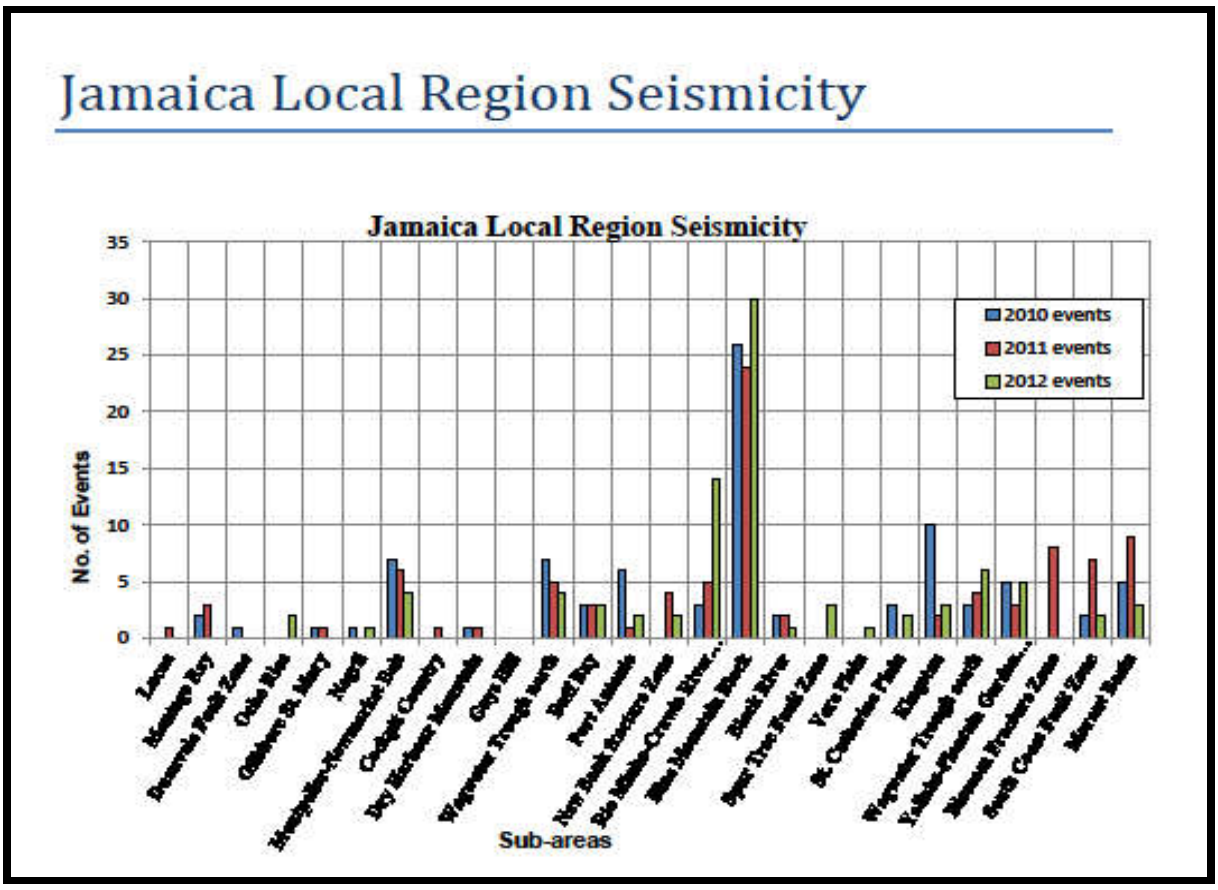

Figure 5.14: Graph showing the number of earthquake events over a 3 year period for sub regions in Jamaica:

Source UNDP

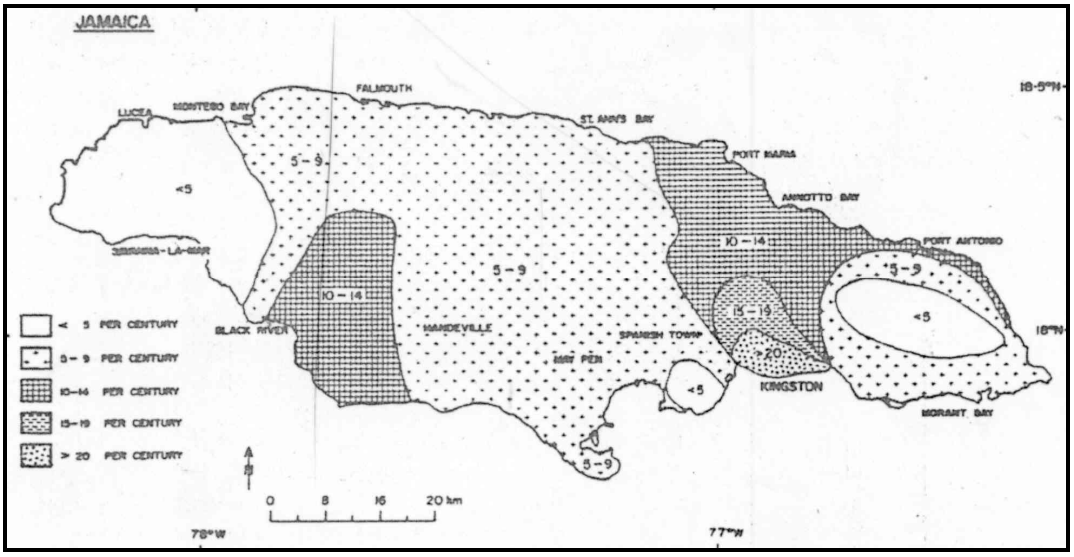

Figure 5.15: Damage frequency map of Jamaica for earthquakes based on intensity data MMVI or greater for period 1880-1960 (Source Shepherd and Aspinall)

engineered (rolled and compacted according to a desired engineering specification) and would therefore experience some amount of ground settlement. The likely impact would be minor shifting or settlement of vaults to cause distortion or cracking in extreme cases.

There is no data available that estimates/calculates a return period for a moderate or large seismic event along the Rio Minho-Crawle River Fault based on seismic modeling; however the damage frequency map which shows a damage frequency of 5-9 for the St Catherine area, does not provide an accurate picture of the potential impact, as the data is based on felt earthquakes which may not be strong enough to cause damage to the vaults.

5.4.7 Flood Vulnerability

The proposed cemetery site at MMG slopes gently towards the south. The main waterway lies towards the southern boundary, it is a poorly defined swale partially connected to the Eastern Gully. This gully passes on the eastern side of the MMG property and drains from north to south. Currently, storm water is removed from the site mainly by sheet and overland flow. An examination of a section of the gully shows that a culvert located south of the site is blocked and hinders the movement of flows further south.

Given existing conditions, the potential for flooding of the Green Acre residential development is possible during extreme storm events if there is no defined storm water conveyance system to remove excessive flows efficiently from the site. In addition, the blocked culvert is likely to create back-flows in the Eastern Gully which in turn will prevent the efficient removal of storm water from the site.

Runoff models calculated for the peak flows to the Eastern Gully estimates an increase o 2.9% to 0.6 % for the 2 year to 100 year return period events after the cemetery site is developed. The post development period therefore shows insignificant increases from pre-development to post-development in storm water drainage. Similarly, increase in total runoff volume after the site is developed ranges from 0.7% to 1.9% for the same return periods.

5.4.8 Hurricanes and Tropical Storms

Jamaica is located in the northern Caribbean region between latitude 18 36 N 175′ S and longitude 76 15′E and 78 22′ W. It is also within the North Atlantic Hurricane Belt and therefore in the path of tropical storms and hurricanes. Over the past 2 decades, tropical storms and hurricanes have done extensive damage to coastal and inland infrastructure. During the period, approximately seven severe weather systems have caused significant economic damage to the country. These include Hurricane Allen (1980), Hurricane Ivan (2004), Hurricane Dean (2007), Hurricane Sandy (2012), Tropical Storm Gustav (2008), Tropical Storm Nicole (2010). Severe tropical storms systems tend to cause flooding in low lying areas, while hurricane damage is generally caused by sea surges (coastal flooding) and wind.

The main concern for the MMG site is the risk of flooding from severe tropical storms. Abnormal rainfall from a severe weather system could overwhelm the existing and/or proposed drainage infrastructure; however, flood water is not expected to pond or settles for long periods. Overland flow will be discharged into drainage systems provided they are designed using appropriate design return periods for the cemetery site and that there is no blockage within the on-site or off site drainage system due to debris and high sediment load. It is therefore important that storm water drainage is properly designed, constructed and maintained to minimize the impact of flooding from a severe storm event.

With respect to wind damage from a hurricane, the only permanent building structures that are connected to the burial site are the chapel and the office located on the existing cemetery site.

5.5 BIOLOGICAL ENVIRONMENT

This section describes the site's flora and fauna observed within context of the proposed expansion of the MMG cemetery over the period 2014 September 13-14. All observations and findings were made in the context of the visual impact of the development, the impact to wildlife movement corridors, habitat fragmentation, and sensitive natural communities and species diversity.

Methodology

There were three (3) objectives of the assessment:

1. To determine the species composition (of birds, reptiles, insects and any other observed animals) within the proposed area, with an emphasis on highlighting endemic, endangered and rare species
2. To determine the floral composition within the proposed area, with an emphasis on highlighting endemic, endangered and rare species.
3. The assessment of various impacts to flora and fauna based on the expansion activities.

Species diversity was assessed by means of the DAFOR scale.

Avifaunal Census

Fixed Radius Point Count Census Method

This Point Count method was based on the principle of counting birds at a defined point or spot and determining the distance of each bird censured. A point is selected and then all bird contacts (seen and heard) are recorded, with a determination of distance given (< 25m or >25m) for each contact. This is done for a predetermined time, usually 10 minutes, before moving to

another point at a specified distance away (Bibby et al. 1998). Points for this survey were at most 40m apart.

Advantages of this method include:

1. Greater concentration on the birds and habitats without having to watch where you walk (Bibby et. al. 1998).
2. More time available to identify contacts (Bibby et. al. 1998)
3. Greater opportunity to identify cryptic and skulking species (Bibby et. al. 1998)
4. Easier to relate bird occurrence to habitat features (Bibby et. al.1998).

Technique Weaknesses

As with all survey techniques, there are weaknesses, which influence overall results. Below are given factors which affect both census techniques used.

1. Time of Day – the best time for conducting a census is in the morning from sunrise until about 10am in the lowlands. It is recognized that as the day continues it gets hotter and the ability to detect birds decreases due to lack of movement (Wunderle 1994). The surveys were conducted from sunrise to 9am.
2. Time of Year – the change in behaviour of birds during the breeding and non-breeding seasons affect detection. However for this report, the assessment was done at the beginning of the non-breeding season, when birds are less vocal, and when winter migrants are present in Jamaica. (Wunderle 1994).
3. Weather – things such as wind, rain, fog or if the day is too hot, affect conducting a census (Wunderle 1994). The day of survey was sunny with minimal wind
4. Summer Counts versus Winter Counts – the counts conducted within the area were done within the early winter period, therefore incorporating both residents and early arriving migrant birds, however such habitats are known to be utilized by summer migrants, and these winter counts tend not incorporate these birds, as well as summer residents which may have left the location.

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.

Vegetation survey

A rapid vegetation description was done at the survey site for the tree and plant assessment in order to generate a species list of trees and plant species inclusive of all plant life forms, endemics and native plants. A rapid vegetation description (assessment) involves a walk through the property to collect biodiversity information. The route passed, through the main areas of woodland and forest habitat variation. The assessment required an examination of

native species abundance, native tree species richness, and native shrub species richness, and vertical vegetation structure, variation in stem sizes, large standing and invasive species abundance.

The DAFOR scale was used in providing a quick estimate of the relative abundance of species in a given area. The DAFOR scale comprises the following categories:

Value	Percentage
D- Dominant	>75%
A- Abundance	51-75%
F – Frequent	26-50%
O- Occasional	11-25%
R - Rare	0-10%

5.5.1 Vegetation Assessment

A species list of trees and plant species inclusive of all plant life forms, endemics and native plants, was generated. The main habitat types found were disturbed woodland patch, disturbed forest patch and disturbed woodland as described in Table 5.20 and shown on Figure 5.16 below.

Table 5.20 Bird and Vegetation Assessment Sites

Location Name	Habitat Type	Comments
1	Disturbed Woodland Patch	Area where charcoal kiln observed as well as other anthropogenic material. Clear signs of secondary and coppiced growth of trees. There were observed a few emergent trees 15 – 20m in height. Other tree heights ranged from 8 – 12m of mixed species.
2	Disturbed Forest patch	At this area/site again a sign of anthropogenic activities but noticeably this area was used as a dumping site. Noted was the recent impact of fire to the area, however fresh growth had started with the growth of gasps.
3	Disturbed Woodland	Clear signs that there has been prior removal of vegetation and he remnants of a charcoal kiln. There is a dominance of shrubs in the area with several trees present as well.

Note: A patch is a small area of trees or shrubs or mixture of both which in size exceeds no more than 2.5 acres (1Ha) and minimum 1acre (0.25Ha).

5.5.1.1 Vegetation

A total of fifteen (15) tree species were observed of which none were Endemic as shown in Table 5.21. Also, eleven (11) herbs and/or shrubs were observed from surveys of which one (1) was Endemic.

Table 5.21: List of Observed Tree Species

#	SCIENTIFIC NAME	COMMON NAME	STATUS	
1	*Chrysophyllum cainito*	Star apple	Native	F
2	*Allophyllus comina*		Native	F
3	*Senna bicapsularis*	Yellow candlewood	Native	O
4	*Zanthoxylum martinicense*	Prickly Yellow	Native	O
5	*Bursera simarouba*	Red Birch	Native	F
6	*Guazuma ulmifolia*	Bastard Cedar	Native	F
7	*Haematoxylum campechianum*	Logwood	Native	D
8	*Bauhinia divaricata*	Bull Hoof	Native	R
9	*Magnifera indica*	Mango	Introduced	F
10	*Matayba apetala*	Cobywood	Native	O
11	*Crescentia cujete*	Calabash	Native	D
12	*Leucaena leucocephala*	Lead Tree	Native	F
13	*Manilkara zapota*	Naseberry	Introduced	F
14	*Ficus membranacea*	Fig	Native	O
15	*Cecropia peltata*	Trumpet tree	Native	A

DAFOR Scale - Key: D – dominant; A – abundant; F – frequent; O – occasional; R - rare

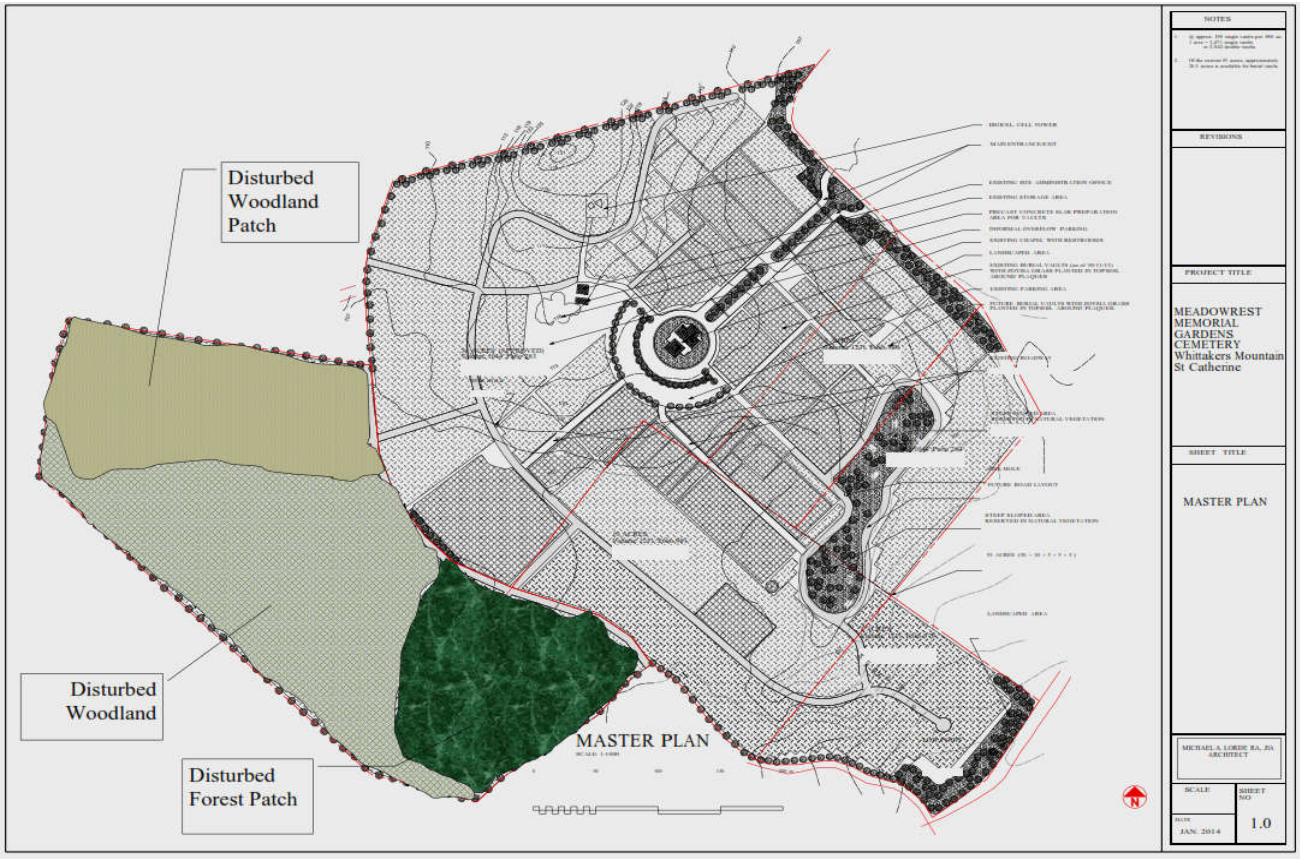

Figure 5.16: Habitat Map for the proposed Meadowrest Memorial Gardens expansion area

B. List of Observed Shrubs/Herbs

Spanish Needle	-	*Bidens pilosa*
Jamaican Rosemary	-	*Croton linearis*
	_	*Sida* sp.
Wild sage	-	*Lantana camara*
Guinea Grass	-	*Panicum maximum*
Ram goat dash a long -	-	*Turnera ulmifolia*
Bougainvillaea	-	*Bougainvillaea* sp.
John Crow Bead	-	*Abrus precatorius*
Christmas Candlestick	-	*Leonotis nepetaaefolia*
Deadly Nightshade	-	*Urechites lute*
Buttonweed	-	*Barrera laevis*

5.5.2 Avifauna

A total of twenty-one (21) bird species were observed as shown in Table 5:22. The breakdown is as follows:

- 3 Endemics

- 6 Endemic Subspecies
- 9 Residents
- 2 Winter migrants
- 1 Summer resident

Table 5:22: List of bird species observed from conducted counts and transect

#	COMMON NAME	SCIENTIFIC NAME	STATUS
1	Black Whiskered Vireo	*Vireo altiloquus*	SR
2	Jamaican Vireo	*Vireo modestus*	E
3	Mangrove Cuckoo	*Coccyzus minor*	E
4	Caribbean Dove	*Leptoptila jamaicensis*	R
5	Yellow-faced Grassquit	*Tiaris olivacea*	R
6	Bananaquit	*Coereba flaveola*	ES
7	Vervain Hummingbird	*Mellisuga minima*	ES
8	Loggerhead Kingbird	*Tyrannus caudifasciatus jamaicensis*	ES
9	Northern Mockingbird	*Mimus polyglottos*	R
10	Common Ground Dove	*Columbina passerina*	ES
11	Zenaida Dove	*Zenaida aurita*	R
12	White Crowned Pigeon	*Patagioenas leucocephala*	R
13	Black Faced Grassquit	*Tiaris bicolor*	R
14	Jamaica Lizard Cuckoo	*Saurothera vetula*	E
15	American Kestrel	*Falco sparverius*	ES
16	Mourning Dove	*Zenaida macroura*	R
17	Olive Throated Parakeet	*Aratinga nana nana*	ES
18	Smooth Billed Anil	*Crotophaga ani*	R
19	White Winged Dove	*Zenaida asiatica*	R
20	American Restart	*Setophaga ruticilla*	W
21	Prairie Warbler	*Setophaga discolor*	W

Key

Status: E – Endemic; ES – Endemic Sub-species; R – Resident; SR – Summer Resident; I – Introduced; W – Winter Migrant

5.5.3 Butterflies

A total of eleven (11) species were observed: One (1) Endemic species and ten (10) Residents as shown in Table 5.23.

Table 5.23**:** Butterfly Species Observed

#	Common Name	Scientific Name	Status
1	Zebra	*Heliconius charitonius simulator*	R
2	Cloudless Sulphur	*Phoebis sennae*	R
3	Julia	*Dryas iulia delila*	R

4	Buckeye	*Junonia genoveva*	R
5	Citrus Swallowtail	*Papilio andraemon*	R
6	Jamaica Mestra	*Mestra Dorcas*	E
7	Eurema	*Eurema lisa euterpe*	R
8	Jamaican Goatweed	*Anaya portia*	R
9	White Albatross	*Appias drusilla castilia*	R
10	Cassius Blue	*Leptotes cassius theonus*	R
11	Hannon Blue	*Hemiargus hanno ceraunus*	R

Key: Status: E – Endemic; ES – Endemic Sub-species; R – Resident

5.5.4 Other Animals

Other animals observed were:

- Snail – (Family: Pulmonata) shell evidence observed
- Wasp (1 species – possibly *Sceliphron assimile* DAHLBOM)
- Honey Bee – *Apis* sp.

5.5.5 Wildlife Corridors and Habitat Fragmentation

The proposed expansion would have little impact to habitat fragmentation. The current area is highly fragmented based on the level of anthropogenic disturbance which is in the area. Also with respect to wildlife corridors these would be maintained on the hilly areas where vegetation (woodland) remains.

5.5.6 Sensitive Natural Communities

There were no sensitive natural communities observed during the survey period and therefore there would be no impact based on the proposed expansion.

5.5.7 Species Diversity

As shown in Table 5.19, vegetation on the property is disturbed although to varying degrees. Signs of anthropogenic activities include charcoal burning which has a direct effect on flora but also negatively impact the distribution of species, their diversity and their numbers. The area of least species count was area 2 that is described as Disturbed Forest Patch where less than 30 per cent of the species count was detected.

5.6 HERITAGE

Methodology

The Archaeological Impact Assessment (AIA) was conducted by the JNHT as follows:

1. Desktop research of relevant historical documents
2. Conduct archaeological field walk survey for the collection of artifacts sample collection etc.
3. Assemble, evaluate and present baseline data
4. Present major issues of archaeological and social concerns
5. Present potential impacts
6. Development of a Monitoring Plan

5.6.1 Background

Archaeological and architectural resources (buildings and structures) are protected under the Jamaica National Heritage Trust Act, 1985 that is administered by the JNHT which provides for protection of historic structures, as well as, areas and species of heritage value. Where such structures, areas or species are found the JNHT would intervene. An Archaeological Impact Assessment (AIA) was prepared by the JNHT and a summary of the findings are presented below.

5.6.2 Discussion and Conclusion

Numerous footpaths traverse the property leading to mango trees and charcoal kilns. One path is used as a short cut from Page Level through the cemetery to Paul Mountain to Page Mountain and also traverses the property.

The area that was surveyed was in ruinate and covered with guinea grass, trees and shrubs. Some trees, such as, naseberry and cashew concur with the belief that the Tiano occupied the site during the prehistoric period. This was confirmed by the presence of Taino pottery sherd observed on the surface difficult for the proposed area. The density of the guinea grass made archaeological surface difficult. In some areas there was also leaf litter which in some cases was cleared for inspection. In these areas, for the greater part, no historical or pre historic material was found. The areas where there were cultural materials remains which suggest that there was residence or residences at the locations. However, as a result of the guinea grass and the leaf cover the foundations were not found except where the demolished house rubble was located.

5.6.3 Mitigation and Recommendations

The historic documents indicate that the Taino occupies the entire area known as the Red Hills. However, the volume of Taino pottery shreds recovered in the area east of the property and on show that expansion area show that the Taino occupied the site permanently. It should also be noted that the vegetation cover impeded the surface survey. Thus it is imperative that careful consideration be given to the possibility of subsurface middens and other Taino features when construction excavation gets on the way. The JNHT should be informed of the clearing excavation stages so that an archaeological watch in brief can be conducted.

The presence of both Spanish and English bricks is an indication that structures apart from the demolished house were in the area. Although falling out of the proposed expansion area these may be indicative of what lies under the heavy vegetation cover. Clearing of the forested area may reveal the location of structures. The JNHT needs to be informed of any clearing or excavations in the areas that fall outside the proposed development, for example, trenches for laying of pipes so that an archaeological watching brief can be conducted.

The two concrete troughs are relics from the time the properties serves ad cattle pens. This all outside the proposed construction zone but there is the possibility that when the vegetation is removed more features associated with pen keeping may be found in that case, these features should be recorded before destruction. Again monitoring during the clearing and excavation stages is recommended. It should be noted that in case archaeological features are found within and outside the development the JNHT will evaluate and record the features and collect any such cultural material found.

5.6.4 Conclusions

No significant archaeological impact was detected. However, because the area is documented to be part of a historical estate undetected features may still be present so watching briefs are recommended during clearing and excavation. The AIA concluded, therefore, that except for a house which was destroyed, the site does not have a large number of archaeological features on the surface. Therefore, the development would not have a significant impact on the historical aspect of the site. Very few archaeological features and evidence of material culture remains were identified and retrieved. **The Archaeological Division therefore has no objection to the proposed expansion of the MMG cemetery**.

6.0 SOCIO-ECONOMIC ENVIRONMENT

This chapter provides information on the social and economic characteristics of the receptor communities. The information was obtained from desktop research, a community survey and that provided by the relevant government entities, such as, the Jamaica Constabulary Force, the Ministry of Education publications and the Jamaica Fire Brigade, The Ministry of Health,- South East Regional Health Authority (SERHA).

Methodology

The general 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 socio-economic assessment 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 6.1: The social variables are tailored toward these variables where appropriate.

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

Population Characteristics – 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 St. Catherine

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 as the Primary interest groups.

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 would seek 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 location and provision of housing and community infrastructure, such as, health, police, fire protection and sanitation facilities. A key to the continuity and survival of human communities is their historical and cultural resources and their potential role in the continuity and survival of the communities.

Table 6.1: 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	X	×	x	×
Influx of temporary workers	X	✓	✓	×
Community and Institutional Structures				
Interest group activity	✓	✓	✓	✓
Size and structure of local government	×	×	×	×
Historical experience with change	X	x	x	×
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	✓	✓	✓	✓

The information was obtained from desktop research, a community survey and the relevant government entities, such as, the Jamaica Constabulary Force, the Ministry of Education publications and the Jamaica Fire Brigade, The Ministry of Health,- South East Regional Health Authority (SERHA).

6.1 REGIONAL & LOCAL SETTING

The MMG is located in the suburban area of Spanish Town, the administrative capital of the parish of St. Catherine. The urban area of St. Catherine along with the parishes of Kingston and St. Andrew comprise the Kingston Metropolitan Region (KMR). The three (3) parishes combined comprise a population of 1,097,644 in 2011 (STATIN, 2011) or 40.7% of the island's population.

6.1.1 Urban and Rural Population Distribution

Urban centres are classified as regional, parish capitals, main towns and other towns. The Parish of St. Catherine was declared 77.2% urban in 2011 up from 73.8% in 2001, just falling below St. Andrew at 86.5% and 86.9% respectively. Kingston continues to maintain its status at 100% urban. These are above the national average for urban population of 52% in 2001 but increasing to 53.9% in 2011.

6.1.2 Hierarchy Urban Centres

With a population of 146, 152, Spanish Town was the second most populated urban centre in 2011, growing from 131,507 in 2001. In 2011, the population of Spanish Town exceeded only by Portmore (182,153) and was followed by Montego Bay (110,115) and May Pen (61,548) and Mandeville (49,695).

6.2 SUMMARY OF AREAS OF SOCIAL SIGNIFICANCE

The socio-economic, physical planning and spatial implications of the proposed cemetery expansion is significant within the context of the KMR due to the general low capacity of facilities for burials within the region. The sustainable development of the proposed site is measured 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. The physical ecological component of the proposal is addressed elsewhere in the EIA report.

The following are the primary issues relating to the development:

- The effects of the expansion of the existing MMG cemetery.
- 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

6.3 POPULATION CHARACTERISTICS

6.3.1 Demographics

According to STATIN,2012, the 2011 population of 2,697,983 reflects a positive population growth (0.36%) island wide over 2001 when the population stood at 2,607,632. The population of St. Catherine stood at 516,218 or 19.13 per cent of the island's population in 2011. St. Catherine was one of the most populous in 2011 just falling behind St. Andrew at 573,369 or 21.25 per cent of the total population. There was a population decline -0.80% in Kingston over the period.

The population of Spanish Town in 2011 stood at 147, 152, an increase from 131,507 or 1.19% in 2001. Within the Social Impact Area (SIA), the 2001 population of the Enumeration Districts (EDs) that fall within the 1km radius of the SIA area was 3,410, this figure increased to 3,754 in 2011, an increase of 1.01% or an annual rate of growth of 0.01%.

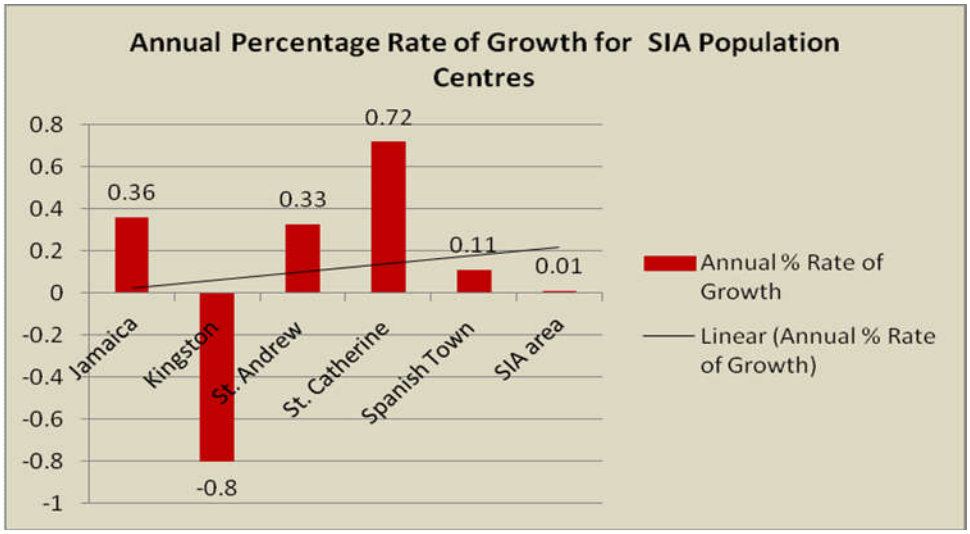

Figure 6.1: Showing Annual Percentage Rate of Growth for relevant SIA impact areas, 2001 to 2011

Relevant population rates of growth for the 10-year period 2001 to 2011 (Figure 6.1) are show a population shift from the parishes of Kingston and St. Andrew to St. Catherine.

6.3.1.1 Population Density

According to the World Bank, in 2011, Jamaica had an overall density of 249 persons per square kilometer of land, however, as shown in Figure 6.2 below, this average was exceeded in the KMR were densities in 2011 ranged from 401-4013 persons per square kilometer of land.

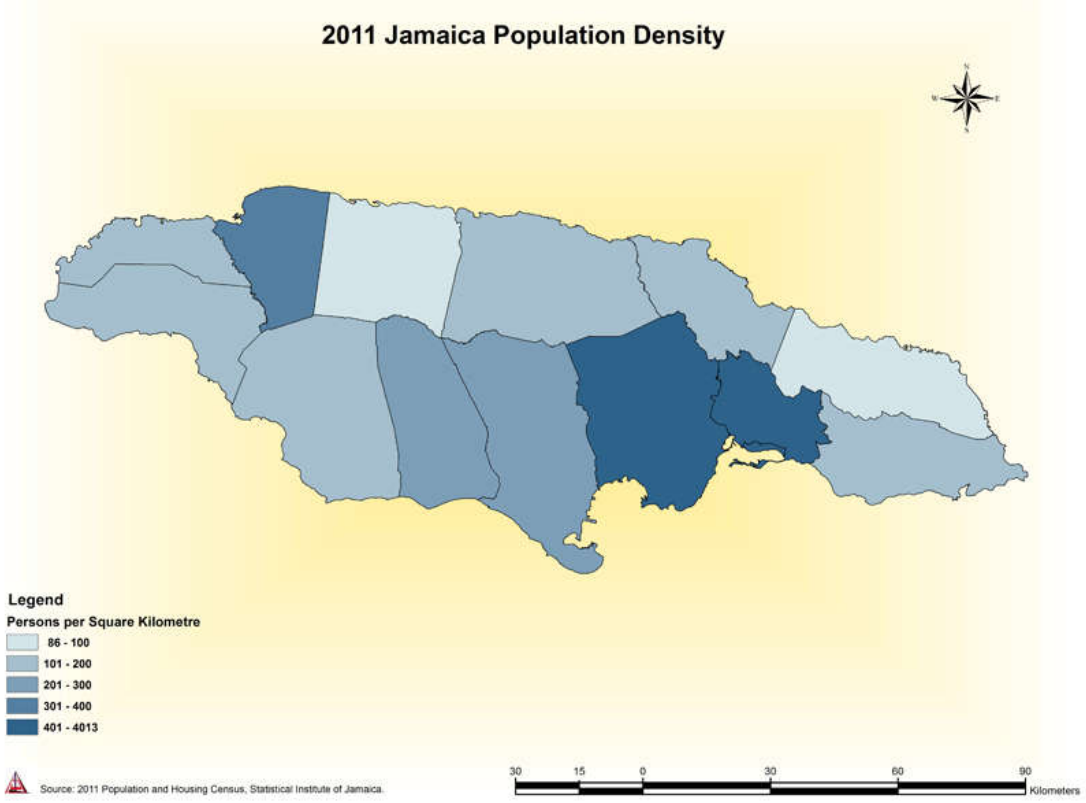

Figure 6.2: Population Density in Jamaica, 2011

6.3.1.2 Age and Sex Ratio

There were slightly more females than males in St. Catherine in 2011 with a male: female ratio of 100:94 which was in line with the national average of 100:97. The ratio for the population that fell within the EDs was unlike the national and parish trend as the male population in these EDs exceeded that of females at a ratio of 100:102.04. This is likely due to the employment opportunities that exist from establishments, such as, the cemeteries located in the area.

6.3.1.3 Dependency Ratio

The dependency ratio describes the number of persons in the population not economically active for every 100 persons who is economically active. Nationally, the census period 2001-2011 was marked by lower fertility, declining numbers in the lower age groups and the aging of the population. According to STATIN, based on the 2011 census, there were 702, 800 persons or 26% who were below the age of 15. This was 135, 000 less persons over the 2001 figure or a -

16.2% decline. On the other hand, there was a positive change (8.80%) in the over 64 age cohort attributable to the aging of the survivors of the previous high fertility periods.

While the dependency ratio for the island stood at 57 in 2011, the ratio within the EDs of the SIA area was slightly less at 54.70, possibly impacted by the apparent influx of employment seekers (economically active persons) to the area.

6.3.1.4 Migration

In the absence of migration data from STATIN, the report deduces that given the close proximity of the Parish to the major urban centres of Kingston and St. Andrew (KMA) along with the availability of lands for housing construction are potentially the main factors driving migration to the parish of St. Catherine. There are also the fairly well developed economic sectors of commerce and manufacturing (which provide numerous employment opportunities). Over the period 2001 to 2011 St. Catherine was the fastest growing parish having grown at an annual rate of growth of 0.72%, doubling the national rate of 0.36%.

6.3.1.5 Population Projection

Assuming that the annual growth rates for the island (0.36%), St. Catherine (0.72%) and Spanish Town (0.01) for the period 2001 – 2011 remain constant it, is projected that the population of Spanish Town will reach 147,431 by 2030 and that of St. Catherine would grow to 591,605 as shown in Table 6.2 based on the Exponential Growth/decay formula below:

$x(t) = x_0 \times (1 + r)^t$
x(t) is the value at time t.
x_0 is the initial value at time t=0.
r is the growth rate when r>0 or decay rate when r<0, in percent.
t is the time in discrete intervals and selected time units[3].

Table 6.2: Population Projection – Jamaica, St. Catherine & Spanish Town, 2011-2030

LOCATION	PERCENTAGE CHANGE 2001-2011	2011	2015	2020	2025	2030
Jamaica	0.36	2,697,983	2,737,044	2,786,678	2,837,190	2,888,628
Catherine	0.72	516,218	531,246	550,649	570,760	591,605
Spanish Town	0.01	147,152	147,211	147,284	147,358	147,431

[3] http://www.rapidtables.com/calc/math/exponential-growth-calculator.htm

6.4.1 Political Organization

The parish of St. Catherine is divided into eleven constituencies and the MMG is located in the West Central Constituency. Within this constituency there are four electoral divisions – Bellevue, Point Hill, Red Hills and Ginger Ridge. The MMG falls within the Bellevue Division.

6.4.2 Community Leadership

Citizen's Associations are 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. The Fraser's Content Development Foundation oversees the affairs of the community. The Social Development Commission (SDC) that promotes community development is also active in the area.

6.4.3 Employment

At October 2014, the national employment rate stood at 85.8% compared to the unemployment rate of 14.3%. The community survey data indicated that over 90 % of the respondents were employed, which was above the national average. Within the receptor community according to the community survey data, the professions of community members include shopkeeper, teacher, engineer, barber, mason, taxi drivers and grounds men. Not only are virtually all the persons working on site from surrounding communities, but concrete blocks, cement, steel and other supplies are sourced from businesses located in those communities where they are available.

6.4.4 Economic Activity

Within the SIA area, the main economic activities are those of the cemeteries and associated linkage activities.

6.5 COMMUNITY RESOURCES

6.5.1 Land use and Planning

Land use planning in St. Catherine is covered under three (3) Development Orders – the Bog Walk/Linstead/Ewarton Development Order, 1965, the Spanish Town Confirmed Development Order, 1964, and the St. Catherine Coast Confirmed Development Order, 1965 as shown in Figure 6.1. The Town and Country Planning (St. Catherine Area) *Draft* Development Order, 2017 (*material consideration*) is proposed as a replacement. The area of the Proposed Action currently falls outside of the Development Order areas, therefore, development in these locations do not normally require planning permission from the St, Catherine Parish Council, however, the need for building approval does apply under the Building Act.

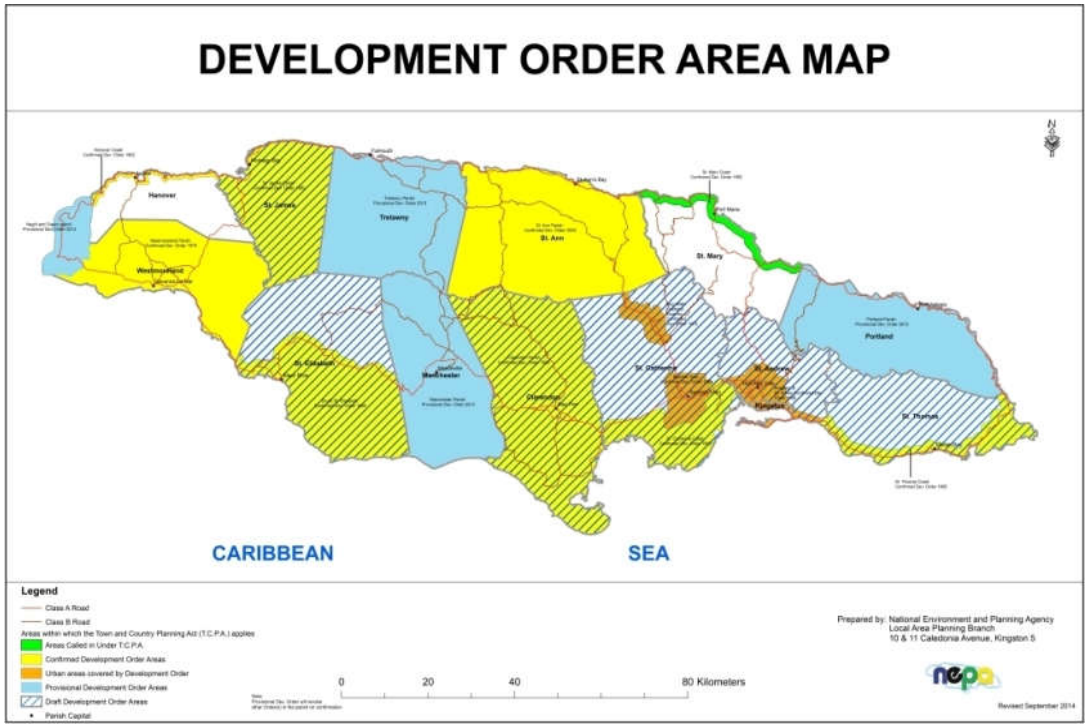

Figure 6.3: Development Order Areas in Jamaica

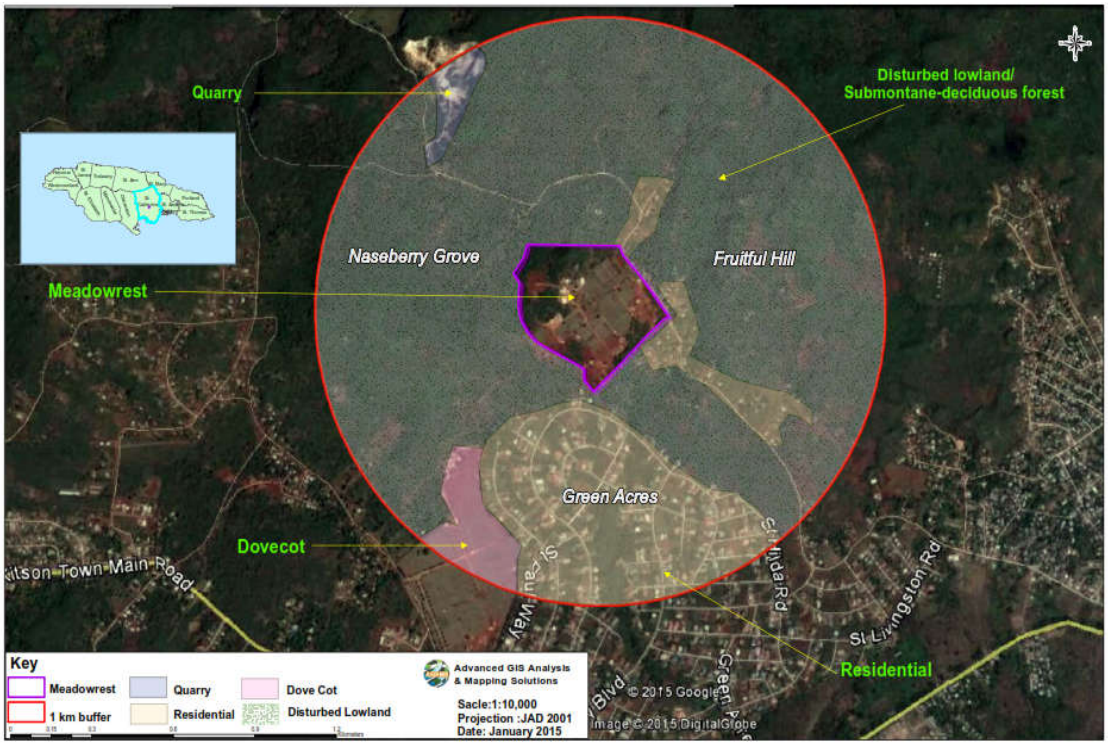

Figure 6.4: Showing Land use within the SIA area of the proposed Meadowrest Memorial Gardens expansion area.

6.5.1 Housing

The total number of dwelling units on the island grew from 723,041 in 2001 to 853,660, an increase of 18%, on the other hand and at a greater rate, the number of households increased from 748,326 to 881,078 or by 17.7%. The total number of dwelling units in St. Catherine grew from 128,974 in 2001 to 156,961 in 2011 a 21.7% increase while the number of households

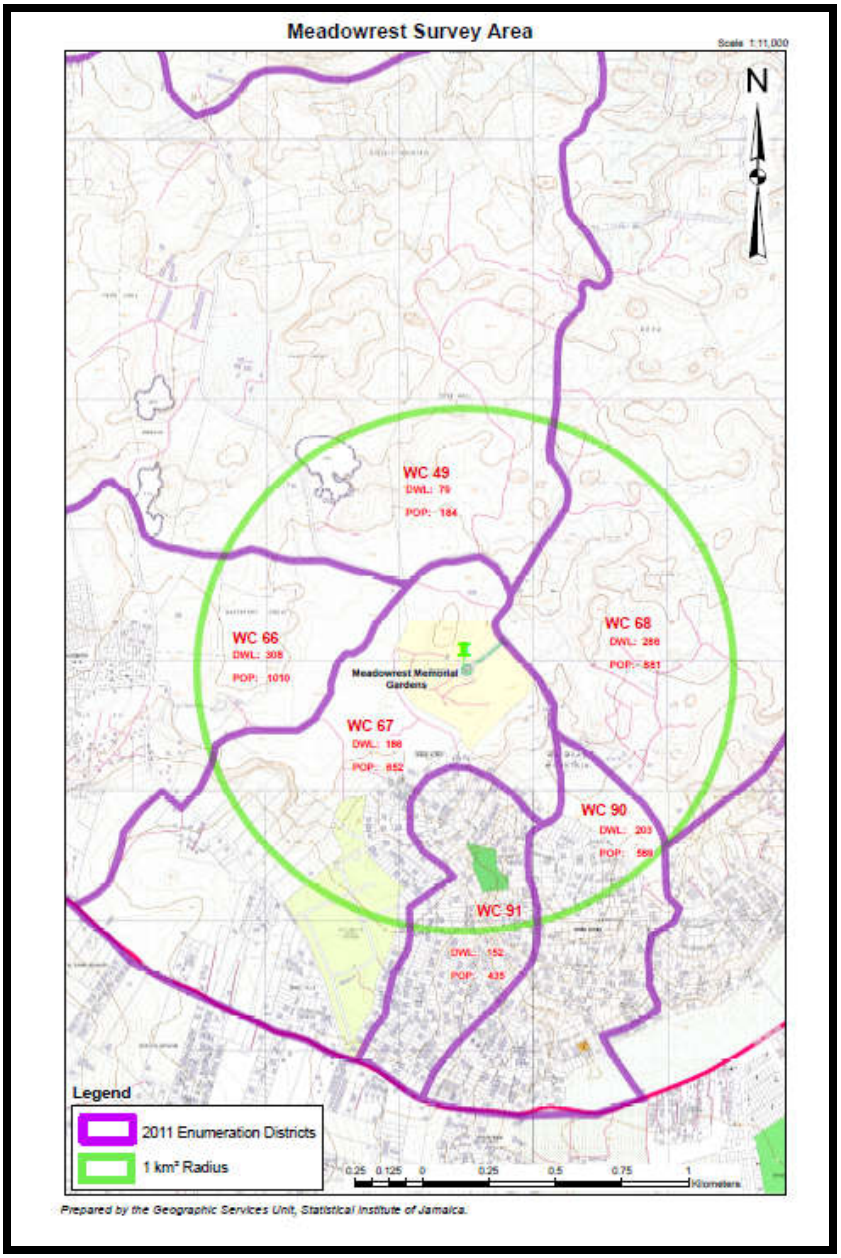

Figure 6.5: Showing the Project Area lying within a 1-kilometre of the project site and Enumeration Districts

Source: Statistical Institute of Jamaica of Jamaica, 2012.

increased from 134,377 to 163,215, an increase which was above the national average. This confirmed the population shift noted above. The total number of dwellings in the entire EDs within the MMG project area was 1,214 in 2011 or 0.8 of the total housing stock in the parish (Figure 6.5); however, the total number of dwellings within the 1 km radius is estimated at 25% of the total for the EDs in the SIA area.

According to the 2011 national census, in Spanish Town, there were 50,692 households with an average household size of 2.9; this was lower than the national 3.52 % average household size recorded in 2001 when the total numbers of households were 37,660. Within the receptor community, survey data shows mean household size of 4.7.

6.5.2 Social Services and Amenities Infrastructure

6.5.2.1 Fire Protection

The Project Site is located within Area III of the four (4) administrative zones of the Jamaica Fire Brigade (JFB). Each area is further divided into thirteen (13) divisions that coincide with parish boundaries. Area III includes St. Catherine, Clarendon and Manchester. There are four (4) fire stations in St. Catherine and they are located at Spanish Town, Old Harbour, Waterford and Linstead.

The role of the JFB is to protect life and property from fire or other disasters within the island and its territorial seas. Specifically, its fire suppression and other functions in the area include responding to structural, vehicle and brush fires, road traffic accidents, hazardous materials spills/releases (HazMat), urban search and rescue (USAR) and water rescue. The primary equipment are operational (firefighting and rescue) and utility vehicles. There are also three (3) fireboats but these are assigned the harbours in Kingston, Montego Bay and Ocho Rios.

The Spanish Town Fire Brigade Station (STFBS) is the first responder for the area. The station has the services of a fire engine and a water truck. The station is equipped with the required rescue tools, such as, the jaws of death. The region is able to provide emergency medical services and an ambulance crew from its Linstead Fire Station.

Bush fires are the greatest incidents involving fires in St. Catherine. According to the Spanish Town Fire Brigade records, over the period January to August 2014 the month with the greatest number of responses to bushfires was July (289) (Miss Allison, STFBS, 2014). The frequency of bush fires is due to the existing land use in the adjacent areas and the tendency of farmers to practice slash and burn agriculture.

6.5.2.2 Law Enforcement

The Jamaica Constabulary Force (JCF) is responsible for the maintenance of law and order, the prevention and detection of crime, the investigation of alleged crimes, the protection of life and property, and the enforcement of all criminal laws as defined by the Jamaican jurisdiction. The JCF also provides general assistance to the public as the case may arise. The current Corporate Strategy of the Jamaica Constabulary Force is the employment of community policing in its efforts to fight crime instead of the traditional style of policing. They are of the opinion that our modern age requires that the police act in partnership with the public and with other public, private and voluntary sector organizations to deliver collaborative services that address crime, fear of crime and other safety issues which concern communities http://www.jcf.gov.jm/service/community-policing. Accessed 2014 September 1.

In the administration of the operations of the JCF, the parishes are divided into five (5) areas. St. Catherine falls in Area V along with St. Andrew North and St. Thomas. Apart from its regular policing activities of relevance to this Proposed Project are the activities of the Traffic Division of the JCF. The Traffic Division is responsible for the monitoring of traffic and the actions of motorists, this includes the escort offered to funeral processions for which a fee is charged.

The Spanish Town Police Station serves the Project Area and checks with the station did not indicate any major issues related to crime or traffic congestion in the area.

6.5.2.3 Schools

Public schools are grouped into six (6) Regions by the Ministry of Education. The schools in St. Catherine fall in Region Vl, the Old Harbour Region along with the parish of Clarendon. St. Catherine has the largest number of public educational institutions (123) followed by St. Andrew (118). As shown on Figure 6.6, there are no public educational institutions that fall within the Project Area. Primary schools in closest proximity to the development site and fall within a 5 kilometre radius, they and their 2012-2013 student populations are the St. Johns Primary (1,797), Friendship Primary (1,632), Paul Mountain Primary (66) and Kitson Town Primary (453). High Schools in closest proximity are the St. Catherine High (2,334) and Inswood High (1,979). In addition, there are several, private and public basic schools located along St, Johns Road.

Figure 6.6: Showing Social Services within 1 & 5 Kilometre radius of Meadowrest Memorial Gardens

6.5.3 Utilities & Services Systems

6.5.3.1 Water Service

The National Water Commission (NWC) is the main institution responsible for major water and sewage operations including: production of water collection, water treatment and disposal of urban sewage. Provision for rural water is shared between the NWC and the Parish Councils. Potable water supply in the area is supplied primarily by wells of which are three within the general area of the project. Checks with the community members have revealed that the water supply is unreliable; therefore, the storage of water has to be practiced.

6.5.3.2 Wastewater Service

Wastewater disposal in the parish is primarily sewers. In 2011, there were 163,215 toilets recorded in St. Catherine (STATIN, 2012) of which 125,011 (76.6%) were linked or not linked to sewers. There still were 28, 733 (17.6%) pit latrines. At MMG the existing waste water solution is by way of an onsite septic system.

6.5.3.3 Storm water Drainage

The Project Area falls under the jurisdiction of the St. Catherine Parish Council. The NWA stipulates that (a) drainage systems should be designed to convey only storm water (b) The designing/construction of drainage schemes should be economical (c) The drainage plan should correlate with the proposed ground level plan to minimize the passage of high from flows on roadways and properties.

There is an absence of publicly built drains in the vicinity of the proposed development, therefore runoff tend to follow roadways and natural drains. The development proposes on site management of storm water as far as is possible.

6.5.3.4 Solid Waste

The National Solid Waste Management Authority (NSWMA) is the agency responsible for administering integrated waste management programs, including arranging for solid waste collection services for residential and commercial clients in most of Spanish Town and its suburbs for disposal at the Riverton City Solid Waste Disposal Site in Kingston. However, solid waste collection service does not extend to the Project Site so onsite waste disposal has been the practice. There are plans, however, to expand the garbage recycling programme and to engage the services of private contractors to remove accumulated solid waste from the Project Site. Solid waste generated at the Project Site include paper and plastics disposed of by mourners, vegetation cuttings from site clearance, earth from excavation works and rocks from blasting

activities. Earth from earth works is used as fill for the vaults and a buffer between MMG and Green Acres.

6.5.3.5 Energy and Energy Conservation

Jamaica Public Service (JPSCo) is responsible for the supply of electricity nationally, a system of substations distributed island wide. Electricity is supplied to the area by means of 24 kV line from the Tradegar Park, St. Catherine substation through a 210 feeder. There are no immediate plans to introduce a renewable source of electricity but this could factor in the long term plans for the facility. There is limited lighting requirement, however, as most interments our within daylight hours except during the later months of the year when the days are shorter and interments continue into the dusk hours.

6.5.4 Recreation

There were no recreational facilities observed within the project area, except for an area at the entrance to the cemetery that children from the Fraser's Content community use as a playfield. Cemeteries, nevertheless, do become places of historical and passive recreational value.

Cemeteries are our links to the past. A cemetery has a particular aura to be found nowhere else, they are peaceful, quiet, reflective, but certainly not the misty, terrifying places depicted in horror movies.

> "*Death must be so beautiful. To lie in the soft brown earth. To have no yesterdays and no tomorrows. To forget time, to forgive life, to be at peace!*" Oscar Wilde [4]

Cemeteries, such as, especially those with the garden-like design of the MMG can be encouraged as aesthetic focal points for passive recreation, contemplation and relaxation.

6.5.5 Transportation & Traffic

A traffic survey was conducted on August 23, 2014 east-west along St, Johns Road within the vicinity of the intersection with the Frasers Content Boulevard that leads to MMG to the North. The directions of the traffic were from Spanish Town (East) and from the direction of Kitson Town (West). The traffic survey was conducted over a 12-hour period (7am to 6.55pm). Since weekend days (Saturday and Sunday) are the busiest for funerals Saturday was chosen as (a) it is the less busy of the two days (b) it reduces the risk that the data presented could be skewed.

[4] Merrit, Nigel (1986) A study of historical cemeteries throughout New Zealand, their value and significance to our culture and means of future restoration, renovation and maintenance. http://researcharchive.lincoln.ac.nz/bitstream/10182/3246/4/morritt_dippr.pdf

6.5.5.1 St. John's Road (East - West)

St. John's 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. St. Johns Road is classified as a Class B road and services a number of residential properties, which include the nearby Green Acres community.

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 2,000 vehicles. The St. John's Road intersects with the Spanish Town to Bog Walk Class A main road.

6.5.5.2 St. John's Road Traffic Flow (East - West) Traffic Flow

A total of 16,649 vehicles travelled east-west along St. John's at a rate of 1,347 per hour or 22 vehicles per minute over the period of the traffic count. The level of service (LOS) was C over the 12-hr

$$S = sf / \left(1 + a(v/c)^b\right)$$

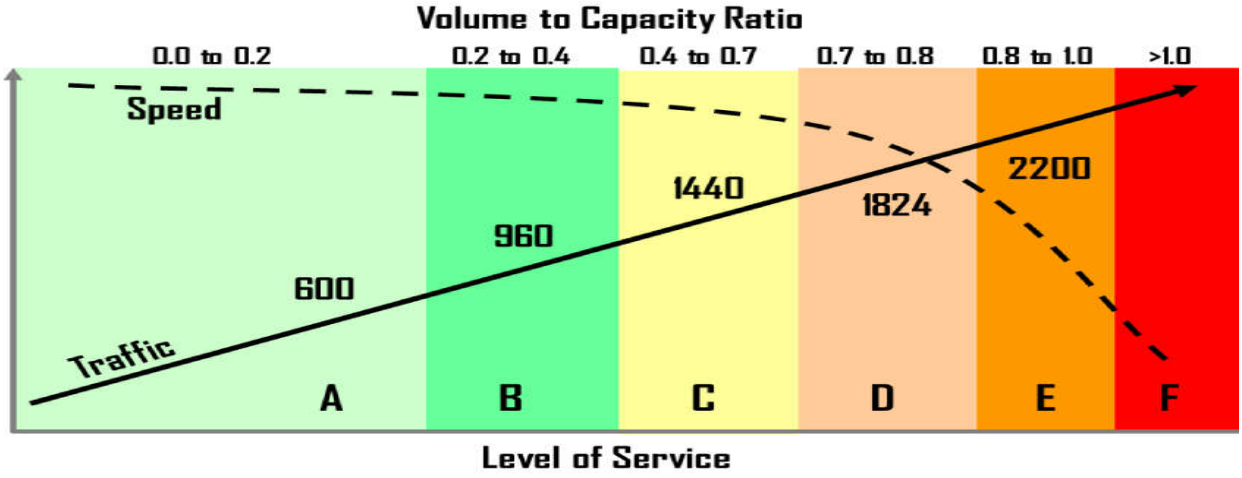

Figure 6.7: Showing volume to capacity ratio.

Source: Transportation Research Board (1994) Highway Capacity Manual, 3rd Edition, p. 3-9. sf = free flow speed, v = volume, c = capacity, a = 0.15 and b=4.

period, with the rate of traffic flow falling between 960 and 1440 vehicles at a volume to capacity ratio of 0.4 to 0.7 where V is the total number of vehicles passing a point in one hour and C is the maximum number of cars that can pass a certain point at the reasonable traffic condition [5]) (Figure 6.7).

This indicates that traffic flow was ***Steady Traffic but Limited*** as:

[5] [5]Rodrigue, P. 2017. The Geography of Transport Systems. https://people.hofstra.edu/geotrans/eng/methods/levelservice.html Retrieved 2017uly 27

"The presence of other vehicles affects drivers. The choice of the speed is affected and maneuvering requires vigilance. The level of comfort decreases quickly at this level, because the driver has a growing impression of being caught between other vehicles"[6].

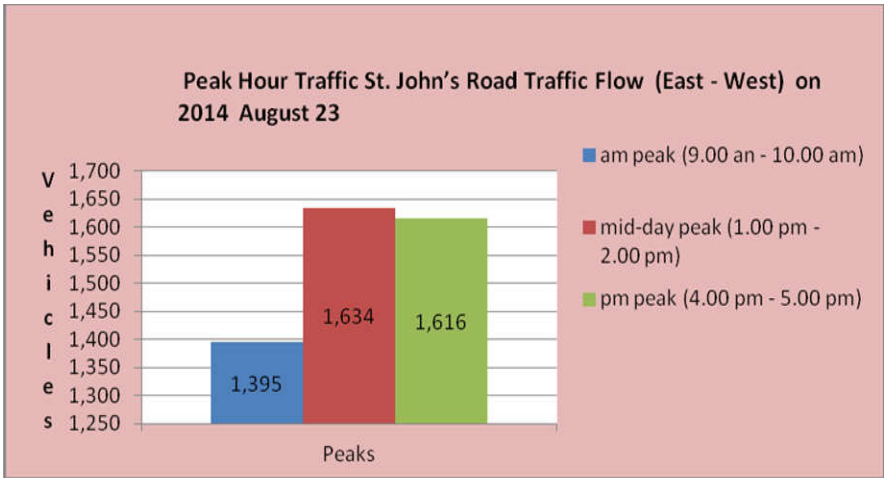

Figure 6.8: Showing peak- hour traffic on St. John's Road, 2014 August 23

In addition, the LOS during the peak periods (9.00am to 10am, 1pm to 2pm and 4 pm to 5 pm) were also C. The results are show in Figure 6.8.

6.5.5.3 St. Johns Road/Fraser's Content Boulevard

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 primarily residential with some low key commercial activities. The Fraser's Content Boulevard runs north off the St. John's Road as a Parish Council (St. Catherine Parish Council) road that provides access to residents of Red Pond, Lower Fraser's Content and Upper Frasers Content. 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.

[6]Ibid

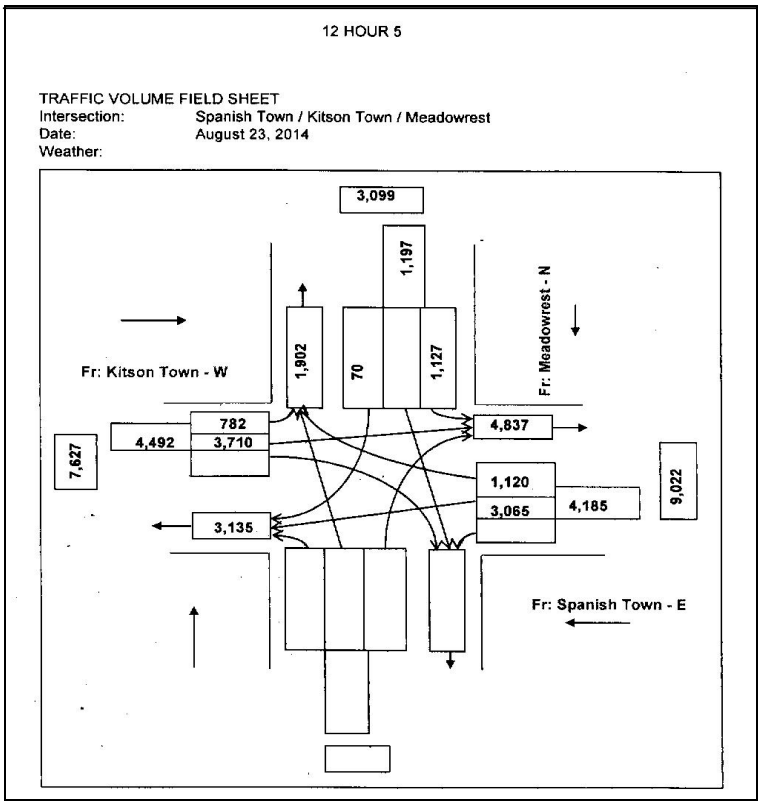

Figure 6.9: Showing peak hours traffic flow volumes Spanish Town/ Kitson Town/Meadowrest

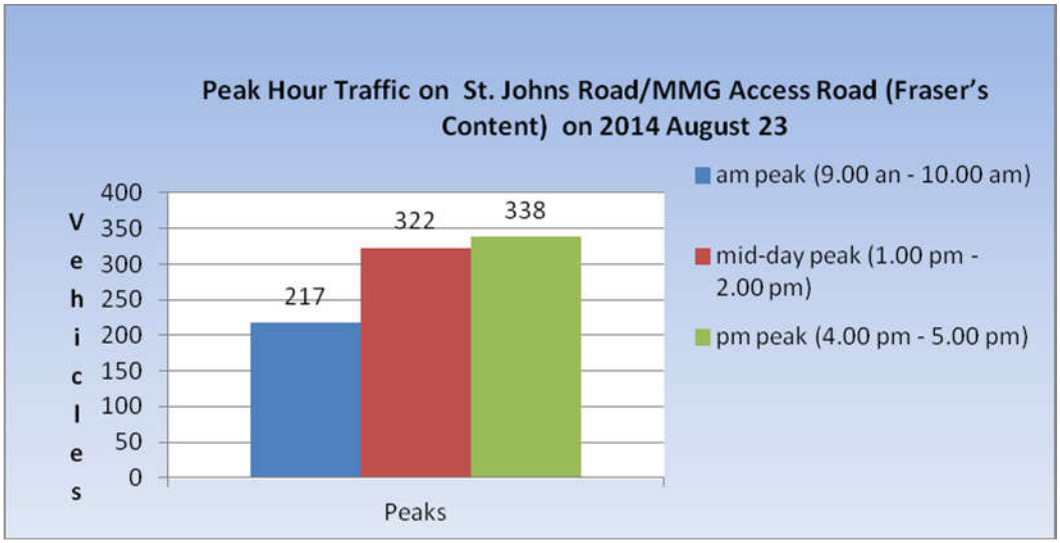

Figure 6.10: Showing peak- hour traffic on St. John's Road/Fraser's Content Boulevard, 2014 August 23

These figures are consistent with the afternoon burials, a cultural norm and demonstrated by the am peak traffic volume of 217 or nearly 4 vehicles per minute; this period was the lowest of

the three peak periods (Figure 6.10) The LOS for traffic entering and leaving the intersection during those peak periods was A; indicating that traffic was flowing freely and individual users were generally unaffected by the presence of other vehicles at the road section with an excellent level of comfort is excellent (see Figure 6.7). The volume to capacity ratio would be in the order of <0.2.

6.5.5.4 Mitigation measures

Given a LOS of C under the existing condition average delay experienced by all drivers entering the intersection would be in the order of 15.1 to 25 seconds. This is not expected to increase with the expansion of the cemetery. However, intervention to improve of traffic flow at the intersection at St. Johns Road could include the appropriate signage and a possible turn lane to facilitate moment off the St. Johns Road onto Frasers Content Boulevard:

> "No objection to the suggested mitigation measures of providing the requisite signage and a turning lane for right turns from St. Johns Road onto Frasers Boulevard" – NWA, August 14, 2017.

Also, given the tendency towards undisciplined behaviour of some bus drivers transporting mourners, frequent patrol by the traffic police during weekends would assist in curbing their behaviour.

6.5.5.5 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 all development types, the proposed development, classified as a cemetery is assigned a trip generation rate of 0.84 per acre. As shown in Table 6.3 the peak traffic growth at the Fraser's

Table 6.3: Traffic leaving and entering Fraser's Content Boulevard (N) at the Intersection with St. John's Road (East – West), 2014 August 23

PERIOD	LEFT IN	RIGHT IN	LEFT OUT	RIGHT OUT	TOTAL	5-YEAR PROJECTION AT 3% GROWTH
AM Peak	49	76	87	5	**217**	**252**
Mid Peak	78	139	95	10	**322**	**374**
PM Peak	72	112	141	13	**338**	**391**
Total	**199**	**327**	**351**	**28**	**877**	**1,017***

Source: EPN Consultants Limited, Traffic Count Survey

*Projected using https://www.easycalculatiob.com/statistics/traffic-growth.php.

Content Boulevard and St. John's Road intersection would increase from 877 to 1017 (16%) over the 5-year period 2014 to 2019. Meanwhile, traffic management issues that may exist with respect to the orderly movement of cemetery traffic (especially buses) along the Red Pond/Fraser's Content road may require further intervention.

6.5.5.6 Internal Layout & Parking Requirements

Access and Egress

The road design discourages movement of through traffic and improves site distances. Access to burial vaults is by way of the gardens as there are limited internal walkways and roadways.

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 MMG development would continue to bring a significant volume of vehicular traffic entering and exiting the cemetery especially on week-ends. However, internal road design would continue to accomplish the following goals:

- Reduce speed
- Accommodate pedestrians;
- Accommodate large vehicles, such as, buses and solid waste removal trucks; and
- Maintain compatibility with existing infrastructure and adjacent land uses.
- Parking

The NWA Schedule of off street parking requirement of 1 space per 7 seats is applied as shown Table 6.4. However, MMG has exceeded this requirement by providing 356 parking bays including 6 parking bays for less able persons.

Table 6.4: Parking requirements for the proposed MMG Development

CEMETERY	NWA REQUIREMENTS	# OF SEATS	PARKING SPACES REQUIRED
-	1 parking bay seven seats	200	29
-	Disabled Parking 5%	200	2

This section provides an analysis and assessment of the aesthetics and open space at the proposed expansion area at the Project Site. Discussed are the physical and regulatory setting and the baseline for determining environmental impacts. The methodology for undertaking the landscape and visual impact assessment is in general accordance with the requirements of the National Environment and Planning Agency and include as study of:

- local topography
- vegetation extent and type;
- built form
- patterns of settlement
- land use
- archaeological and cultural identity.
- identification of the sources of impact, and their significance and their magnitude
- the landscape character and its quality

The Whittaker's Mountain area of St Catherine lies within the western slopes of the parish of St, Catherine. The land use contrasts with the eastern plains of the parish with its more rural characteristics and large areas of natural vegetation and sparse ribbon residential development along the Kitson Town Road to the west and the Fraser's Content Boulevard in the east. Whittaker's Mountain falls between these two roadways.

The expansion area now consists primarily of shrubs and secondary and coppiced growth of trees. The primary views at the site of the proposed expansion are the residential subdivision of Green Acres to south and the disturbed open woodlands to the south and to the west. The dominant view from the expansion area will be some of the residences on the higher slopes of the Green Acres residential development to the south. Vegetated ridges serve to provide a contrast in the aesthetics of the site as they overlook the landscaped garden cemetery.

6.6.1 Landscape and Planning Context

In the context of development control, the MMG cemetery is governed by the St. Catherine but falls outside the Spanish Town urban fence and, as such, there is no zoning requirement but the area does fall under the Ministry Agriculture and Fisheries. The existing land use and its proposed expansion create open space views because of its design as a garden cemetery. The other immediate land use is residential as the Northern boundary of the Green Acres subdivision abuts on to the cemetery lands and Upper Frasers Content road and community form its eastern boundary.

6.6.2 Existing Landscape and Visual Resources

This section examines the existing landscape resources of the Project Site. Site topography is undulating but most of it has been earmarked for development, except for the higher northern, eastern and western slopes. The large areas of vegetation function as an ecological habitat and wildlife corridors and towards the south acts as buffer between the cemetery and residential development. Due to the topography of the area and vegetation, views are limited. The visual impact of the cemetery is most notable on entering the facility impacting only a few adjacent residences in Green Acres.

6.6.3 Landscape and Visual Impact Assessment

The key landscape and visual impacts were considered in the design so that given MMG's proximity to residential areas major potential impacts would be avoided. The presence of the high quality landscape units, namely LZ1, LZ2 (Table 6.5) provide buffers at the limits of the cemetery.

Table 6.5: Summary of Existing Landscape and Visual Resources

Landscape Zone	**Landscape Zone Description**	**Quality / Sensitivity**
LZ1	Primary Green Backdrop (55%) There is the degraded Secondary woodland to south in the direction of the Dovecot cemetery and to the south west that act as a buffer and transition zone between both cemeteries and the adjacent woodland areas.	High
LZ2	Views of the Garden Cemetery (45%) Built out upper and lower slopes of MMG with the northern south eastern and western slopes offering a captivating view of the cemetery garden landscape	High

A coherent landscape design provides linkage between the topographical elements at the site and at the proposed expansion area. Consideration is also given in the design and site planning to the orientation of the development elements, such as, the chapel, parking areas and the burial plots. Pedestrian and vehicular movements are designed to exploit efficient connectivity that allows for easy access to burial plots.

The proposed expansion would have a significant visual impact resulting from major land clearance that land clearance. However, aesthetically, due to the existing hilly areas of forest/woodland vegetation, complete loss of vegetation would be avoided, as shown in the

view envelope shown in Figure 6.9. Therefore, the primary landscape and visual impacts to the receptors are and will be the transition from natural vegetated slopes to terraced, manicured lawns of the Gardens. The visual impact of this site characteristic is evident in the results of the community survey where respondents used descriptive words such as "beautiful landscaping", "clean", "peaceful", "lovely" to describe the cemetery.

Figure 6.9: Goole earth image showing the view envelope at MMG

7.0 PUBLIC PARTICIPATION

During the EIA process public involvement and consultation allow for the views and concerns of stakeholders are considered when ensuring the successful implementations of a development project. This activity is an essential element in the process. The objective of such consultation and participation of affected stakeholders is to identify, early in the EIA process, their concerns about the impact of the proposed project in order to address such issues during the actual study and to reflect stakeholder feedback.

There are three components to the public participation process:

1. Community Survey - This required face-to-face interviews within a determined sample frame.
2. Telephone interviews with selected prominent stakeholders.
3. Public Consultation (Community meeting) - which will afford the community an opportunity to express their opinions on the proposed expansion.

Items 1 and 2 are presented below; however, Item 3 will be proceeding after this document has been approved by NEPA.

7.1 COMMUNITY SURVEY

7.1.1 Methodology

A community survey was conducted within the immediate receptor communities in the Project Area over the period 2014 November 24 to 27. The decision was taken to obtain empirical data by the convenience and purposive sampling strategies to determine "What are the social and economic characteristics of the populations within the immediate receptor communities?". Convenience sampling is a non-probability sampling strategy[7] that is popular in development research. This strategy was selected over a probability technique that would require that participants are randomly selected from the entire SIA area. A convenience sampling strategy was considered valid as the main objective was to obtain feedback from members of the immediate receptor communities who were:

- Accessible

[7] Bornstein, Marc H., Justin Jager, and Diane L. Putnick. 2013. "Sampling in Developmental Science: Situations, Shortcomings, Solutions, and Standards." *Developmental Review* 33 (4): 357–70. doi:10.1016/j.dr.2013.08.003.

- Within geographical proximity to the cemetery
- Available during the period allocated for the survey
- Willing to participate

That is, participants were those who were the easiest to access rather than selecting subjects at random from the entire population (Etikan, Abubakar Musa, and Sunusi Alkassim 2016). The sample is likely to be biased; therefore, the data presented should not be generalized to the entire population but it provides a "snapshot" of the opinions of community members who reside in close proximity to the already established facility.

The strategy was also purposive as the main goal was to focus on a particular characteristic of the population of interest which was in this instance the population in closest proximity to the MMG.

Potential survey participants were selected as follows.

1. The Enumeration Districts (EDs) (N=6) that fall within the 1km radius of the MMG cemetery were selected. They were found to have a population of N= 1,214 according to the 2011 population census (STATIN 2012)
2. The survey sample was further refined by estimating the number of persons who were ineligible that is below the age of 18. This age cohort was calculated to be approximately 28.26 % of the population therefore N= 871 persons fell within the sampling frame.
3. Sampling was purposive (a non-probability sampling strategy) requiring that participants originate from the immediate receptor communities of Red Pond, Green Acres, Fraser's Content, Lower Frasers Content and Maxim.

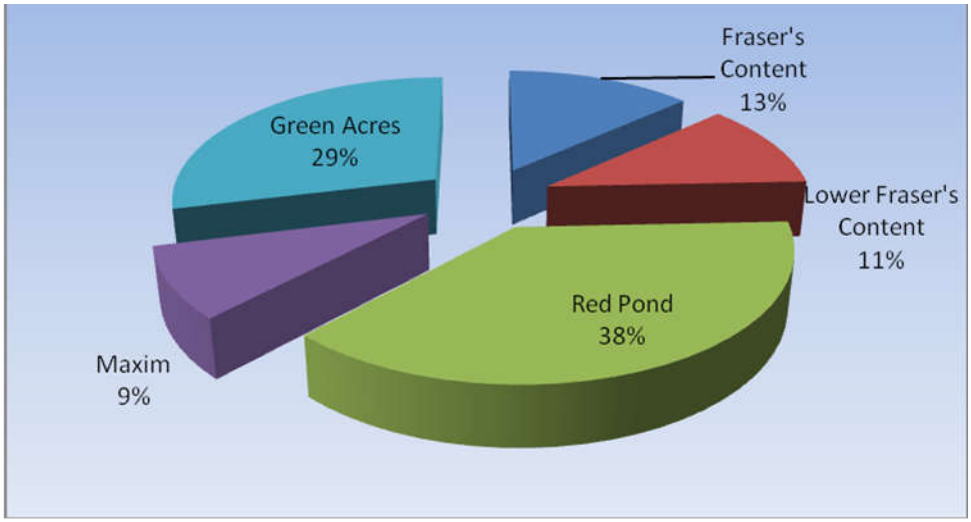

Figure 7.1: Distribution of particpants in the sample, November, 2014

Eventually, face-to-face interviews resulted in responses from N = 45 participants. However, most (Green Acres - 29% and Red Pond - 38%) of the respondents were from communities located closest to the cemetery. The distribution of participants is shown in Figure 7.1 and the findings are described below. The survey instrument and survey results are shown in Appendix 13.5.

Results of Community survey

The frequencies of the respondents to the survey were Maxim (9%), Fraser's Content (13%) Lower Fraser's Content (11%), Red Pond (38%) and Green Acres (29%), as shown, in Figure 7.1. All communities except Green Acres are located entirely along the access road to the MMG cemetery and are areas of similar socio-economic characteristics; therefore, findings from the community survey were grouped and presented similarly.

Essentially, except for the overall concern for the poor road conditions and unreliable water supply, responses to the potential impacts of the proposed project were positive. With respect to the characteristics of households, more of persons owned their own homes (62 %) than those who leased or rented (Figure 7.2). In addition, household sizes were greater than the national average of 3.1 (STATIN, 2012) over 50% of the households in the sample comprised 4-6 members (Figure 7.3).

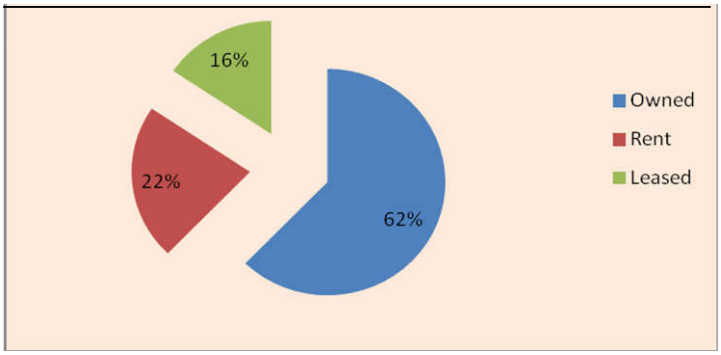

Figure 7.2: Home tenure among participants in the survey

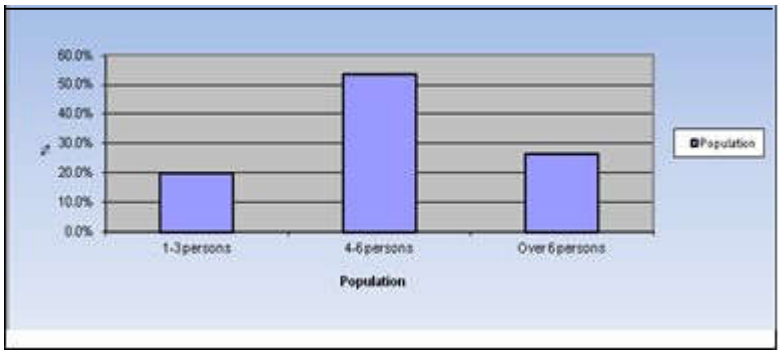

Figure 7.3: Population by household among survey participants

The survey also revealed a tendency for persons to work in close proximity to their places of residence as shown Figure 7.4 where the majoity of respondents (58%) worked in the area or in adjacent areas. Possible places of employment included establishments along St. Johns Road.

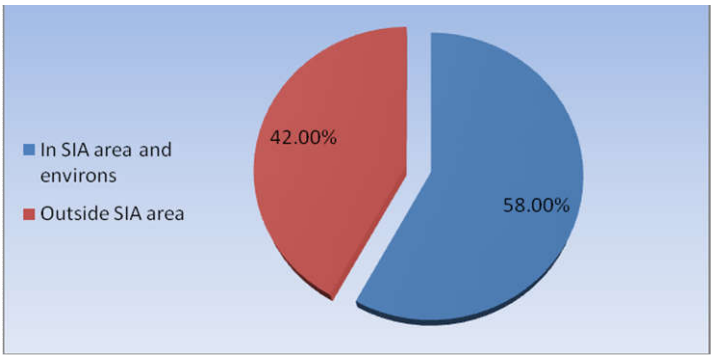

Figure 7.4: Employment among survey particpants

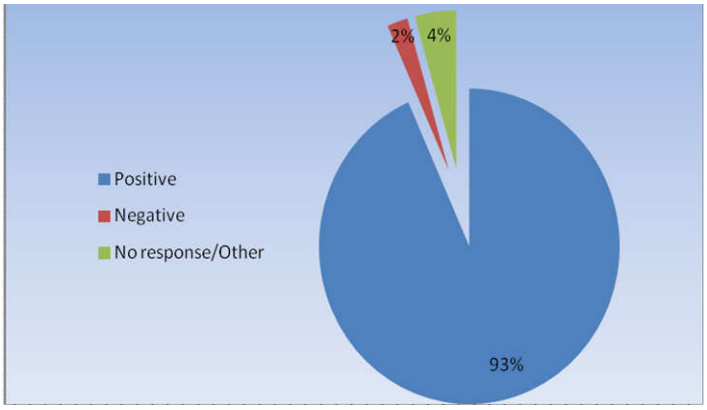

Figure 7.5: Concerns about the environment among survey participants

Only 2% of the comments on the environment could be considered negative as shown in (Figure 7.5). While the main negative comments included "it should be away from the community", the positive comments were overwhelming (93%) among which were "no problem" and "it is there already".

A summary of the findings of the community survey is shown in Table 7.1 also presented is a comparison of the survey results among Green Acres and the other receptor communities of Fraser's Content et al. The Table 7.1 also shows that the population in Green Acres was more permanent with 62% of the survey sample living in the area for more than 10 years. Also of significance is the difference in the size of the dwellings. In Frasers Content only 6% had five habitable rooms compared to 31% in Green Acres. Additionally, household sizes (more than six persons) were largest in Fraser's Content et al (31%) compared to Green Acres (15%).

Table 7.1: Main findings of the community survey within the receptor communities

SELECTED QUESTIONS	RESPONSES	GREEN ACRES (%)	OTHERS COMMUNITIES (%)
Length of time living in the area	➢ 10 years	62	27
Gender	Male	54	59
Housing Tenure	Owned	69	59
Size of Dwelling	➢ 5 habitable rooms	31	6
Construction materials	Concrete	100	69
Number of persons occupying households	➢ 6 persons	15	31
Awareness of plans for expansion	Yes	84	62
Family member buried at MMG	Yes	88	92
Concerns for environmental effects etc.	Positive	97	92
Contribution to local economy	Yes	97	92
Negative effect on land values	No	76	85
Negative effect on traffic	No	97	100

The overall attitude to the potential impacts was positive as persons did not think impacts on the environment; land values and the local economy would be significant. Concerns were raised, however, about the roads and the unreliability of the water supply.

7.2 STAKEHOLDERS' CONSULTATION

7.2.1 Methodology

Telephone and face-to-face interviews were conducted with selected community stakeholders who were identified as some of the most prominent residents. Their responses are outlined in Table 7.2. Telephone surveys, like face-to –face interviews allowed a two-way interaction between consultants and respondent that facilitated feedback from prominent citizens on their opinions and their perspectives on potential impacts of the proposed development. The dates of these interviews were recorded and reported.

Table 7.2.: List of selected stakeholders and their comments on the proposed development

CONTACTS	COMMENTS	DATE
Mrs. Sharon Pusey-Brown **Secretary: Frasers Content Development Foundation**	1. The road from Red Pond to MMG needs fixing. 2. Not aware of any negative effects of the cemetery just that it provides employment for a few persons 3. Since home burials are not allowed community members are given discount for the burial of their loved ones. 4. The expansion area could be used for farming crops, such as, cassava, vegetables, mangoes and naseberry 5. There is heavy traffic on week-end but it flows freely for the rest of the week.	October 28, 2014
Mr. Donovan McLaren **Kevoy Community Development Institute** **(NGO)**	1. The community needs a multi-purpose facility for classes/training, for example computing can be held during the day and recreational activities in the afternoons/ evenings for "unattached" youths. 2. What will be the effects of the cemetery on the potable water, say, in another twenty (20) forty (40) years? Already there is the threat from farming activities in Paul Mountain. 3. There is the need for training the youth in order to reduce the reliance on the cemetery for employment. 4. The expansion area could be used for a recycling plant, for example, for electronic waste. 5. The MMG operators are good corporate citizens and are amenable to the community.	November 6,2014
Mr. Alvin Beckford, Councilor, Belleview Division	1. Two of the most pressing community concerns are unemployment and the deplorable state of the road to MMG. 2. Bus drivers transporting mourners are "disorderly", sometimes travelling two abreast so there is need for the traffic police presence on Saturdays and Sundays. 3. Recommends framing for the expansion area. 4. MMG is peaceful, quiet and provides employment.	November 7,2014
Mr. Clovis Reid **President, Frasers Content Development Foundation**	1. There is need for a community centre and a football team. The communities also need to be cleaned up and the garbage removed. 2. Community members should also desist from removing signs when they are posted.	October 28, 2014

CONTACTS	COMMENTS	DATE
Dr. Kenneth Baugh, Member of Parliament, West Central Division	1. The idea of an EIA is a good thing as the clearing of the land and the effect on runoff is a concern. 2. The two cemeteries are represent the largest economic activities in the area and should play a larger role in the repair of the roads given the extent of the traffic they generate.	November, 2014
The St. Catherine Parish Council	During e-mail and telephone contact with the parish, the only concern expressed was the state of the Fraser's Content road and the need for improvement.	

Source: Telephone and face-to-face interviews

8.0 ENVIRONMENTAL IMPACTS AND MITIGATION

This chapter details the environmental consequences associated with construction and operation of the Proposed Project based on the assumptions and assessment guidelines outlined below. The chapter also rates the impacts, their significance, duration, and whether they are direct, indirect, short term or long term.

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 archaeological heritage
- Substantially affect the visual and landscape views of receptor communities

5. Environmental issues and Definitions

Direct effects - are caused by the action and occur at the same time and place.

Indirect effects - are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Magnitude & Intensity - Any development which can cause effects over a wide area, to a large number of receptors, or effects which are of an intensity which is significantly in excess of those normally experienced.

Duration - Any development which can cause impacts for a long period of time (more than one generation) or which will cause permanent changes to any aspect of the environment.

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

Table 8.1 Legend: Environmental Issues

DESCRIPTION OF IMPACT	**RATING**	
IMPACT	Minor	(L)
	Moderate	(M)
	Major	(H)
SIGNIFICANCE	**RATING**	
	Not significant	(N)
	Potentially Significant Impact	(Y)
DURATION OF IMPACT	**RATING**	
	Short Term	(S)
	Long Term	(L)
DIRECT/INDIRECT IMPACT	**RATING**	
	Direct	(D)
	Indirect	(I)
* - Indicates positive Impacts		

TABLE 8.1A: GEOLOGY AND SOILS: IMPACTS ON STRUCTURES AND MITIGATION

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/L)	DIRECT/ INDIRECT IMPACT (D/I)
I. Geology and Soils Would the project:							
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?	-			N/A N/A N/A	N/A N/A N/A	N/A N/A N/A	N/A N/A N/A
b) Result in substantial soil erosion or the loss of top soil?	The process of the removal of vegetation and excavation works (earthworks) for land readjustment will create open spaces with exposure of soils which could cause a subsequent increase in surface runoff which may in turn result in soil erosion. This could result in sediment loading of waterways.	**Construction/ Implementation**	It is recommended that burial plots are built in phases instead of totally stripping the area of vegetation. Where access roads to burial sites will be used as conveyance for storm water, the access roads should be paved and kerb and channel structures used to control storm water to minimize erosion. In instances where access roads are constructed on sloping ground, cross drains should be used, in addition to kerb and channel structures to reduce storm water velocity to allow for efficient removal and minimal erosion. Appropriate management of the construction process to ensure that excavation activities are aligned with vault construction and the building of terraces so that exposed areas are not left for unnecessarily long periods. To avoid soil compaction, manage the movement of heavy duty equipment away	M	L	M	D

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/L)	DIRECT/ INDIRECT IMPACT (D/I)
			from areas not under construction. Remove soil and reinstate as needed. Also, use techniques to minimize soil compaction, such as, protective boarding.				
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?	Rocks will be removed during excavation works – removal of geological resource.	**Construction/ Implementation**	Reuse of rocks in fencing and as fill material, for example, during construction of terraces.	L	L	N/A	N/A
d) Be located on expansive soil, creating substantial risk to life or property?	-	-	-	N/A	N/A	N/A	N/A
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?	-	-	-	N/A	N/A	N/A	N/A

TABLE 8.1B: HYDROLOGY/WATER: IMPACTS ON ECO-SYSTEMS

ENVIRONMENTAL ISSUES	IMPACT	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
III. Hydrology Would the project:							
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?	The method used in the construction of vaults can potentially result in reduced groundwater recharge.	**Construction/ Implementation** **Operation/ Maintenance**	Construction of system of vaults allowing for internal drainage.	M	N	L	D

ENVIRONMENTAL ISSUES	IMPACT	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
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?	*Surface water hydrology and channel morphology* Removal of vegetation will increase storm water run-off and increase flow velocity. *Flooding* Disruption of flow pattern can result in water logging and increased flood risk	**Construction/ Implementation**	Construction activities to be aligned with vegetation clearance to avoid leaving areas bare. Appropriate engineering solution proposed to manage surface flows.	M	Y	L	D
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?	The proposed cemetery site at the MMG slopes gently towards the south. There are no onsite drainage channels to convey storm water off the site, however, towards the southern boundary; a poorly defined swale is partially connected to the Eastern Gully. Potential for increased sedimentation of waterways.	**Construction/ Implementation**	The blocked culvert on the Eastern Gully must be cleared and properly maintained. The gully is sufficiently large to accommodate significant volume of storm water from a 100 year event. For example, Location 1 is at the main road leading to the Meadowrest cemetery and Location 2 is at the point where the gully/drain enters the Green Acres subdivision. The capacity of these drains is in the order of 90 and 270 cubic meters per second, significantly more than is expected from the catchment. However, it is critical that arrangements be made between MMG and the St Catherine Parish Council to unblock the culvert so that flooding can be significantly reduced or eliminated.	M	Y	L	D
g) Place proposed development within a 100-year flood hazard area, as mapped on a national flood hazard boundary or flood, or other flood hazard delineation map?	-	-	-	N/A	N/A	N/A	N/A
h) Place structures that would impede or redirect flood flows within a 100-year flood hazard area?	-	-	-	N/A	N/A	N/A	N/A

TABLE 8.1C: LOCAL CLIMATE: IMPACTS ON ECOLOGY AND THE PUBLIC

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
VI. Local Microclimate Would the project:							
a) Have a substantially adverse effect on microclimate through the use of concrete and asphalt?	It is likely that the microclimate at the project site will be altered from its present condition due to the need to extensively remove the vegetation which would be replaced by an area of sealed vaults.	**Implementation/ Development Operation/ Maintenance**	Landscaping of the lawn using drought resistant grass, such as, zoysia grass limits the possible effects of heat trapping and ornamental plants, also, replanting of trees.	L	L	L	I
b) Substantially reduce the number of trees in the project area?	"There will be some clearance of vegetation	**Implementation/ Development**	"	M	N	L	D
c) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	-	-	-	N/A	N/A	N/A	N/A

8.2 NATURAL HAZARDS

TABLE 8.2A: NATURAL AND MANMADE HAZARDS: IMPACTS ON PUBLIC SAFETY, STRUCTURES AND ECOLOGY

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
Natural Hazards Would the project:							
a) Result in substantial damage from flooding caused by torrential rainfall?	-	-	-	L	L	N/A	N/A
b) Result in serious loss or damage from the primary and secondary effects of a hurricane?	Some minor damage to the roof of the chapel will occur where roof tiles are exposed to strong hurricane wind forces during a severe tropical weather system. No additional buildings are expected to be erected at the proposed site. The risk of damage to vaults from wind hazard will be negligible and should not be a concern for the proposed cemetery.	**Operation/ Maintenance**	Ensure roof is safely secured along with a routine maintenance programme	L	L	N/A	N/A
b) Result in serious loss or damage from the primary and secondary effects of an earthquake?	-	**Operation/ Maintenance**	-	L	L	N/A	N/A

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
a) Expose the population to hazardous materials?	Pollution could occur from suspended materials in storm water and from spills or leaks of fuel oil and construction materials. The use of pesticides and herbicides and spillage	**Construction/ Implementation** **Operation/ Maintenance**	Hazardous and potentially polluting materials must be stored on an impervious base, away from possible contact with water and kept locked when unattended. Herbicides and pesticides should be used carefully and as minimally as possible.	L	L	N/A	N/A
b) Expose the natural environment to hazardous materials?	"As above"	"As above"	""As "above"	""As "above"	""As "above"	""As "above"	""As "above"
c) Expose the population to the effects of blasting.	Body and surface waves generated by blast energy may result in major damage to the vaults due to bending motion or shearing of the vault structure. Energy released from blast excavation can cause damage to adjoining building structures and facilities in the immediate environs, create noise nuisance and cause personal injury due to 'fly rock' from air blast. Cracks could develop along the sides and base of the existing vaults leading to leakage of fluids that might contain traces of formaldehyde, pathogens etc.	**Construction/ Implementation**	Peak Particle Velocity vibration should not exceed 15 mm/sec. Detonation for each row of blast holes should be delayed, preferably by about 8 milliseconds. To reduce the occurrence of 'fly rock', stemming of the blast drill holes should be sufficiently deep so that the blast energy is dissipated mainly within the ground rather than above ground surface. Where necessary, the cover blast technique must be applied. With respect to safety at blast sites, precautionary measures, such as, appropriate safety and protective gears, blast warning signs and signals and the proper control and management of blast sites are extremely important. Following closure of a burial plot and the last set of constructed vaults adjacent to the walkway, the point/area of the next plot closest to the walkway should be blasted. A certified and experienced blaster should be used and be required to have adequate insurance coverage as a pre-requisite for undertaking the work. It is also recommended that	M	N	L	D

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
			police or reputable security personnel should be placed on site owing to the nature of the area.				

8.3 BIOLOGICAL

TABLE 8.3A: BIOLOGY - IMPACTS ON THE TERRESTRIAL ENVIRONMENT

ENVIRONMENTAL ISSUES	IMPACT	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
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?	Habitat removal, fragmentation and severance Species are disturbed or lost through removal of top soil and vibration, As those species of birds (namely observed endemics), which are forest dependent, would be affected most by forest removal. 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 removal of most of the natural vegetation on the Project Site. This will negatively impact species diversity. This change in land use will intern dramatically alter the composition of fauna of the site by way of a sharp decrease in both numbers of individuals, species diversity, and a significant loss of endemic fauna/birds at the site. The development will produce a change in the avian community and other fauna from one dominated by forest dependent species, composed of endemic species and subspecies, to a community comprised of a few	**Construction/ Implementation**	Maintain the higher slopes in natural vegetation by incorporating existing habitat features into the design Habitats should be created to compensate for that which will be lost. Areas to be restored should aim for the include measures that would improve the ecological status of the location. In addition, the adjacent property to the south remains in natural vegetation Adhere to the Landscape Plan	M	N	M	D

ENVIRONMENTAL ISSUES	IMPACT	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
	species almost totally of non-endemic						
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?	-	-	-	N/A	N/A	N/A	N/A
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?	-	-	-	N/A	N/A	N/A	N/A
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?	-	-	-	N/A	N/A	N/A	N/A
e) Conflict with any local policies or ordinances protecting biological resources such as a tree preservation policy or ordinance?	-	-	-	N/A	N/A	N/A	N/A
f) Have a substantial adverse effect on any protected areas identified by local policies and regulations or by NEPA?	-	-	-	N/A	N/A	N/A	N/A

8.4 HERITAGE

TABLE 8.4A: CULTURAL RESOURCES: IMPACTS ON HISTORICAL FEATURES AND RESOURCES

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
Cultural Resources Would the Project:							
a) Cause a substantial adverse change in the significance of an archaeological resource?	Artifacts found were not considered of great archaeological value	**Construction/ Implementation**	No significant archaeological impact was detected. However, because the area is documented to be part	L	L	N/A	N/A

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
			of a historical estate undetected features may still be present so watching briefs are recommended during clearing and excavation				
b) Directly or indirectly destroy a unique palaeontological resource or site or unique geologic feature?	-	-	-	L	L	N/A	N/A
c) Disturb any human remains, including those interred outside of formal housing	-	-	-	N/A	N/A	N/A	N/A

8.5 HUMAN/SOCIAL/CULTURAL

TABLE 8.5A: SOCIAL INFRASTRUCTURE: IMPACTS ON PUBLIC SERVICES/UTILITIES WITHIN THE DEVELOPMENT AREA

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
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? Police Protection? Schools?	*Solid Waste* The proposed development will produce large volumes of solid waste. This is considered a significant environmental impact, as it will include excavated soil, rocks removed to make way for the construction of vaults. Other solid waste will include waste left by mourners, cuttings, trimmings etc. The effects 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	**Construction/ Implementation** **Operation/ Maintenance**	Impacts are not considered substantial/significant; therefore the Implementation of an Environmental Management Plan and the Solid Waste Management Plan would sufficiently mitigate potential impacts.	L M	N Y	L M	I I

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
	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. *Energy Consumption* Although the power demand of the development can 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 raises issues regarding climate change. *Potable water* The supply of potable water comes from wells in the area, therefore the need to protect ground water from leachate.		The concern is the carbon footprint of the development and how to adopt the best measures to reduce its carbon output.				
Utilities and Services: Would the project	-	-	-				
a) Exceed wastewater treatment restrictions or standards of NEPA and the Ministry of Health?	-	-	-	N/A	N/A	N/A	N/A
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?	-	-	-				
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?	Ann extension of the system of drains would be required to manage storm water on the site.	**Construction/ Implementation**	Mostly on site drainage solutions	L	N	L	I
d) Have sufficient water supplies available to serve the project from existing sources.	The existing NWC supply along with additional drum storage will be Sufficient to meet the needs of the project.	**Construction/ Implementation** **Operation/ Maintenance**	None required	L	N	L	D
e) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	The Waste Management Plan address issues related to solid waste management.	**Construction/ Implementation** **Operation/ Maintenance**	"None required	L	N	L	I

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
f) Comply with NEPA/ NSWMA statutes and regulations as they relate to solid waste?	Site clearance will result in vegetation and rock waste while other solid waste will be generated by mourners	**Construction/ Implementation** **Operation/ Maintenance**	Organic waste 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. Waste would generally be managed according to the Solid Waste Management Plan.				
g) Significantly increase energy consumption in the project area, which would contribute substantially to the greenhouse gases?	-			N/A	N/A	N/A	N/A
h) Provide a substantial number of employment opportunities for neighbouring community members throughout the project lifecycle?	Employment opportunities would result from the development. Priority for employment would continue to be given to the residents within the immediate community.	**Construction/ Implementation** **Operation/ Maintenance**	*Positive impact – No mitigation necessary.	H	Y	L	I

TABLE 8.5B: LAND USE AND PLANNING: IMPACTS ON COMMUNITY CONSERVATION AND HABITAT CONSERVATION

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
Land Use and Planning Would the project:							
a) Physically divide an established community?	-		-				
b) Conflict with the applicable land use plan, policy, or regulation of NEPA/NRCA (including, but not limited, to a general plan, specific plan, local zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.	The potential effects on existing communities and the compatibility of land use. However, the site of the proposed expansion is zoned for the intended use as approved by the St. Catherine Parish Council	**Construction/ Implementation** **Operation/ Maintenance**	Application of best practices to minimize impacts. Adequate screening methods should be introduced to minimize visual impact. Altered landforms should be stabilized to reduce erosion.	M	N	L	I
c) Conflict with any applicable	-	-	-	N/A	N/A	N/A	N/A

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
habitat conservation plan or natural community conservation?							

TABLE 8.5C: POPULATION GROWTH: IMPACTS ON THE PUBLIC AND SOCIAL INFRASTRUCTURE

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
Population and Housing Would the project:							
a. Induce substantial population growth in the area, indirectly (for example, through extension of roads or other infrastructure)?	-	**Operation/ Maintenance**		N/A	N/A	N/A	N/A
b. Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	-	**Construction/ Implementation**		N/A	N/A	N/A	N/A
c. Growth in population resulting in a change in the character of the community?	Potential growth in primarily male population due to employment opportunities at the cemeteries in the area. Continued employment of community members and support of businesses in the area	**Operation/ Maintenance**	*Positive impact – No need for mitigation	M	Y	L	I

TABLE 8. 5D: TRANSPORTATION AND TRAFFIC: IMPACTS ON PUBLIC SAFETY AND TRAVEL

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
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)?	No significant increase in traffic is anticipated given the nature of the development. The expected trip generation rate of .84 per acre for cemeteries is expected to remain with the expansion of the facility.	**Operation/ Maintenance**	There has been ongoing dialogue between the developer and the St. Catherine Parish Council with respect to road improvement in the vicinity of the cemetery. This should be concluded in order to improve the capacity of the road to handle the traffic load.	H	Y	L	I

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
			Also, a turn lane is recommended for the intersection of St. John's Road and the Frasers Content Road				
b. Exceed, individually or cumulatively, the level of service standards established for the designated roads or highways?	-	-	-	N/A	N/A	N/A	N/A
e. Result in inadequate emergency access?	-	-	-	N/A	N/A	N/A	N/A
f. Result in inadequate parking capacity?	-	-	-	N/A	N/A	N/A	N/A
g. Conflict with adopted policies, plans or programmes supporting alternative transportation (e.g., bus turnouts, bicycle rack)?	-	-	-	N/A	N/A	N/A	N/A

TABLE 8.5E: AESTHETICS: IMPACTS ON THE LANDSCAPE AND VISUAL RESOURCES

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
Aesthetics Would the Project:							
a) Have a substantially adverse effect on the scenic vista?	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 the development will be aesthetically pleasing	**Operation/ Maintenance**	Re-vegetation in terms of landscaping by way of grassing of the garden and the planting of ornamentals and trees to compensate for loss and the general permanent change in the landscape.	L	N	L	I
b) Substantially damage scenic resources, including, but not limited to trees, within a scenic highway?	-	-	-	N/A	N/A	N/A	N/A
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	-	-	-	N/A	N/A	N/A	N/A

8.6 PUBLIC HEALTH ISSUES OF CONCERN

TABLE 8.6A: WATER QUALITY: IMPACTS ON ECO-SYSTEMS AND PUBLIC HEALTH

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
III. Water Quality Would the project:							
a) Violate any water quality standards or waste discharge requirements?	Any potential spillage of chemicals and pesticides and gasoline		Appropriate management of all materials, fuel, and machinery etc as indicated above.	L	N	L	I
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?	-	-	-	N/A	N/A	N/A	N/A
ii) Substantially degrade water quality?	Potential impacts include: • Pollution from suspended materials. • Disturbance of contaminated soil leading to pollution of waterways • Pollution from spills and leaks • Sediment loading of waterways 1. Contamination of ground water due to gradual seepage of decomposition products from corpses 2. Contamination from microbiological contaminants, such as, viruses, bacteria and pathogens whose survival in the subsurface environment 3. Contamination from chemicals,	**Construction/ Implementation** **Operation/ Maintenance** **Operation/ Maintenance**	Appropriate management of hazardous materials as well as, the construction activities with respect to the exposure of soil leading to erosion as outlined above. Creation of a dedicated location for the storage of waste and materials for recycling. The scale of the risk is dependent on the ability of micro-organisms to survive in the subsurface and the size of the fissures in the bedrock and depth to water table. There is also significant depth to groundwater although the porous nature of limestone could limit the degree of protection. The risk is however, minimized as the construction method involves the sealing of vaults with concrete, therefore, greatly reducing the potential negative impact on groundwater.	L	N	L	I

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
	such as, formalin.						

TABLE 8.6B: AIR QUALITY: IMPACTS ON PUBLIC HEALTH

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
Air Quality Would the Project:							
a) Violate any air quality standards or contribute substantially to an existing or projected air quality violation?	Potential impacts are: The operations of heavy-duty vehicles and equipment are likely to produce increased combustion emissions. Atmospheric dust from bare soils and stockpiles. The movement of heavy trucks results in additional road wear. Removal of trees shrubs and bushes could result in a change in carbon dioxide absorption capacity.	**Operation/ Maintenance**	Maintain a set maintenance schedule for heavy equipment. Stockpiles should be covered or sprinkled daily to reduce particulate count especially in the vicinity of sensitive receptors. Besides a permanent boundary structure a vegetation screen would be a buffer from gaseous and particulate emissions.	L	N	L	I
b) Result in a considerable cumulative net increase of any criteria pollutant based on NEPA/NRCA ambient air quality standards (including releasing emissions, which exceed quantitative thresholds for ozone precursors)?	-	**Operation/ Maintenance**	-	N/A	N/A	N/A	N/A
c) Expose sensitive receptors to substantial pollutant concentrations?	-	-	-	N/A	N/A	N/A	N/A
d) Create objectionable odours affecting a substantial number of people?	-	-	-	N/A	N/A	N/A	N/A

TABLE 8.6C NOISE AND VIBRATION: IMPACTS ON THE PUBLIC

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE L/M/H	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
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 guidelines, or in other applicable local standards?	Noise will invariably be generated, as access road is cut and vaults are built. These impacts include: Noise nuisance that is likely to result from periodic controlled blasting and use of heavy equipment.		Establish a timetable for the use of heavy equipment. Ensure that activities that generate noise and vibration are conducted within the workday between 9.00 am and 5.00 p.m.	L	N	L	I
b) Generate or expose people to excessive ground-borne vibrations or ground-borne noise levels?	-	-	-	N/A	N/A	N/A	N/A
c) Create a substantial permanent increase in ambient noise levels near the project (above levels without the project).	-	**Construction/ Implementation**	-	N/A	N/A	N/A	N/A
d) Create a substantial temporary or periodic increase in ambient noise levels in excess of noise levels existing without the project?	As above.	-	As above	L	N	L	I

TABLE 8.6D: WASTE AND HAZARDS: IMPACTS ON PUBLIC HEALTH AND THE ENVIRONMENT

ENVIRONMENTAL ISSUES	**IMPACTS**	**PHASE**	**MITIGATION**	**IMPACT (L/M/H)**	**SIGNIFICANCE Y/N**	**DURATION OF IMPACT (S/M/L)**	**DIRECT/ INDIRECT IMPACT (D/I)**
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?				L	N	L	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?	There will be limited use of hazardous materials.	-	Implementation of a Waste Management Plan Hazardous materials must be managed and disposed of appropriately as guided by the Ministry of Health. Strict health and safety procedures for workers on such as the use of personal protection equipment.	L	N	L	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?	-	-	-	-	-	-	-
e) Substantially increase solid waste in the project area thereby exceeding the present landfill capacity?	Solid waste During site clearance and earthwork activities,	**Construction/ Implementation**	Rocks will be recycled, for example, used in construction of perimeter	L	N	L	I

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/ INDIRECT IMPACT (D/I)
	construction waste will be generated. This occurs if the material contains high quantities of large boulders or limestone blocks. If construction waste is improperly stored on site, it can be easily removed /eroded during storm events thereby affecting communities nearby. Hazards Given the nature of construction potential risks from hazards normally exist.		walls Creation of a dedicated location for the storage of waste and materials for recycling. Strict health and safety procedures for workers on such as the use of personal protection equipment				
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	-	-	-	N/A	N/A	N/A	N/A
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 forested areas?	-	-	-	N/A	N/A	N/A	N/A

8.7 RISK ASSESSMENT

TABLE 8.7A: GEOLOGY AND SOILS: IMPACTS ON PUBLIC SAFETY AND STRUCTURES

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/M/L)	DIRECT/INDIRECT IMPACT (D/I)
III. Hydrology and Water Quality Would the project:							
a) Violate any water quality standards or waste discharge requirements?	-	-	-	N/A	N/A	N/A	N/A
b) 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?	-	-	-	N/A	N/A	N/A	N/A
c) Result in inundation by hurricane or tsunami?	-	-	-	N/A	N/A	N/A	N/A

TABLE 8.7B: GEOLOGY AND SOILS: IMPACTS ON PUBLIC SAFETY AND STRUCTURES

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/L)	DIRECT/ INDIRECT IMPACT (D/I)
I. Geology and Soils Would the project:							
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?	-			N/A	N/A	N/A	N/A
b) Result in substantial soil erosion or the loss of top soil?	**Erosion** The process of the removal of vegetation and excavation works (earthworks) for land readjustment will create open spaces with exposure of soils which could cause a subsequent increase in surface runoff which may in turn result in soil erosion. This could result in sediment loading of waterways. **Compaction** The operation of heavy vehicles and machinery can compact soils and increase surface runoff.	**Construction/ Implementation**	Soil erosion is not a major concern; however, it is recommended that burial plots are built in phases instead of totally stripping the area of vegetation. Where access roads to burial sites will be used as conveyance for storm water, the access roads should be paved and kerb and channel structures used to control storm water to minimize erosion. In instances where access roads are constructed on sloping ground, cross drains should be used, in addition to kerb and channel structures to reduce storm water velocity to allow for efficient removal and minimal erosion. Appropriate management of the construction process to ensure that excavation activities are aligned with vault construction and the building of terraces so that exposed areas are not left for unnecessarily long periods. Manage the movement of heavy duty equipment away from areas not under construction. Use techniques to minimize	M	L	M	D

ENVIRONMENTAL ISSUES	IMPACTS	PHASE	MITIGATION	IMPACT (L/M/H)	SIGNIFICANCE Y/N	DURATION OF IMPACT (S/L)	DIRECT/ INDIRECT IMPACT (D/I)
			soil compaction, such as, protective boarding				
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?	-	**Construction/ Implementation**		N/A	N/A	N/A	N/A
d) Be located on expansive soil, creating substantial risk to life or property?	-	-	-	N/A	N/A	N/A	N/A
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?	-	-	-	N/A	N/A	N/A	N/A

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 was assessed in the context of the existing facility and its proposed expansion, as well as, the proposed expansion of the Dovecot cemetery. The geographic scope of the addition of 49 acres (11.18 hectares) of the MMG development expansion is shown in Table 9.8 below.

Table 8.8: 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	Effects on the local ecosystem
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)	Effect of increase in storm water flows
Hydrology	Local, regional	Effects on Ground water Potential impact of water quality
Groundwater Resources	Local, regional	Reduction in resources in aquifer
Noise	Local (within immediate project vicinity)	Construction activities on site
Employment, Population & Cemetery	Local (within the parish, and adjacent parishes)	Positive impact on demand for interment options locally and regionally
Public Services and Utilities	Regional (potable water, electricity, solid waste, police, fire)	Need for management of solid waste
Transportation and Traffic	Regional and local	Low impact on public transportation but increased traffic flows on week-end

Source: Personal Interpretation

9.0. 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 proposed in Chapter 8.

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 KMR in general would see an increase in capacity of vaults for burial.

Other potential residual impacts are summarized below.

9.1 THE ENVIRONMENT

Soils, Geology and Hydrogeology – Construction is ongoing so new drainage pathways will be developed order to manage storm water flows as the development proceeds. These waterways should also have the capacity to facilitate groundwater recharge.

Climate – There will be residual impact on micro-climate due to the large scale removal of vegetation.

Water quality – Implementing mitigation measures will result in no significant residual impact on underground water quality.

Existing drainage – There will be direct impact on existing drainage channels mitigation measure will be employed to minimize any risk through the design of new drainage structures or the improvement of existing ones.

Natural Hazards - Given nature of the development, site characteristics and mitigation of storm water flows, no residual impact are anticipated.

Manmade Hazards - The mitigation measures proposed for blasting will reduce any potential residual effects.

Biological - The role of the proposed site as a habitat will change permanently and will be limited to the higher slopes remaining in natural vegetation. Also, for the time being the adjacent areas to the south and west will remain in natural vegetation, offering some tradeoff/compensation.

9.2 OTHER RESIDUAL IMPACTS

Employment – Continuous source of employment for community members.

Noise and Vibration – These will be temporary at each location and no residual effects are anticipated.

Landscape and Visual - Significant landscape and visual impact due to expected altering of the landscape as discussed above.

Carrying Capacity- The low capacity of the larger KMR ecosystem to support the need for space for interment of the dead has been served by locations such as MMG.

Within the immediate ecosystem the most significant impact would be that on ground water resources, however, the practice of sealing vaults mitigates this impact. Towards the north and west there are no incompatible land uses while to south is another cemetery. The expansiveness of vegetation to the west offers some compensation to the residual impacts of the loss of habitat at the site.

An analysis of alternatives should be used for distinguishing among alternative development strategies and investment programs within a sector. In the case of the proposal, the expansion area has been zoned for cemetery use by the St. Catherine parish

There were two potential alternatives to this proposal which are
(1) The No Action Alternative (2) Development of mausoleums.

10.1 The No Action Alternative

The No Action Alternative reflects the status quo conditions as outlined in Chapter 6 and 7 and acts as a benchmark against which the effects of the Proposed Action can be evaluated.

10.2 Mausoleum development

A mausoleum development would consume less land than the proposal. In a mausoleum, the caskets would be stacked above ground, an above ground entombment. There is cultural bias towards below ground burial. The proposal is an economic decision not consid

ered feasible at this time hence the decision to proceed with the original proposal to expand the existing facility

10.3 Limit to the Scope of the Cemetery Development

Limiting the scope of the proposed expansion was not considered as an option (a) as the demand for vaults has been experiencing steady growth at the facility (b) general increase in demand for the desired cemeteries in the KMR as the existing ones reach or exceed their capacities (c) the existing baseline conditions and the proposed mitigation measures (d) economic viability of the proposal do not appear to impose significant limitations on the proposal for expansion.

10.4 Potential effects of the proposed Action

Tables 10.1 and 10.2 below outline potential benefits and costs of the proposed development.

Table 10.1: Swift Benefit/Cost Analysis of Environmental Resources base on the proposed Action

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.	–

INDICATORS	BENEFITS TO THE ENVIRONMENT	COST TO THE ENVIRONMENT	MONETARY VALUE
2) Air Quality	–	Air quality would be negatively affected as a result of construction activities (increase in particulates). 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, such as, the outlay for acquiring a skip for solid waste storage.
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 in the development area may increase slightly due to changes in the micro-climate.	Cost for purchase and operation of cooling equipment in the office and chapel.
6) Energy Consumption	Alternate forms of energy will be utilized where feasible e.g. use of solar energy.	Negligible increase in Energy consumption.	Cost per kilowatt of energy used.
7) Natural Hazards	Proper 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 and fire.	Natural Hazards, such as, hurricanes and flooding may cause damage to the structures on the property as well as destroy flora and fauna on the property.	▪ 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.	Cost of health insurance for workers.
9) Upset Accidental Conditions		Accidents are unpredictable and may result in injury, loss of life and damage to property.	▪ Cost of liability insurance for employees on the site ▪ Cost for Property Insurance (depends on the value of the property).
10) Use change		The anticipated change would impact on two fronts: 1. Loss of lands under the Ministry of	▪ There is no agricultural production, the vegetation is degraded,

INDICATORS	BENEFITS TO THE ENVIRONMENT	COST TO THE ENVIRONMENT	MONETARY VALUE
		Agriculture 2. Loss to biodiversity	and impact on biodiversity and impact on ecosystem services are not been shown to be significant. Will be of significant benefit to the KMR with respect to increased capacity for burials ▪ The economic value of this decision (use value/ non use value) is therefore likely to be positive given the potentially less than significant environmental impact of the project.

Table 10.2: Socio-economic Benefits/Costs

INDICATORS	SOCIO-ECONOMIC BENEFITS	SOCIO-ECONOMIC COSTS	MONETARY VALUE
10) Solid Waste Disposal	–	Increase in solid waste generation during the construction phase. Also, increase in pressure on the Riverton City landfill in St. Andrew to accommodate the additional waste. The continuation and enhancement of recycling efforts will reduce costs and to the facility and the developer.	Cost for the removal of solid waste during all stages both to the developer and to the municipal service provider. –
11) Roads	The main access road to MMG could be upgraded and drainage improved	–	Road and drainage infrastructure cost to the St. Catherine Parish Council and the Developer.
12) Health & Safety	Measures will be incorporated to ensure that health and safety are maintained for the employees, mourners and other visitors.	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. Vault design and measures to protect the structural integrity of the vaults result in a reduction on the potential	▪ 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 ▪ Cost to monitor ensures

INDICATORS	SOCIO-ECONOMIC BENEFITS	SOCIO-ECONOMIC COSTS	MONETARY VALUE
		negative impacts	best construction practices are kept for vault preparations. ▪ Cost of security services
13) Noise & Vibration, particulates	–	The ongoing noise, vibration and levels of particulates during the construction and operation phases which may affect near-by residents.	Cost for residents affected by the noise to acquire relief (doctor's visit / medication) – approximately $3,500 (minimum for doctor's visit and medication).

11.0 ENVIRONMENTAL, HEALTH, SAFETY, MANAGEMENT AND MONITORING PLAN

The Environment, Health, Safety, Management and Monitoring Plan is a site specific plan that is developed to ensure that appropriate environmental management practices are followed during a project's preparation, construction and/or operation and maintenance. The Plan outlines environmental management best practices for the project including compliance with environmental legislation and management of the mitigation measures of the environmental risks are summarized in Table 11.1.

The DEMP has been developed specifically for use at the proposed Meadowrest Memorial Gardens expansion worksite. The DEMP has been produced to address potential issues based the findings of the Environmental Impacts Assessment for the proposed development. The DEMP is intended to compliment other documents, such as the Waste Management Plan.

The approach adopted for this DEMP is derived from the concept of the continuous framework cycle that entails the reiterative actions of plan, do , check, act and then return to the planning phase as shown in Figure 11.1.

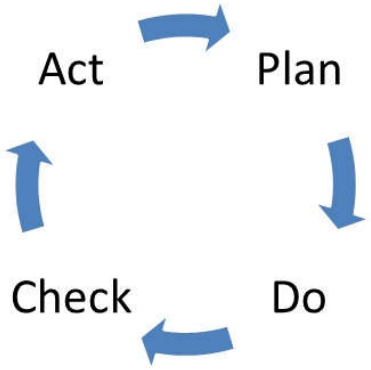

Figure 11.1: Plan-Do-Act-Check Cycle

The following environmental issues that require environmental management plans based upon the potential impacts of the proposed development during implementation and construction are as follows.

- Air Quality
- Energy Management
- Noise and Vibration
- Waste Management
- Storm Water Management

To ensure the purpose of this DEMP will be achieved, the environmental management plans will be established as follows:

- Objectives to be achieved
- Management strategies
- Tasks
- Responsibilities
- Monitoring and reporting
- Corrective actions

The DEMP is be based on the requirement for an Environmental Permit and has been prepared in accordance with, Section 9 of the Natural Resources Conservation Authority (NRCA) Act, 1991, in respect of the Subdivision of 10 or more lots

a. Management of Air Quality

The main source of pollution to be managed is dust produced during construction activities - construction materials, such as, marl and sand, preparing site for construction.

Performance objectives:

To minimize the impact to air quality from site operations. Ensure the relevant provisions of the Natural Resources Conservation Authority (Air Quality) Regulations (2006) under the Natural Resources Conservation Authority (NRCA) Act.

Management Strategies:

The performance objectives above will be achieved by the following management strategies:

- Use of improved technology where economically feasible.
- Evaluate the effect of air emissions where appropriate.
- Employment of dust extraction equipment on equipment.
- Use of PPE.
- Use of equipment truck to sprinkle exposed surfaces through wet suppression
- Construction activities are to be contained to reasonable hours during the day avoiding periods of sunrise and sunset

Tasks: The following actions will be undertaken to implement the above management strategies.

- DEMP awareness training to be included as part of inductions.
- Dust extraction and collection units to be maintained and repaired as required.

Responsibilities: This DEMP is the responsibility of the Project Manager (PM) and the Environmental Manager (EM). The actions outlined in this plan are the responsibility of the Contractor, subcontractors, foremen and Employees.

Performance Indicators: Nil complaints relating to air quality management. Extraction

equipment maintained as per maintenance schedule.

Monitoring and reporting. Monitoring would be ongoing and any complaints as to the management of onsite air quality will be directed to the Contractor and the PM as soon as practical. Complaints and any actions arising from a complaint will be recorded in a complaints register to be maintained by site management.

Corrective actions: Review dust management procedures.

b. Energy Management

The energy management DEMP is aimed at minimizing electricity use and reducing the development's carbon footprint. The main sources of use are:

- Site equipment
- Lighting

Performance objectives: To minimize electricity usage on site.

Management Strategies: The performance objective above will be achieved by the following management strategies:

- Monitor energy usage to determine high-use areas.
- Establishing areas of wastage.
- Install energy management systems where economically viable.
- Take energy rating into account when purchasing new equipment.

Tasks: The following actions will be undertaken to implement the above management strategies:

- Undertake DEMP awareness training as part of inductions.
- Maintain energy control systems.

Responsibilities: This DEMP is the responsibility of the PM, the Contractor and the Environmental Manager. The actions outlined in this plan are the responsibility of management, subcontractors, foremen and Employees.

Monitoring and reporting: Ongoing. Any complaints as to the management of onsite energy usage will be directed to the Contractor and the PM as soon as practical. Complaints and any actions arising from a complaint will be recorded in a complaints register to be maintained by site management.

Corrective actions: Undertake energy monitoring and establish where and how increased usage in electrical energy has occurred.

c. Noise And Vibration Management

The potential sources of noise are from land clearing and construction activities (machinery, drilling, equipment and traffic)

Performance objectives: To meet requirements of the National Noise Standard, 1999:

- To avoid nuisance noise to nearby residents.
- To avoid vibration nuisance to nearby residents.

Management Strategies: The performance objective above will be achieved by the following management strategies:

- Activities that produce excessive noise will be restricted where practical to hours permitted by the NEPA.
- Maintain on-site equipment including noise reduction equipment.
- Enclose excessively noisy equipment likely to generate community complaints where economically feasible.

Tasks: The following actions will be undertaken to implement the above management strategies.

Responsibilities: This DEMP is the responsibility of the PM and Contractor. The actions outlined in this plan are the responsibility of management, subcontractors, foremen and Employees.

Performance Indicators: Nil complaints relating to noise or vibration nuisance. Conformance with the provisions of the National Noise Standard, 1999

Monitoring and reporting: Ongoing. Any complaints as to the management of onsite air quality will be directed to the Contractor and PM as soon as practical. Complaints and any actions arising from a complaint will be recorded in a complaints register to be maintained by site management.

Corrective Actions: Immediate shutdown of noisy activities Investigate complaint immediately

d. Waste Management

The main wastes likely to be produced on-site:

Recyclables include:

- paper
- corrugated cardboard
- plastic and glass bottles, drums, bins and jars
- metal cans
- crates

Other Waste

- Stones
- Vegetable matter

Performance objectives: To meet the objectives of the Solid Waste Management Act, 2001. To manage waste in a manner that is sustainable and sensitive to the environment.

Management Strategies: The performance objective above will be achieved by the following management strategies:

- Components of waste streams will be separated at source where possible to minimize contamination and maximize potential for reuse and recycling of materials.
- Waste will not be stored on areas where it could contribute to the generation of contaminated runoff.
- Waste storage on-site will generally be organized by the head contractor.
- Waste management will form part of the on-site induction process.

Tasks: The following actions will be undertaken to implement the above management strategies:

Organize regular waste collection to minimize excessive waste storage.
Audit the locations of waste storage to ensure that the above strategies are being met.

Performance Indicators: Nil complaints about waste storage or removal.

Monitoring and reporting: Ongoing. Any complaints as to the management of onsite waste nuisance will be directed to the Contractor and PM as soon as practical. Complaints and any actions arising from a complaint will be recorded in a complaints register to be maintained by site management.

Corrective Actions: PM and Contractor to recommend corrective actions.

e. Water Management Plan

The water management plan is designed to manage:

- Sediment and Process.
- Water usage and disposal.

Performance objectives: To comply with the National Works Agency conditions of approval.

Management Strategies: The performance objective above will be achieved by the following management strategies:

- Divert clean storm water runoff from site to prevent it entering operations area.
- Ensure waste is located in areas which will not contaminate surface water runoff.

Tasks: The following actions will be undertaken to implement the above management strategies.

- Undertake DEMP awareness training at inductions.

Responsibility: This DEMP is the responsibility of the PM and the Contractor. The actions outlined in this plan are the responsibility of management, subcontractors, foremen and Employees.

Performance Indicators: No contaminated runoff. No flooding.

Monitoring and reporting: Ongoing. Any complaints as to the management of onsite waste nuisance will be directed to the Contractor and PM as soon as practical. Complaints and any actions arising from a complaint will be recorded in a complaints register to be maintained by site management.

Corrective Actions: Investigate any non complying runoff.

Table 11.1: Showing Indicators, Agency/Individual Responsible and Activities

INDICATORS	AGENCY/INDIVIDUAL RESPONSIBLE	ACTIVITIES
Preparation, Construction, Operation and Maintenances Phases		
Health, Safety & Environment		
1. Noise	Developer	Monitor to ensure agreed schedule protocols are adhered to and noise levels and vibration from blasting activities to ensure minimal effect on nearby receptor communities and existing vaults
2. Solid Waste	NSWMA/Developer	Sorting and storing and disposal of solid waste based on the guidelines outlined in the Solid Waste Management Plan
3. Air Quality	Contractor	Management of the storage of excavated earth to be recycled for infilling vaults and landscaping the gardens to reduce particulate count.
4. Traffic Control	Developer/Contractor	Monitor the use and adequacy of parking spaces including those reserved for the less able.
5. Aesthetics	Developer/Contractor	Site aesthetic to be implemented and monitored by MMG Superintendent
6. Flood Control Measures	Engineer/Contractor	Ensure adherence to NWA approved Storm water Management Plan.
7. Construction Materials	Contractor/ Project Engineer	Ensure materials are sources from The nearest appropriately licensed source (where applicable) and that haulage vehicles are covered to prevent spillage of materials on the roadways and in the gardens
8. Building Plans	St. Catherine Parish Council had already approved the	-

INDICATORS	AGENCY/INDIVIDUAL RESPONSIBLE	ACTIVITIES
	building plans – there have been slight adjustments in order to improve the burial process/Contractor Developer	
9. Roads and Storm water	Developer/National Works Agency	Seeking and obtaining approval to ensure site drainage issues are appropriately addressed.
10. Removal of trees	NEPA/Developer	Ecologically viable large diameter trees (e.g. >20cm) should be marked and preserved as far as is possible
Operation and Maintenance Phases		
Health, Safety & Environment		
1. Aesthetics	Developer	The MMG Superintendent will ensure adherence to MMG's Landscaping Plan.
2. Education of employees and residents	NSWMA and Public Health Department	Monitoring of the facility.
3. Potable Water	NWC/Developer	Monitoring the availability of potable water. Monitoring water quality in wells.
4. Noise	Developer	Ensure that the controlled blasting protocol guarantees protection against damage
5. Solid Waste	Developer	Adherence to the Solid Waste Management Plan
6. Public Health	St. Catherine Parish Council	Monitoring of environmental health conditions

12.0 LIST OF REFERENCES

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13.1 REFERENCE DOCUMENTS

NEPA's RESPONSE

NATIONAL ENVIRONMENT & PLANNING AGENCY

10 & 11 Caledonia Avenue, Kingston 5, Jamaica W.I. Tel: (876) 754-7540/3 Fax: (876) 754-7595-6 Tollfree: 1-888-991-500
E-mail: ceo@nepa.gov.jm, Website: http://www.nepa.gov.jm

Ref: 2012-14017-EN00022

11 February 2013

S. LeRoi Lorde
Managing Director
Meadowrest Memorial Gardens
12 Carlton Crescent
Kingston 10

Dear Mr. Lorde,

Re: Enquiry Application Proposed Expansion to Cemetery at Whittaker Mountain, St. Catherine
By: Meadowrest Memorial Garden

Reference is made to your letter dated 17 December 2012 requesting the Agency's support to release the additional 25 acres for use of the expansion of the cemetery. Further to a review of the documentation provided; please be advised that it is a breach of section 9 of the NRCA Act to undertake a permitted activity before the grant and issuance of an environmental permit. The Agency therefore requests that all burials being conducted in the area referred to as the "lower 25 acres retained for agriculture," cease with immediate effect. You are hereby directed to apply for the requisite permit through the Applications Secretariat Branch of the National Environment and Planning Agency within thirty (30) working days of the effective date of this letter. This letter represents an official warning and failure to comply will result in further enforcement action without further notice to you.

The following information is provided to assist you in submitting the application:

1. Environmental Permit

Pursuant to the Natural Resources Conservation Authority (NRCA) Act 1991 and in accordance with the Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order, 1996), an Environmental Permit will be required for the proposed expansion which falls within the category of 'Cemeteries and Crematoria'. The requisite approvals for the Environmental Permit must be sought from the Natural Resources Conservation Authority through the Agency (NEPA). The relevant forms are available on the Agency's website at www.nepa.gov.jm.

2. Technical Requirements

The following information is required to facilitate the review and the assessment of the proposed expansion.

- The total area of the site. That is, the respective areas (in square metres) of the existing cemetery and areas of the site earmarked for the proposed expansion.
- A location map at a scale of 1:12,500 (or an appropriate scale)
- A comprehensive description of all components e.g. chapel and crematorium and the various design elements of the project.
- The spatial allotments for the various design elements of the project, such as the quantum of land to be reserved for buildings, roads, burial and landscaping and the number of parking bays.
- A site layout plan showing the various components and design elements of the proposed development.
- The total number and types (single/double) of vaults proposed.
- The burial density; i.e. the number of vaults per hectare/square metres
- The typical design proposed for the vaults
- The arrangements for water supply (source and distribution)*
- The sewage treatment and disposal solution. The relevant designs of the proposed system should be provided.*
- The means of solid waste disposal.*
- The description of the existing soil structure, geology, geomorphology, landscape, aesthetic values and hydrology. It should be noted that past mining activities may have impacted soil structure, geomorphology and landscape in some sections of the site. The possible effects of such activities on the subject site should be carefully assessed.
- Special emphasis should also be placed on the storm water run-off, drainage patterns, characteristics of the aquifer, including the level and status of the groundwater. Additionally any slope stability issues that could arise should be evaluated.*
- A comprehensive drainage assessment of the site should be conducted. This assessment should take into consideration existing natural drainage channels, proposed man-made drainage/water features or

any proposed changes in topography. Potential issues of increased surface runoff and sediment loading must also be addressed.

- Percolation tests should be conducted
- A landscape plan highlighting grading and proposed changes in topography should be provided.
- Measures to mitigate any potential negative impact that the development activity may have on the environment during the construction and operation phases should be provided

3. Land Ownership

It is a requirement that all applications are accompanied by proof of ownership or a letter of consent from the registered proprietor in the event that the applicant is not the registered owner of the property. The letter should state the following:

- That the owner(s) of the land is aware of the applications being made to the National Environment and Planning Agency to procure Environmental Permit(s) and/or Licence(s) for the development on the subject property.

- That "I<*name of the owner of the land*> consent to the applications being made for the permits/licences for the property to be issued in the name of the Applicant."

Note that the letter should be signed by the relevant parties and witnessed by a Justice of the Peace and bear their signature and seal.

4. Statutory Requirement of Other Government Agencies

Prior to the submission of a formal application the developer should undertake consultation with other relevant government Agencies such as the Ministry of Health, Water Resources Authority, National Works Agency, Mines and Geology Division and the Manchester Parish Council to ensure that the proposal satisfies their respective requirements.

5. Restrictive Covenant

The developer should be guided by the Restrictive Covenant and Discharge Modification Act, 1960. Where the development will constitute a breach of any encumbrances on the title, modification through an application to the Supreme Court of Judicature in Jamaica located at 134 Tower Street Kingston will be required.

If there are any queries, do not hesitate to contact the undersigned at 754 7540 ext. 2164 or Mrs. Ruth-Ann Lacey-Sherrard at 754 7540 ext. 2179 or email rlacey-sherrard@nepa.gov.jm.

Yours sincerely,
National Environment and Planning Agency

Weston Jackson
Acting Manager, Applications Processing Branch
for **Government Town Planner/Chief Executive Officer**

WJ/rl-s

c. Secretary/Manager, St. Catherine Parish Council
Richard Nelson, Manager of Enforcement Branch - NEPA

LETTER FROM MINISTRY OF AGRICULTURE

Ref: 2012-14017-EN00022

03 April 2013

S. LeRoi Lorde
Managing Director
Meadowrest Memorial Gardens
12 Carlton Crescent
Kingston 10

Dear Mr. Lorde,

Re: Enquiry Application Proposed Expansion to Cemetery at Whittaker Mountain, St. Catherine
By: Meadowrest Memorial Garden

Further to the National Environment and Planning Agency's letter dated 11 February 2013 *(attached for ease of reference)*, please be advised that the Agency is in receipt of the comments of the Ministry of Agriculture and Fisheries, Rural Physical Planning Division. The Division in letter dated 8 February 2013 offers no objection to the expansion of the burial plot utilizing the 25 acres.

Notwithstanding, the Agency wishes to remind you of the requirements as outlined in the Agency's 11 February 2013 letter which required the submission of an application for an Environmental Permit. The said letter represented an official warning and in consideration of the timelines stated in same, the Agency anticipates a prompt response.

Should there be any queries, please do not hesitate to contact the undersigned at 754 7540 ext. 2162 or Mrs. Ruth-Ann Lacey-Sherrard at 754 7540 ext. 2179 or email rlacey-sherrard@nepa.gov.jm.

Yours sincerely,
National Environment and Planning Agency

Aisha Bedasse
Acting Manager, Applications Processing Branch
for **Government Town Planner/Chief Executive Officer**

AB/rl-s

c. Secretary/Manager, St. Catherine Parish Council
Richard Nelson, Manager of Enforcement Branch - NEPA

EASTERN DIVISION

QUALITY ASSURANCE & CHLORINATION DEPARTMENT

WATER QUALITY MONITORING

EASTERN LABORATORY

Meadowrest Memorial Gardens

DATE: December 11, 2017

PARISH:

Date	Sampling Point	Type	Total Coliform/ MF	Faecal Coliform	Suspended Solids (mg/L)	Orthophosphate (mg/L)
27/04/2017	Green Acres	Raw Water	<2.2	<2.2		
05/05/2017	Friendship Well	Raw Water	0.0	0.0		
06/12/2017	Green Acres	Raw Water	<2.2	<2.2		
06/12/2017	Friendship Well	Raw Water	<2.2	<2.2		
07/12/2017	Browns Well	Raw Water	0.0	0.0		
		Target	**<2.2/0**	**<2.2/0**		
25/05/2017	Browns Well				11.3	0.13
30/05/2017	Green Acres				0.0	0.05
25/05/2017	Friendship Well				2.3	0.14

WHO Drinking water Standards:	Total coliform	not mentioned
	Faecal coliform	not mentioned
	Suspended Solids	not mentioned
	Orthophosphate	not mentioned

NATIONAL WATER COMMISSION – PORTABILITY CERTIFICATES

NATIONAL WATER COMMISSION
POTABILITY CERTIFICATE

No. PC- A 2017-13

TO: **Mrs Beverline Brown -Smith**
Consultant and Project Manager
EPN Consultants Limited
Shop 16, Red Hills Mall
105 Red Hills Road
Kingston 19

Schedule: This is to certify that the Samples collected from Green Acres, Friendship and Brown's Wells in St Catherine has been evaluated **for the period August 2017.** These Wells were found to be producing water of satisfactory quality, meeting and exceeding the WHO and MOH potable water quality standards.

NB: Standards – Samples positive for Coliform bacteria must be < 5% of the total number of samples.

.....
Wendy Harrison-Smith
Manager Quality Assurance
And Chlorination (Acting)

August 30, 2017
Date

NATIONAL WATER COMMISSION
POTABILITY CERTIFICATE

No. PC J 2014-01

TO: **Mrs Beverline Brown Smith**
EPN Consultants Limited
Shop 16, 105 Red Hills Road
Kingston 19

Schedule: This is to certify that the **Green Acres Well, Friendship Well and Browns Well** in St Catherine has been tested **for the period January 2014 to September 2014** and is of good quality and potable for consumption conforming to the WHO and MOH Jamaica drinking Water quality standards.

.....
Manager Quality Assurance
Chlorination and Environment

2014/10/28
.....
Date

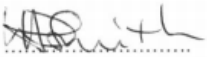
NATIONAL WATER COMMISSION

Water is life

Nitrates for Wells in the Meadowrest Area

Station	Maximum	Minimum	Average	Standard	Unit	Time Period
Browns Well	10.6	10.2	10.3	50	ppm	July - August 2017
Friendship Well	20.7	19.3	20.0	50	ppm	July - August 2017
Green Acres Well	31.9	26.2	28.7	50	ppm	June -July 2017

Senior Technical Officer



Manager QA&C

NATIONAL WATER COMMISSION

Water is life

Nitrates for Wells in the Meadowrest Area

Station	Maximum	Minimum	Average	Unit
Green Acres Well	22.5	13.9	18.1	ppm
Friendship Well	17.4	10.6	13.9	ppm
Browns Well	8.4	6.0	7.2	ppm

.....

Senior Technical Officer

.....

Manager QA&C

Hydrological Report for Meadowrest Cemetery, St. Catherine

Assessment Report

Prepared for

EPN Consultants Ltd

Prepared by TeraSun Company Limited

Table of Contents

INTRODUCTION

BACKGROUND

The Meadowrest Memorial Gardens is located at Whittaker's Mtn. Green Acres, in the Parish of St. Catherine as shown in Figure 1. It lies approximately 7.1 km to the North West of the Spanish Town commercial district. The Cemetery is located on approximately 55 acres of land; approximately 50 percent of which unusable due to large rock outcrops on the site. The operators of the cemetery are currently looking to expand the facilities westward in an effort to continue their operations.

NEPA has however requested that an EIA be done to explore the impacts of the expansion on the surrounding environment. This report seeks therefore to highlight the hydrological impacts of the development to the proposed mitigation measures that are in line with NEPA's requirements.

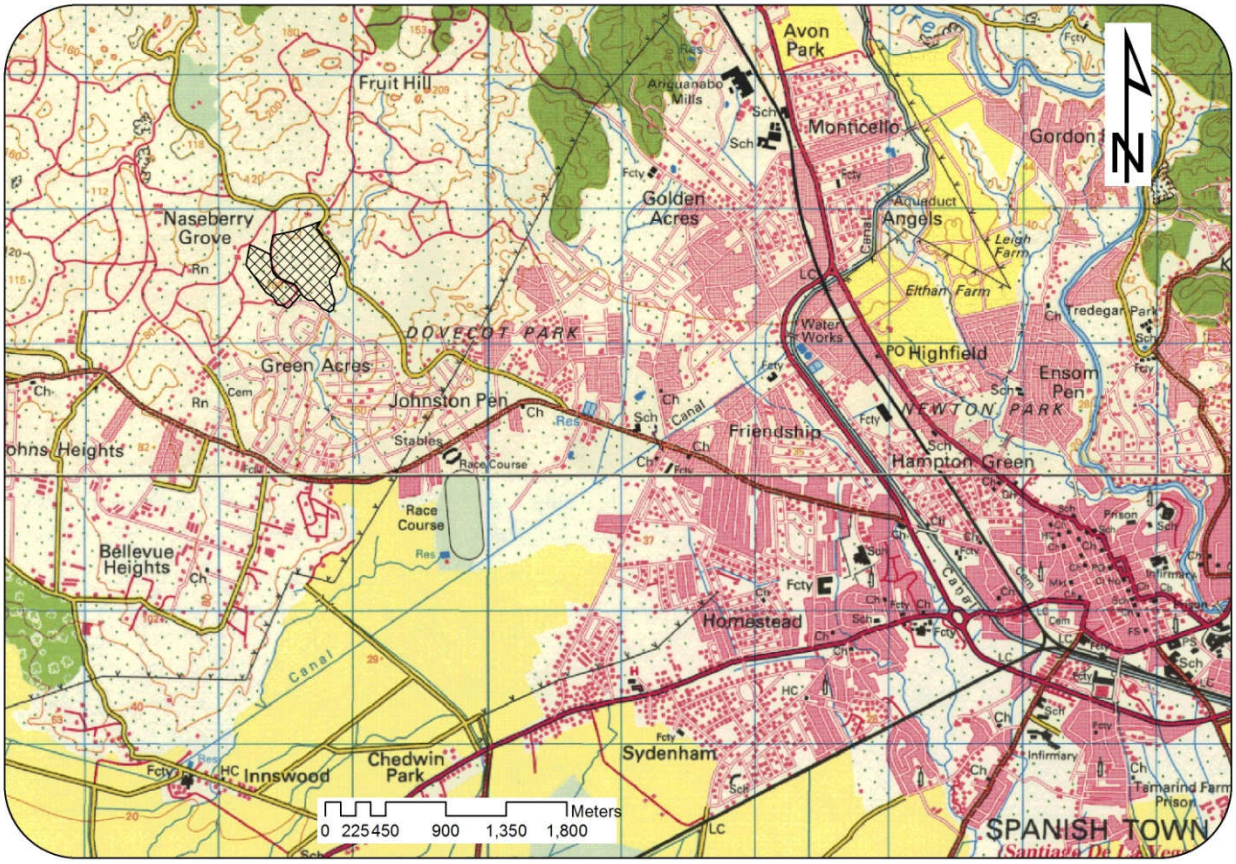


Figure 1: Location for Meadowrest in St. Catherine

SCOPE OF OBJECTIVES AND METHODOLOGY

The Developer has purchased approximately 22.9 acres of land to the west of the existing property. The scope therefore is to identify the potential hydrological impacts of the new section and to propose mitigation strategies.

The methodology adopted for this assignment is as follows:

1. Data collection to include project description;
    a. Description of the environment to include:
        i. The topography of the area
        ii. Soils
        iii. Meteorology (rainfall)
2. Calculation of peak and total runoffs
3. Conduct analysis to determine size and adequacy of the proposed ponds and drains.

DESCRIPTION OF THE ENVIRONMENT

TOPOGRAPHY

Topographical data for the proposed site was obtained from two sources to include:

1. The survey departments 12,500 map series;
2. Site contours generated by the client's land Surveyor

The survey departments' 12500 map series elevations varying from 300m to 400m above mean sea level. The proposed location for the expansions has much less variations in elevations and consequently gentler slopes. A portion of the Survey Department 12500 map for the area is shown in Figure 0.1 below with the lot boundaries superimposed.

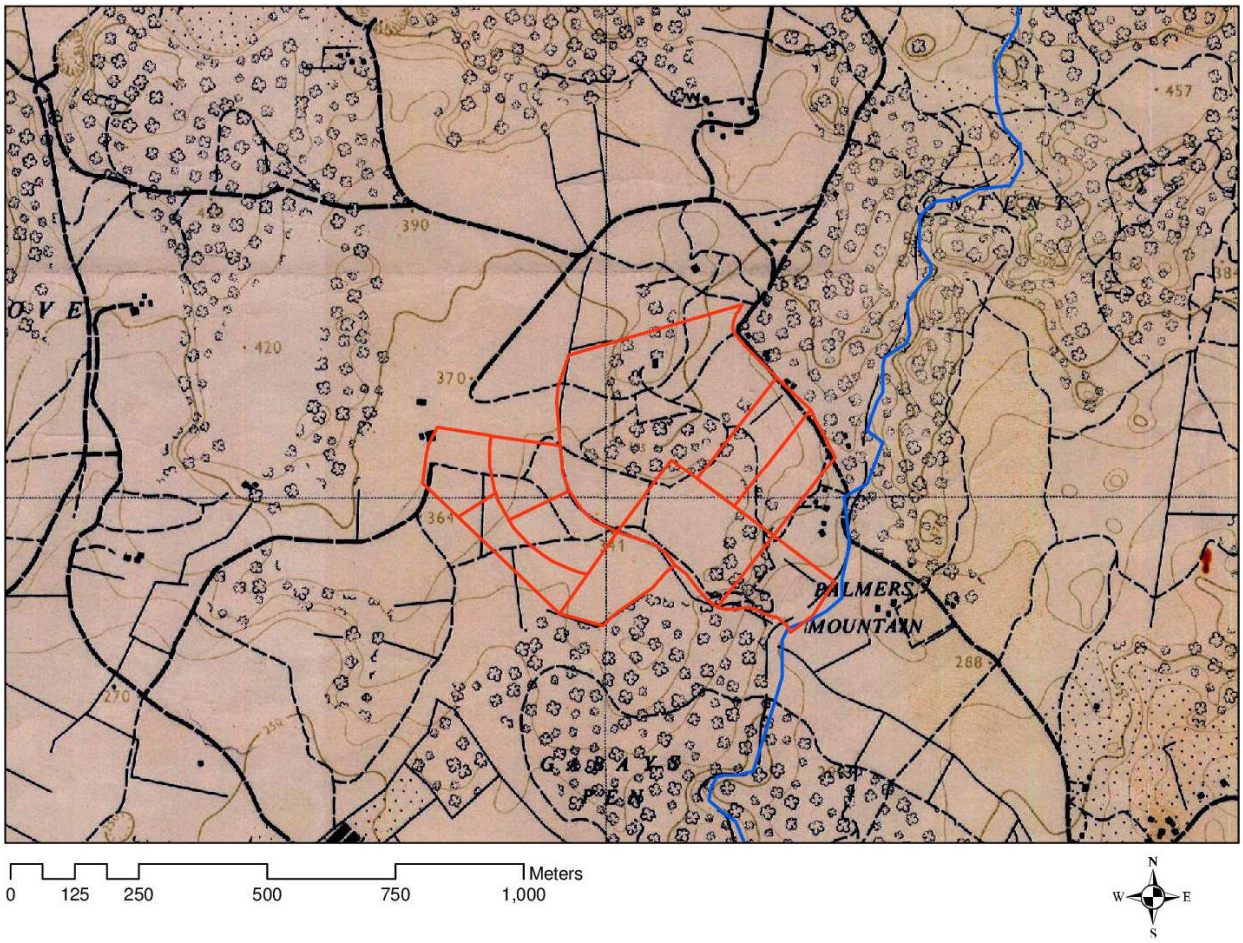


FIGURE 0.1 SURVEY DEPARTMENTS 12500 MAP OF THE AREA SHOWING THE CONTOURS AND MAIN GULLIES

A slope analysis of the Survey department's 12500 map contours revealed the proposed site has slopes ranging from 0 to 25 percent with the steeper slopes of 16 to 25 percent occupying less

than 30 percent of the proposed site. The existing site as well as the hills to the north has significant percentages of the areas with slopes in the higher ranges of 46 to 200 percent.

It should be noted however that in reality the landscape at the northwestern section of the existing site less steep than the 12500 map contours will produce because of terracing used for large plots. These help to prevent erosion by shortening the slope into a series of shorter, more level steps that allows excess rainfall to infiltrate into the soil rather than rapid run off that causes erosion.

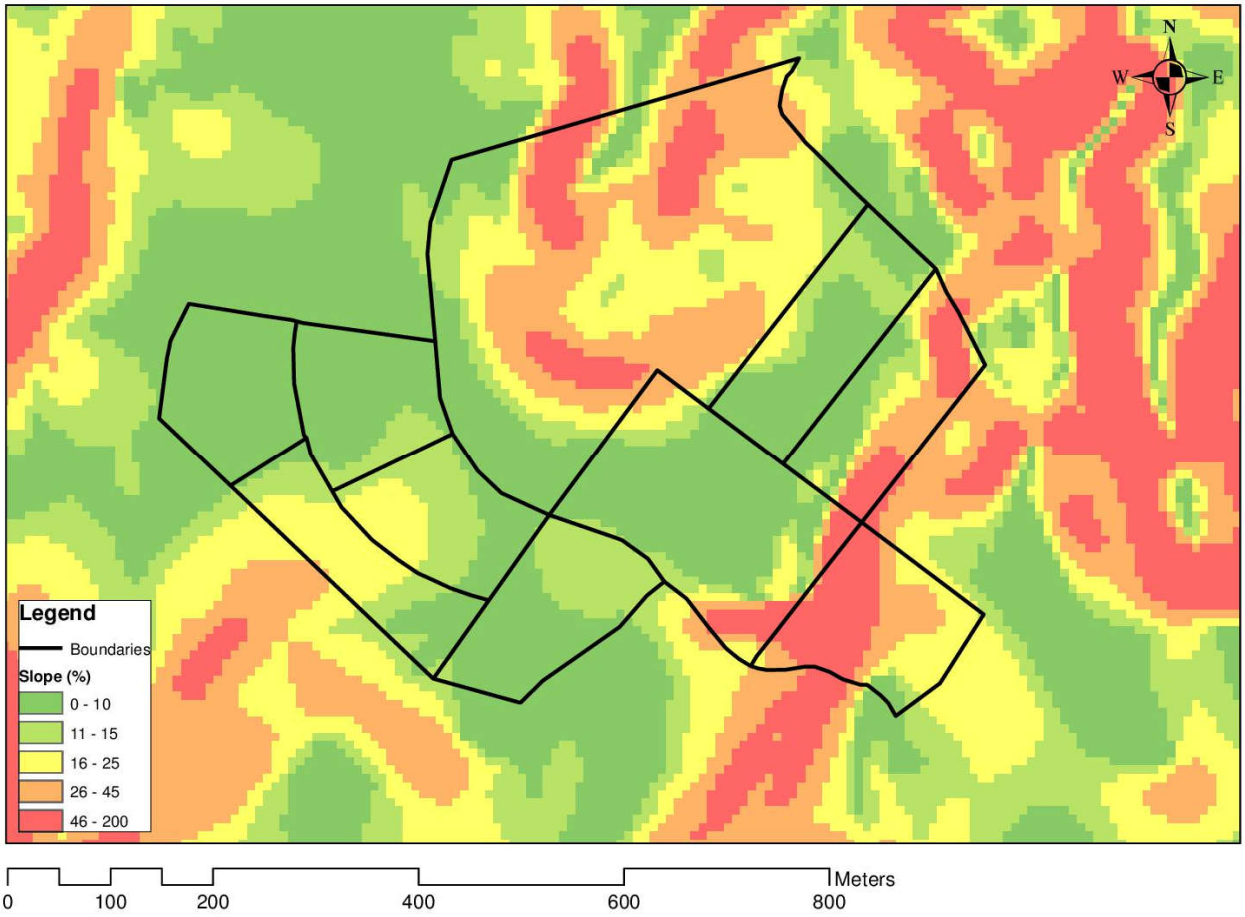


FIGURE 0.2 - SPATIAL VARIATION OF SLOPES IN THE AREA BASED ON SURVEY DEPARTMENT 12500 MAP CONTOURS

EXISTING DRAINAGE FEATURES

SITE DRAINS AND SINKHOLES

The Meadowrest property has several internal drains traversing the property. The most half of the existing site currently drains to the main road. The north-western section of the site drains to a sinkhole at the northernmost section of the site. The central and southern half the existing site drains to the major gully which runs east of Meadowrest in a north to south direction. Swale 2 is presently not clearly defined in most areas and therefore has the potential to cause flooding of neighbouring properties. It is therefore recommended that it be clearly defined especially along the southern boundaries. A second sinkhole was noted in the southern section

of the existing site. That receives flows from sections of the internal roads. The proposed expansion site has no clear drainage feature associated with it. However the contours indicate it drains to the south-west by overland shallow concentrated and sheet flows.

FIGURE 0.3 DEPRESSION CONTAINING SINKHOLE 1

FIGURE 0.4 INTERNAL SITE DRAIN LEADING TO SINKHOLE 2

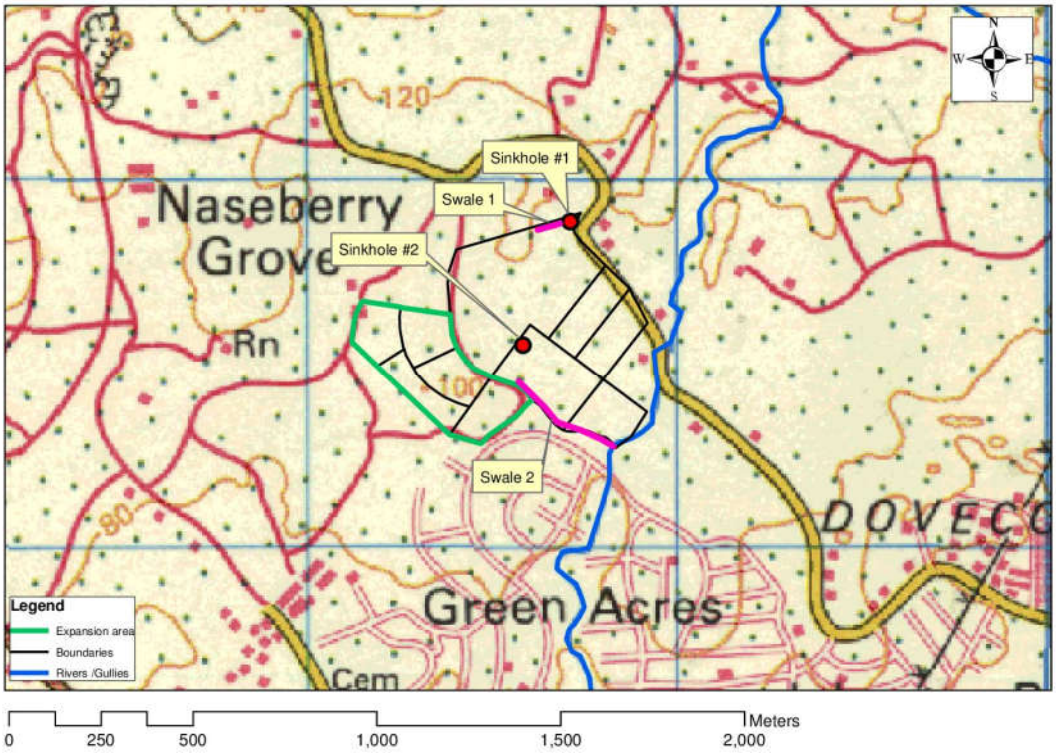


FIGURE 0.5 EXISTING DRAINAGE FEATURES CONTIGUOUS TO THE MEADOWREST MEMORIAL GARDENS

EASTERN GULLY

The eastern gully originates in Fruit Hill approximately 2km north of MMG. The channel is not well defined until it crosses the road and enters the Green Acres subdivision. Because of this, informal settlements to the north of the main road have structures in the flood plain of the gully. Where the gully enters the Green Acres subdivision, there is a culvert crossing that is

currently blocked with silt and other debris. Residents who have lived in the area for more than 20 years have indicated the opening is approximately 1.5m in diameter. As the drain enters the subdivision it widens significantly and does not appear to be a flood hazard to properties within the subdivision.

FIGURE 0.6 EAST GULLY ENTERING GREEN ACRES

FIGURE 0.7 SECTION OF ROAD IN GREEN ACRES WHERE THE DRAIN BYPASS THE CULVERT

FIGURE 0.8 SECTION OF PC ROAD LEADING TO MMG ENTRANCE ROAD WHERE EAST GULLY CROSSES PC ROAD

FIGURE 0.9 SECTION OF PC ROAD LEADING TO MMG ENTRANCE ROAD WHERE EAST GULLY CROSSES PC ROAD

SOILS AND LAND USE

The site is situated on St. Ann clays and Bonnygate Stony Loam. The clays are described by the ICTA[1] as having very slow draining through the soil, which indicated it has high runoff rates. The Bonnygate on stony loam on the other hand has moderate to rapid draining through the soil.

[1]Soil and Land-Use Surveys No.14 Jamaica

The Imperial College of Tropical Agriculture, Trinidad

University of the West Indies

A percolation test carried out at six locations on the site, three in the proposed areas and three on the western fringes of the existing site. The results indicated the soils were predominantly silty clays (based on visual inspection). The percolation rates varied from 90 to 23 minutes per inch across the test area. The trend across the test areas indicates the rates of percolation through the soils. It can be concluded that the discontinuity line separating clays and loam as indicated on the soils map is not completely true as shown on the ministry of agriculture soils map.

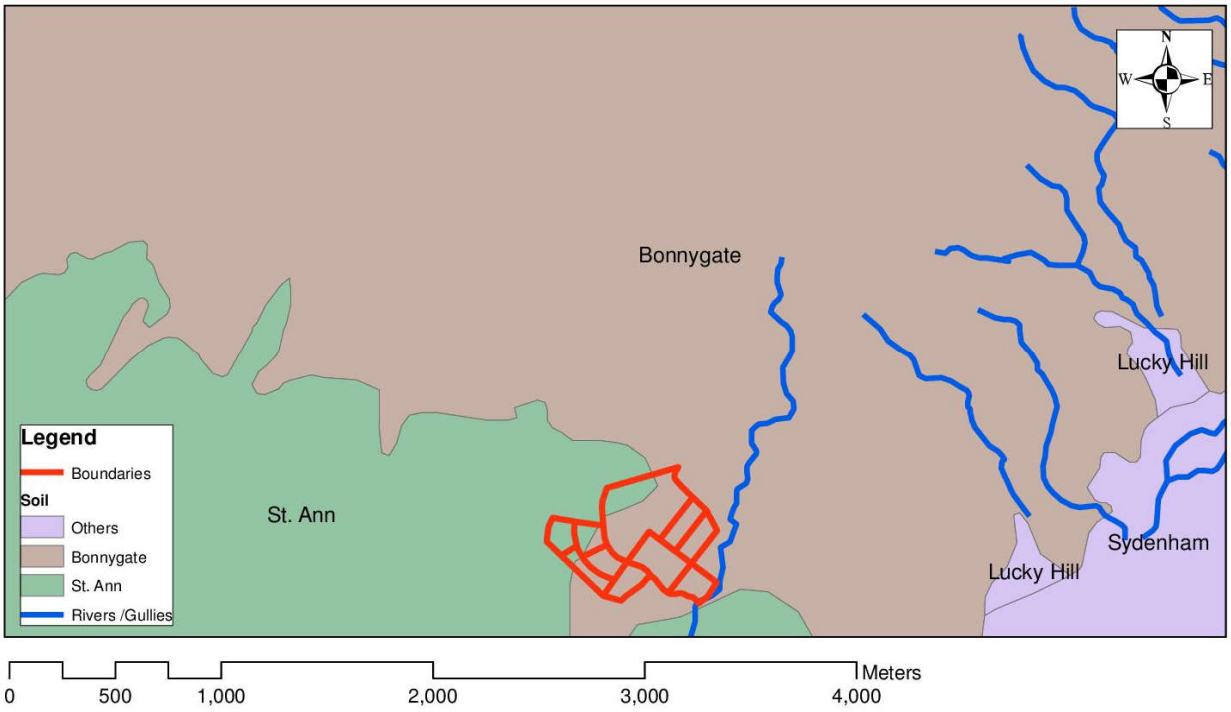


FIGURE 0.10MINISTRY OF AGRICULTURE SOILS MAP OF JAMAICA

TABLE 0.1 SUMMARY RESULTS OF THE PERCOLATION TESTS CONDUCTED AT MEADOWREST

TEST PIT	DEPTH		PERCOLATION RATE	
	Ft	m	MIN/INCH	MIN/CM
1	6	1.80	90	300
2	5.7	1.72	45	112.5
3	5.2	1.60	41	102.5
4	5.6	1.70	40	100
5	5.3	1.60	23	57.5
6	3.8	1.15	30	75

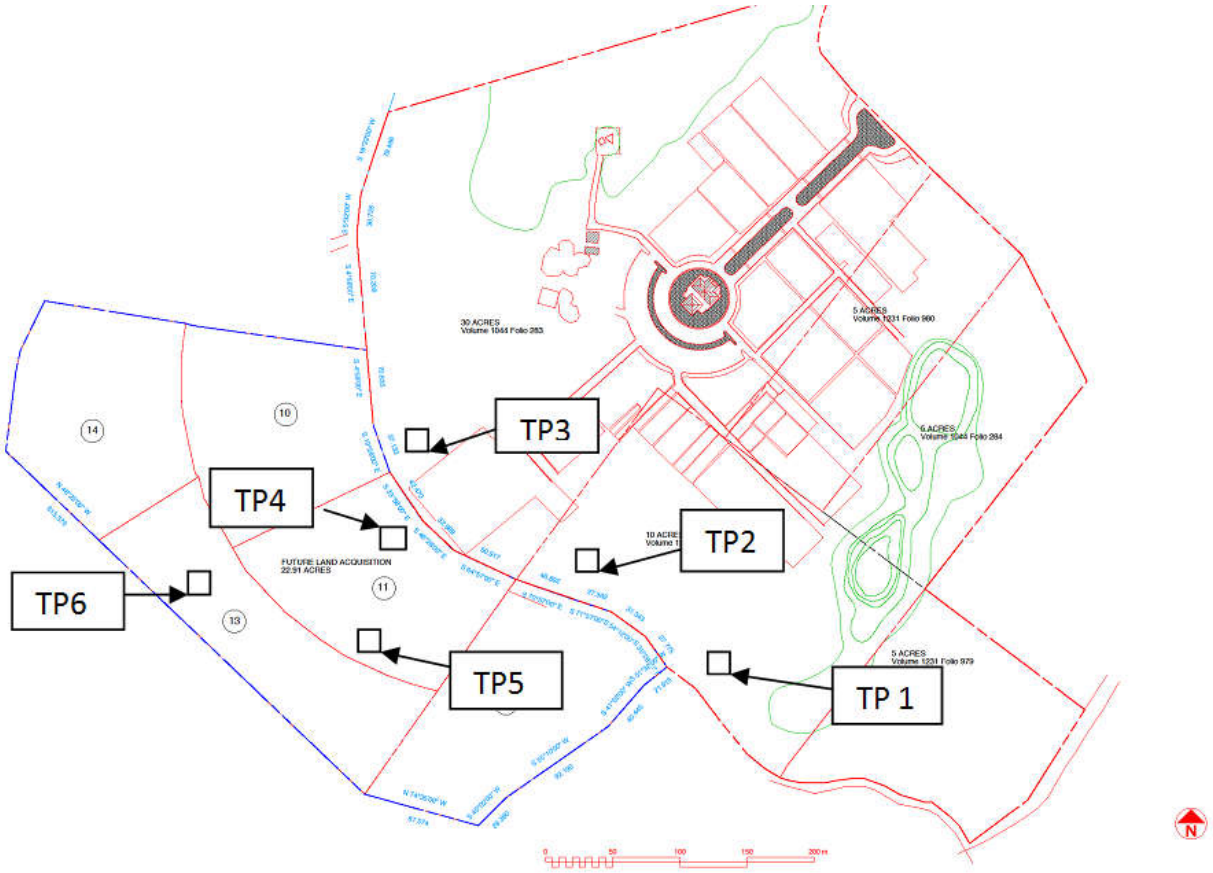


FIGURE 0.11PERCOLATION TEST PIT LOCATIONS AT THE MEADOWREST SITE

Site inspections as well as inspections of satellite imagery of the area indicates most of the site slated for development is in a ruinate state and is covered in brush. Changing the land use will inevitable increase the runoff rates however, mitigating strategies will be used to minimize the impacts on the surroundings.

METEOROLOGY (EXTREME RAINFALL)

MET OFFICE DATA

24hr intensity Rainfall data from the met office of Jamaica was utilized for the analysis. The 24 hr intensity data used was for the Dam Head Station which is located approximately 4.5 kilometres to the north east of the site.

Return Period (yr)	2	5	10	25	50	100
Intensity (mm/24hr)	166	201	228	263	295	330

WRA IDF CURVES (EXTREME RAINFALL)

The Intensity Duration Frequency Curves data set analyzed in 1995 by the Water Resources Authority Rainfall data for the closest station, Norman Manley International Airport (NMIA), obtained for the determination of rainfall intensities for events less than the 24hour rainfall. The

IDF curve used is shown below in and the corresponding regression equations are also shown below.

TABLE 0.2 REGRESSION EQUATIONS FOR NORMAN MANLEY IDF CURVES

Return Period	Regression Equation	
2 years	$i = 370.96\ t^{-0.618}$	Where: i = intensity (mm/hr)
5 years	$i = 487.57\ t^{-0.597}$	t = duration (minutes)
10 years	$i = 566.27\ t^{-0.590}$	
25 years	$i = 666.43\ t^{-0.583}$	
50 years	$i = 741.03\ t^{-0.579}$	
100 years	$i = 815.23\ t^{-0.577}$	

HYDROLOGYAND HYDRAULICS

SURFACE AND GROUNDWATER HYDROLOGY

SURFACE HYDROLOGY

The Project Site falls within the Lower Rio Cobre sub-watershed. Principal variations in character of the stream flow result from variations in the underlying geological formations. Most of the rain falling in the upper reaches of the watershed on the Cretaceous formations (to the north and west) is quickly converted into surface flows. However, practically all of the rain falling on the karstified limestone in the lower mountains (in the immediate project area and environs) is consumed by vegetation or passes into an extensive subterranean system, without causing surface runoff. The Rio Cobre is the primary surface water feature within the hydrologic basin. It originates from surface flows draining the Cretaceous Inlier to the north. This upfaulted region constitutes the longitudinal axis of the island that results in drainage to the north and south coasts.

The Rio Cobre flows drains from a topographic high of the Cretaceous Central Inlier to traverse the Tertiary limestones via the Bog Walk-Spanish Town Gorge. Natural aquifer outflow and irrigation return flows in the southern plains allow for perennial drainage of this source.

The Rio Cobre tributaries are the Rio D'oro, Rio Pedro, and Thomas River. Of these, Rio Pedro is the largest contributor. The available surface water resources for the Lower Rio Cobre Basin has been quantified by the Water Resources Authority (WRA) as …per year (2006, Water Resources Development Master Plan Draft).

GROUNDWATER HYDROLOGY

The Project Area is located within the limestone outcrop region of the basin. This area is noted for the absence of a well-developed surface drainage pattern. Instead there are many closed depressions within which water is channeled underground through centrally located sinks or laterally draining caverns and eventually infiltrated to the groundwater system. The Project Area is therefore one of primary recharge.

The Walderston Browns Town Formation underlies the Project Site, which has been characterized as a Limestone Aquifer under Jamaica's hydrostratigraphic suite. It is mainly rubbly or chalky and consequently more likely to develop secondary permeability through

solution than fracturing. This results in a more even distribution of permeability rather than supporting massive conduit type flows. There may be some primary permeability in the Walderston Browns Town Formation and the occurrence of diffuse flows across hydraulic gradients.

Where the limestone crops out the water table is under atmospheric conditions and the aquifer is unconfined. Depth to groundwater in the vicinity of the Project Site is approximately 30 metres below ground level.

The nearest mapped fault is located 1.5 kilometres northwest of the Meadowrest Cemetery and trends northwest-southeast. It is expected that the dominant fault orientation is a structural control on groundwater movement to the southeast and subsequently discharges to sea.

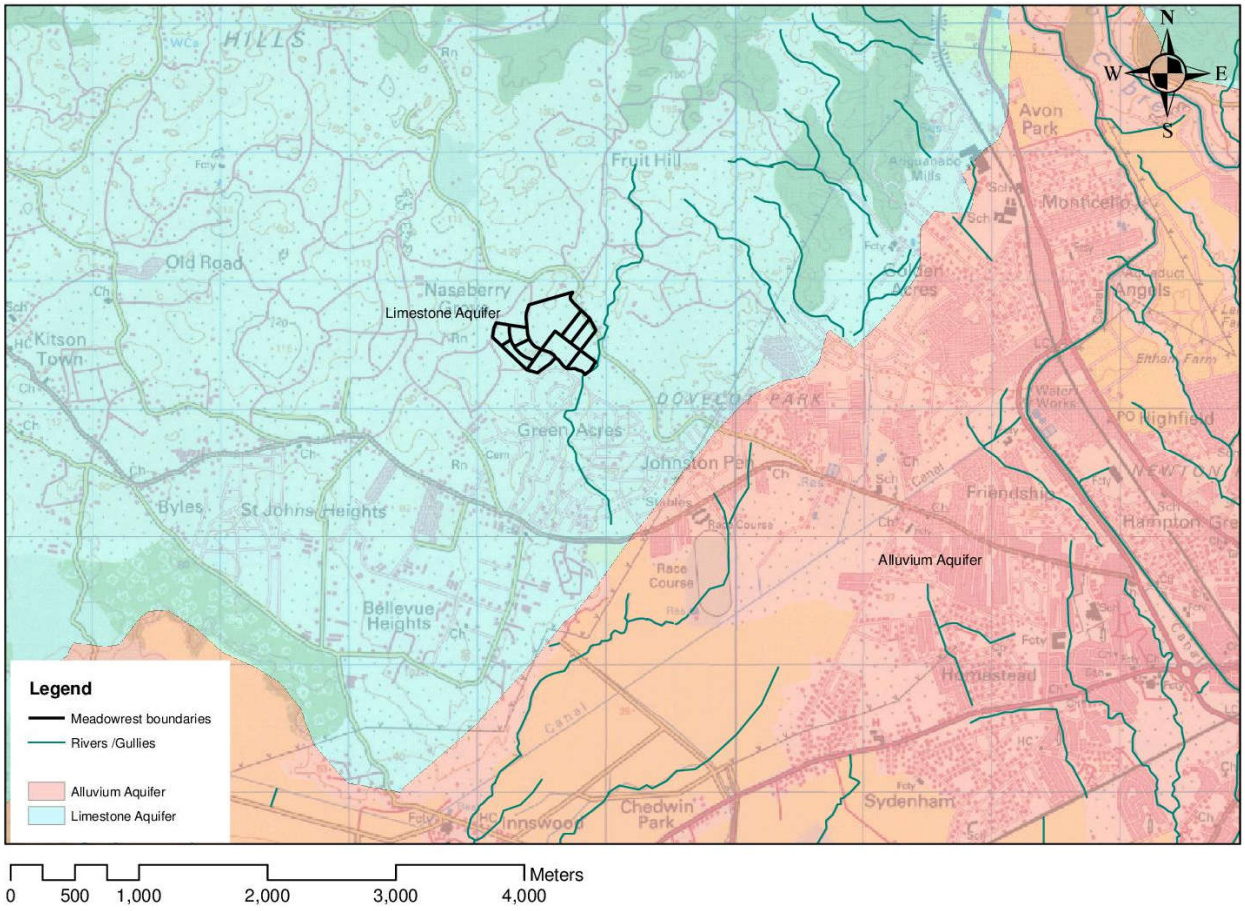


FIGURE 0.1 SUBDIVISION LAYOUT SUPERIMPOSED ON THE HYDROSTRATEGRAPHY MAP OF JAMAICA

PEAK AND TOTAL RUNOFF

THE CATCHEMENTS

The two main catchments of concern that will be directly impacted by the development are the East Gully catchment and the expansion area catchment. The area south of the expansion are also expected to be impacted; however a cut-off drain will need to be constructed on the outer south-west to southern boundaries to mitigate this. The gully catchment is approximately 177 hectares whereas the site proposed for development is approximately 9 hectares in area.

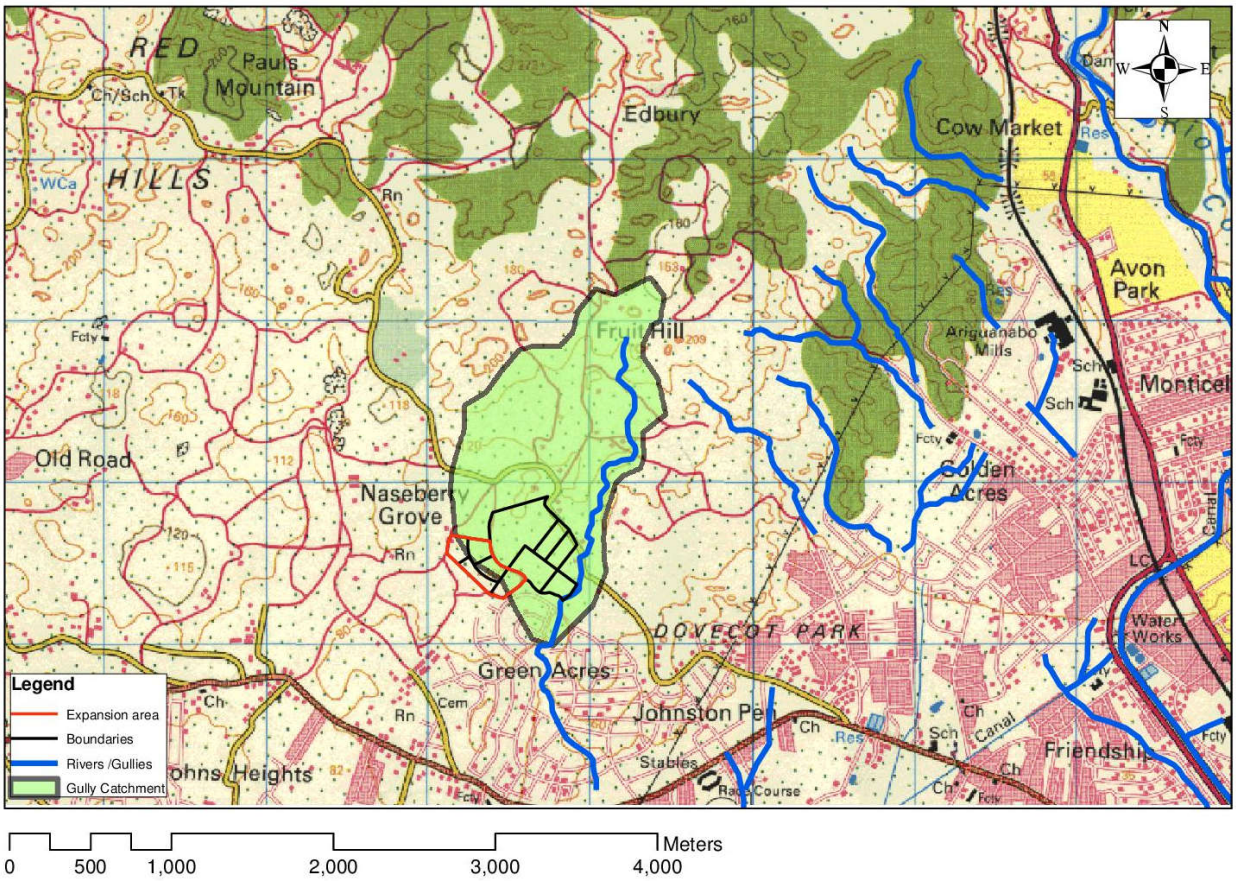


FIGURE 0.2 CATCHMENT AREA OF THE GULLY SUPERIMPOSED ON THE SURVEY DEPARTMENT 1:50000 MAP

RUNOFF MODEL (SCS)

SCS method is an empirical model for rainfall runoffs which is based on the potential for the soil to absorb a certain amount of moisture. On the basis of field observations, this potential storage S (millimeters or inches) was related to a 'curve number' *CN* which is a characteristic of the soil type, land use and the initial degree of saturation known as the antecedent moisture condition. Hydrological modeling of the watersheds encompassed three main elements:

- Precipitation
- Rainfall abstraction model (Curve number method)
- Runoff model (Dimensionless unit hydrograph)

The SCS curve number method was used to determine the rainfall excess P_e using the following equation:

$$P_e = \frac{(P^2 - I_a^2)}{P - I_a} + S$$

Where, P = precipitation

I_a = initial abstraction

S = Potential retention which is a measure of the retention capacity of the soil.

The Maximum Potential retention, S, and the watershed characteristics are related through the Curve number CN.

$$S = \frac{25400 - (254 \times CN)}{CN}$$

Curve Numbers have been tabulated by the NRCS on the basis of soils group, soil cover or land use, and antecedent moisture conditions (initial degree of saturation).

The peak runoffs are generally calculated using the type III rainfall distribution for catchments in Jamaica. The primary inputs into the model are as follows:

- Drainage area size (A) in square miles (square kilometers);
- Time of concentration (Tc) in hours;
- Weighted runoff curve number (RCN);
- Rainfall distribution (see Figure 4.1);
- Total design rainfall (P) in inches (millimeters).

RUNOFF COEFFICIENT AND CURVE NUMBERS

The curve numbers used were based on those determined by the NRCS for varying soils types and land use conditions. The lots are expected to experience build out in most areas over the next few years. The curve numbers used for the predevelopment and post development conditions were 65 and 73 respectively. This is given the soil type was silty clays whereas the land uses are meadows and terraced lawns respectively.

Description of Land Use	Hydrologic Soil Group			
	A	B	C	D
Paved parking lots, roofs, driveways	98	98	98	98
Streets and Roads:				
Paved with curbs and storm sewers	98	98	98	98
Gravel	76	85	89	91
Dirt	72	82	87	89
Cultivated (Agricultural Crop) Land*:				
Without conservation treatment (no terraces)	72	81	88	91
With conservation treatment (terraces, contours)	62	71	78	81
Pasture or Range Land:				
Poor (<50% ground cover or heavily grazed)	68	79	86	89
Good (50-75% ground cover; not heavily grazed)	39	61	74	80
Meadow (grass, no grazing, mowed for hay)	30	58	71	78
Brush (good, >75% ground cover)	30	48	65	73
Woods and Forests:				
Poor (small trees/brush destroyed by over-grazing or burning)	45	66	77	83
Fair (grazing but not burned; some brush)	36	60	73	79
Good (no grazing; brush covers ground)	30	55	70	77
Open Spaces (lawns, parks, golf courses, cemeteries, etc.):				
Fair (grass covers 50-75% of area)	49	69	79	84
Good (grass covers >75% of area)	39	61	74	80
Commercial and Business Districts (85% impervious)	89	92	94	95
Industrial Districts (72% impervious)	81	88	91	93
Residential Areas:				
1/8 Acre lots, about 65% impervious	77	85	90	92
1/4 Acre lots, about 38% impervious	61	75	83	87
1/2 Acre lots, about 25% impervious	54	70	80	85
1 Acre lots, about 20% impervious	51	68	79	84

FIGURE 0.3 NRCS CURVE NUMBER TABLE

TIME OF CONCENTRATION

The time of concentration for a particular catchment is normally described as the time it takes for the hydraulically most distant part of the catchment to contribute to the flow at the design point. Surface flows normally pass through three stages; time of entry, shallow overland flow and channel flow. The sum of these will determine the overall time of concentration. See Table below.

TABLE 0.1 TIME OF CONCENTRATION COMPONENTS

Stage	Model
Time of entry	Mannings Kinematic equation (MKE) $t_1 = \frac{5.48\ (nL)^{0.8}}{P^{0.5}\,S^{0.4}}$ L = length of flow to 300 ft (91m) P_2 = 2 year, 24 hour rainfall (in) n = manning's roughness coefficient S= slope of hydraulic grade line -m/m or m/m-(Land slope).

Time of Shallow overland flow	NRCS equations of shallow concentrated flow **$V = 4.9178\ S^{0.5}$** for an unpaved surface **$V = 6.1960\ S^{0.5}$** for a paved surface **$t_2 = L/(60V)$**
Time of travel (Channel flow)	Mannings equation for the applicable drainage channel for each catchment. $Q = VA = \left(\frac{1.49}{n}\right) AR^{\frac{2}{3}}\sqrt{S}$ [U.S.] $Q = VA = \left(\frac{1.00}{n}\right) AR^{\frac{2}{3}}\sqrt{S}$ [SI] Where: Q = Flow Rate, (ft^3/s) v = Velocity, (ft/s) A = Flow Area, (ft^2) n = Manning's Roughness Coefficient R = Hydraulic Radius, (ft) S = Channel Slope, (ft/ft)
Time of Concentration	$Tc = T_e + T_s + T_t$

RATIONAL METHOD

The rational method was developed primarily for estimating peak runoff according to the formula:

Q = CIA, where

C = runoff coefficient

I = rainfall intensity and

A = area of the catchment

Runoff coefficients were chosen based on the Urban Water Resources council 1992 recommended values. Composite runoff coefficient numbers were generated bases on the areal extent of the different runoff surfaces across the catchments. The equation used was as follows:

$$C = \frac{\sum_1^i AC}{\sum_1^i A}$$

The runoff coefficients were estimated for three scenarios to include preconstruction and post construction scenarios when the land would have been fully utilized. The runoff coefficients used were 10 and 30 percent respectively.

TABLE 0.2 URBAN WATER RESOURCES COUNCIL 1992 RECOMMENDED RUNOFF COEFFICIENTS

Land use	Range
City Centre	0.7-0.95
Suburban Business	0.5-0.7
Industrial	0.5-0.9
Residential	0.3-0.7
Parks and Gardens	0.05-0.3
Asphalt and conc. paving	0.7-0.95
Roofs	0.75-0.95
Lawns	0.05-0.35

RESULTS

SITE RUNOFF

The runoff from the proposed site is estimated to vary from 0.4 to 0.8m3/s for the existing scenario. There is an expected 200 percent increase in runoff when the site is fully developed. It should be noted however that even though the increases are in the order of 50 percent they are not significantly large to be of any great concerns downstream. The total runoff from the proposed site will vary from 2619 to 18911 cubic metres. The increases in total runoff are expected to be in the order of 15 to 47 percent.

TABLE 0.3 PEAK RUNOFF FROM PROPOSED EXPANSION SITE

Site Catchment	2	5	10	25	50	100
Predevelopment Peak Runoff (m3/s)	0.40	0.44	0.53	0.63	0.72	0.80
Post development Peak Runoff (m3/s)	0.61	0.66	0.80	0.95	1.09	1.20
	0.21	0.22	0.27	0.32	0.37	0.40
Increase (%)	51%	50%	50%	51%	51%	50%

TABLE 0.4TOTAL RUNOFF FROM PROPOSED EXPANSION SITE

Site Catchment	2	5	10	25	50	100
Predevelopment total Runoff (m3)	2619	6361	9198	13006	15922	18911
Post development total Runoff (m3)	3843	8212	11363	15484	18588	21737
	1224	1851	2165	2478	2666	2826
Increase (%)	47%	29%	24%	19%	17%	15%

GULLY RUNOFF

The estimated peak runoff to the gully is in the order of 7.1 to 67.6 cubic metres per second for the 2 to 100 year return storm event. The development of the site will increase the peak flows to the gully by 2.9 to 0.6 percent from the 2 year to 100 year storm event. The trend is similar for the total runoff from the site. The peak and total runoffs are not expected to have any significant runoff downstream of the site. The culvert entering the green acres subdivision is already

significantly undersized for the 25 yr peak flows. The relevant authorities should be lobbied to clear the culvert as well as to improve the culvert capacity.

TABLE 0.5 PEAK RUNOFF FROM THE EASTERN GULLY CATCHMENT

Gully Catchment	**2**	**5**	**10**	**25**	**50**	**100**
Peak Runoff	7.1	21.0	31.6	45.8	56.6	67.6
Increase from Development of Site						
m3/s	0.21	0.22	0.27	0.32	0.37	0.40
Percent (%)	2.90%	1.05%	0.84%	0.70%	0.65%	0.60%

TABLE 0.6 TOTAL RUNOFF FROM THE EASTERN GULLY CATCHMENT

Gully Catchment	**2**	**5**	**10**	**25**	**50**	**100**
Total Runoff	63587	142059	199638	275629	333193	391792
Increase from Development of Site						
m3/s	1224	1851	2165	2478	2666	2826
Percent (%)	1.9%	1.3%	1.1%	0.9%	0.8%	0.7%

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The following are our conclusions based on the assessments conducted to date:

1. The runoff from the proposed site will vary from 0.61m^3/s to 1.2m^3/s for the 2 to 100 year return rainfall, when the site is fully developed, this is an overall increase of 200 percent from the post development levels. The actual values of the increase are relatively small however.
2. As it relates to the overall runoff to the gully, the increase as a result of the development is in the order of 1.09 to 3.9 percent.
3. The gully dimensions downstream of the subdivision culvert are sufficiently sized to convey the peak flows. This gully discharges to the cane fields to the south of the Green Acres subdivision where the impacts are negligible.

RECOMMENDATION

Based on the assessment conducted to date, our recommendations are as follows:

1. The proposed expansion site should be bounded by a perimeter drain to the south west to intercept runoff from the site and discharge to the gully.
2. The authorities should be agitated to remove the blockage from the subdivision culvert and increase the opening to accommodate the flows from the catchment above.

SOLID WASTE MANAGEMENT PLAN

Company Name: Meadowrest Memorial Gardens **Contact Person: Mr. S. LeRoi Lorde, JP**
Telephone #: 929-2394

Address: 12 Carlton Crescent, Kingston 10

Project Location: Whittaker's Mountain

Superintendent: Mr. Reid **Architect: Mr. Michael Lorde**
Contact Person: -
Telephone #: - **Telephone #: -**

Recycling Coordinators:

Project Description:

Waste Management Goals:

- This project will recycle or salvage for reuse a minimum of **95%** by weight of the waste generated on-site.
- Waste reduction will be achieved through building design of vaults, and reuse and recycling efforts will be maintained throughout the construction process.

Waste Prevention Planning:

- Recyclables include:
    - paper
    - corrugated cardboard
    - plastic and glass bottles and jars
    - metal cans

Project Construction Documents – Requirements for waste management which will be included in all work allocations. The General Contractor will contractually require all subcontractors to comply with MMG recycling requirements. A copy of this Solid Waste Management Plan will accompany all Subcontractor Agreements and requires the subcontractor participation.

- The Construction Waste Reduction Plan shall be implemented and executed as follows and as on the chart:
    - Salvageable materials will be diverted from disposal where feasible.
    - There will be a designated area reserved for a row of dumpsters/barrels
    - Before proceeding with any removal of construction materials from the construction site, the Superintendent or the Assistant Superintendent will inspect containers for compliance with MMG requirements.

- Hazardous waste will be managed by a licensed hazardous waste vendor.

Communication & Education Plan:

- The MMG will conduct an on-site pre-construction meeting with subcontractors. Attendance will be required for the subcontractor's key field personnel. The purpose of the meeting is to reinforce to subcontractor's key field employees the commitments made by their companies with regard to MMG's goals and requirements.
- As each new subcontractor comes on site, he/she will be advised of the requirements.
- The subcontractor will be expected to make sure all his/her crew complies with the Waste Management Plan.
- All recycling containers will be clearly labeled. Containers shall be located in close proximity to areas under construction where recyclables/salvageable materials will be generated.

Motivation Plan:

- MMG will develop and publish a mission statement that can be distributed to the subcontractors, attached to the subcontracts, and posted at the jobsite.

- This document will be an attachment to every subcontract. Copies of the attachment will be posted prominently at the jobsite.

Evaluation Plan:

- The Superintendent will develop, update, and post at the jobsite a graph indicating the progress to date for achieving the project's waste recycling goal of 95% by weight of the total project waste stream.

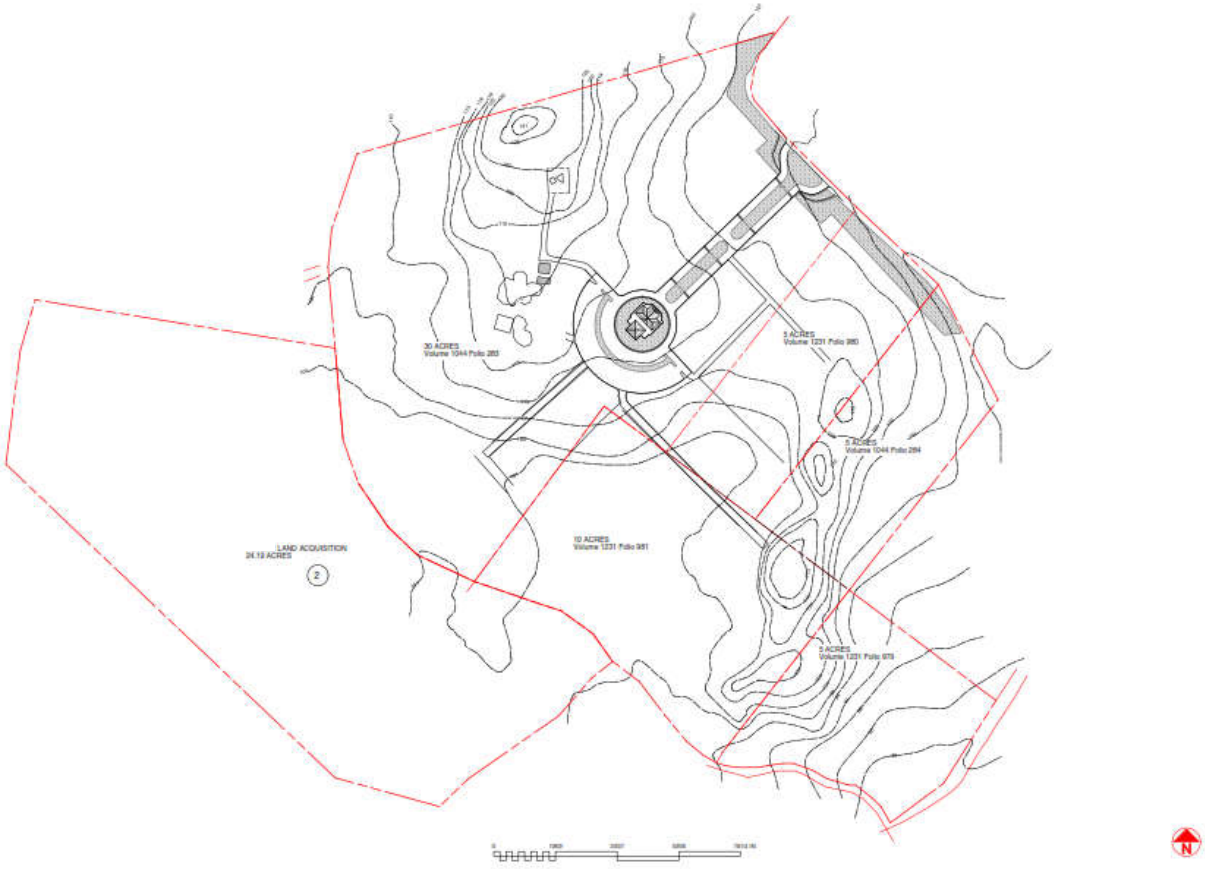
Expected Project Waste, Disposal, and Handling:

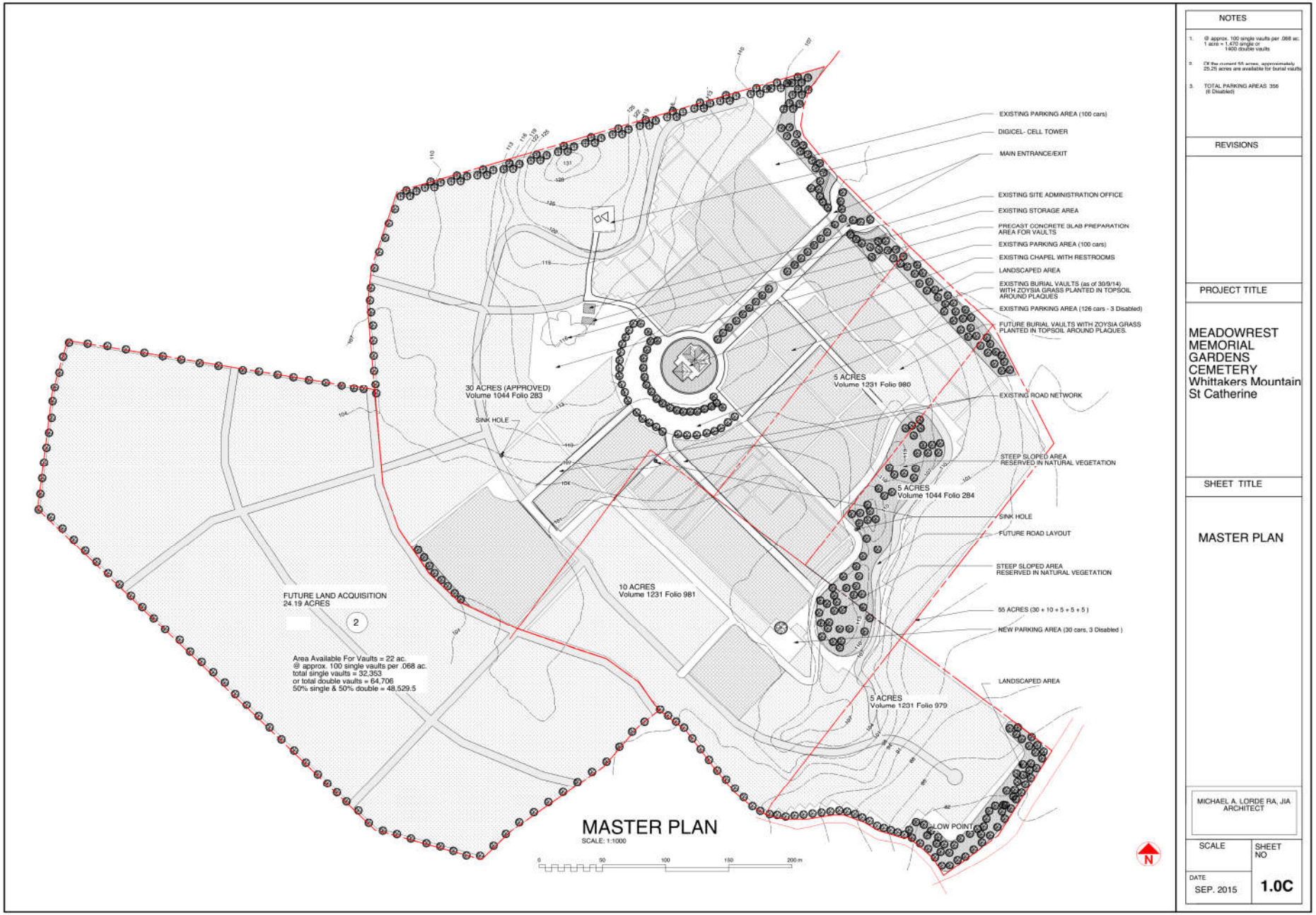
The following charts identify waste materials expected on this project, their disposal method, and handling procedures:

Material	Disposal Method	Handling Procedure
Grass and wood cuttings	Keep separate for reuse and or landscaping	Keep separated in designated areas on of site
particle board	Reuse, landfill	Keep separated in designated areas on site. Place in "Trash" container.
Painted or treated wood	Reuse, landfill	Keep separated in designated areas on site. Place in "Trash" container.
Concrete Masonry Units	Keep separate for re-use by on-site construction or by site employees	Keep separated in designated areas on site
Metals	-	Keep separated in designated areas on site.
Paint	-	Keep separated in designated areas on site

Glass	-	Keep separated in designated areas on site. .
Plastics	-	Keep separated in designated areas on site.
Beverage	-	Keep separated in designated areas on site. Cardboard" container
Cardboard	-	Keep separated in designated areas
Paper and newspr	-	Keep separated in designated areas on site.

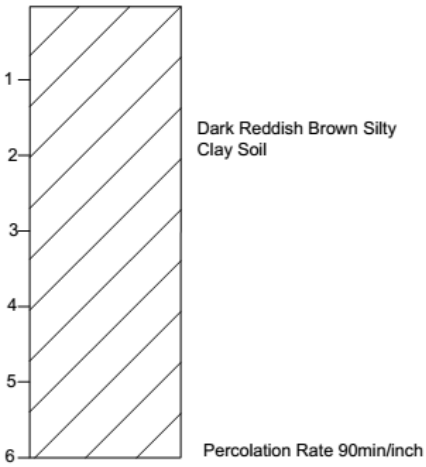
PLAN SHOWING LOT 2 (NEW PURCHASE) AT MEADOWREST MEMORIAL GARDENS



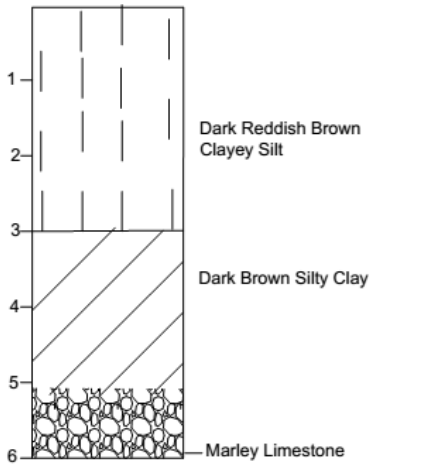

EXISTING PARKING AREA (100 cars)
DIGICEL- CELL TOWER
MAIN ENTRANCE/EXIT
EXISTING SITE ADMINISTRATION OFFICE
EXISTING STORAGE AREA
PRECAST CONCRETE SLAB PREPARATION AREA FOR VAULTS
EXISTING PARKING AREA (100 cars)
EXISTING CHAPEL WITH RESTROOMS
LANDSCAPED AREA
EXISTING BURIAL VAULTS (as of 30/9/14) WITH ZOYSIA GRASS PLANTED IN TOPSOIL AROUND PLAQUES
EXISTING PARKING AREA (126 cars - 3 Disabled)
FUTURE BURIAL VAULTS WITH ZOYSIA GRASS PLANTED IN TOPSOIL AROUND PLAQUES.
30 ACRES (APPROVED)
Volume 1044 Folio 283
SINK HOLE
5 ACRES
Volume 1231 Folio 980
EXISTING ROAD NETWORK
STEEP SLOPED AREA RESERVED IN NATURAL VEGETATION
5 ACRES
Volume 1044 Folio 284
SINK HOLE
FUTURE ROAD LAYOUT
STEEP SLOPED AREA RESERVED IN NATURAL VEGETATION
10 ACRES
Volume 1231 Folio 981
55 ACRES (30 + 10 + 5 + 5 + 5)
NEW PARKING AREA (30 cars, 3 Disabled)
LANDSCAPED AREA
5 ACRES
Volume 1231 Folio 979
LOW POINT
FUTURE LAND ACQUISITION
24.19 ACRES
2
Area Available For Vaults = 22 ac.
@ approx. 100 single vaults per .068 ac.
total single vaults = 32,353
or total double vaults = 64,706
50% single & 50% double = 48,529.5
MASTER PLAN
SCALE: 1:1000
0
50
100
150
200 m
N
NOTES
1. @ approx. 100 single vaults per .068 ac.
1 acre = 1,470 single or
1400 double vaults
2. Of the current 55 acres, approximately 25.25 acres are available for burial vaults
3. TOTAL PARKING AREAS 356
(6 Disabled)
REVISIONS
PROJECT TITLE
MEADOWREST MEMORIAL GARDENS CEMETERY
Whittakers Mountain
St Catherine
SHEET TITLE
MASTER PLAN
MICHAEL A. LORDE RA, JIA
ARCHITECT
SCALE
SHEET NO
DATE
SEP. 2015
1.0C

TEST PIT LOGS OF PERCOLATION TEST PITS

Test Pit 1

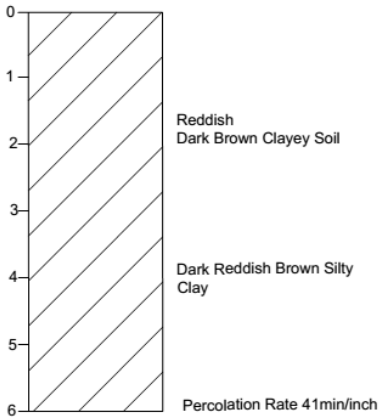


Test Pit 2

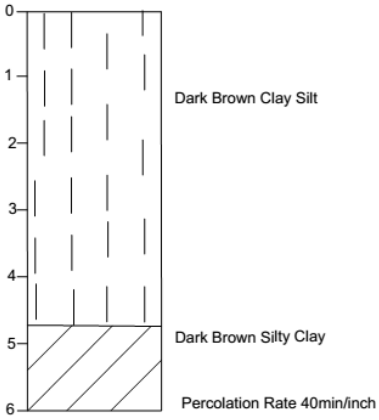


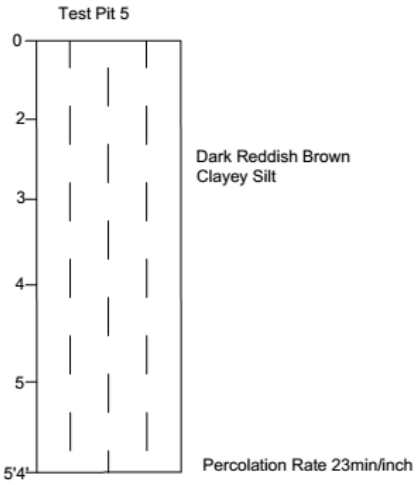
Percolation Rate 45min/inch

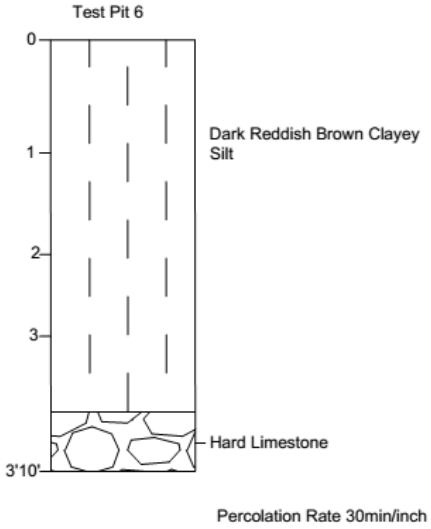
Test Pit 3

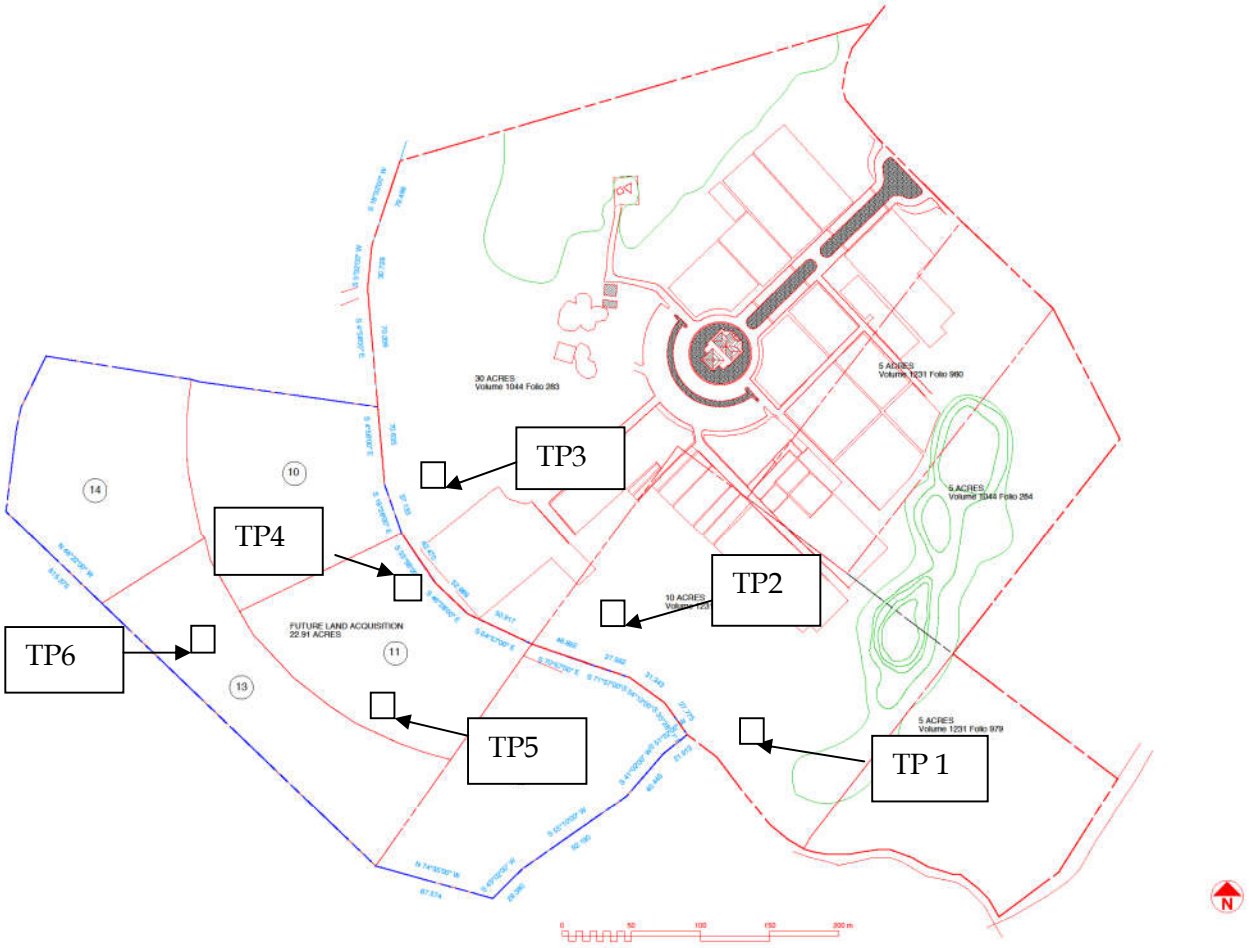


Test Pit 4

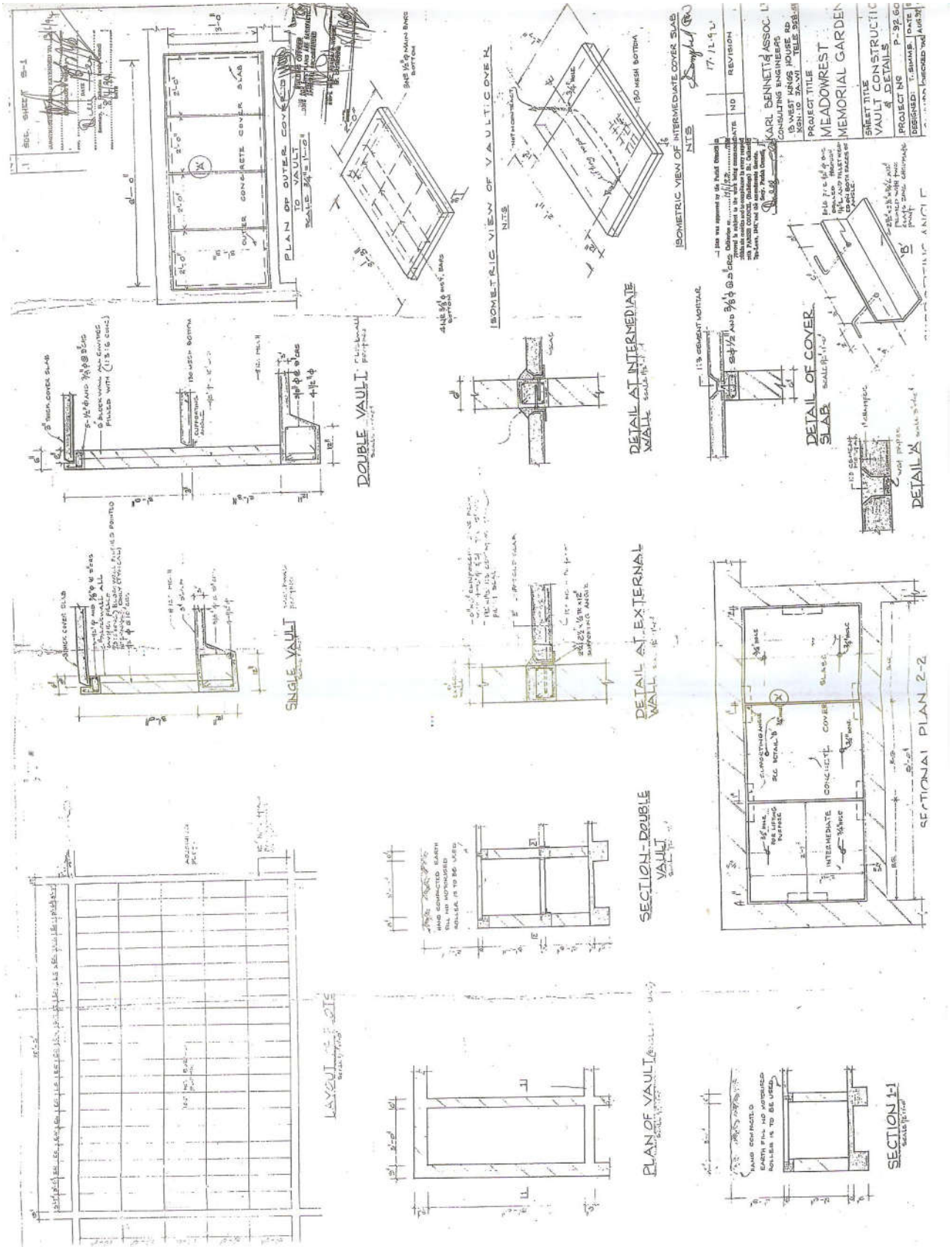



Test Pit 5
0
2
3
4
5
5'4'
Dark Reddish Brown
Clayey Silt
Percolation Rate 23min/inch


Test Pit 6
0
1
2
3
3'10'
Dark Reddish Brown Clayey
Silt
Hard Limestone
Percolation Rate 30min/inch



LOCATION OF TEST PITS



VAULT DESIGN

IMAGES FROM THE MEADOWREST MEMORIAL GARDENS 2014-2015

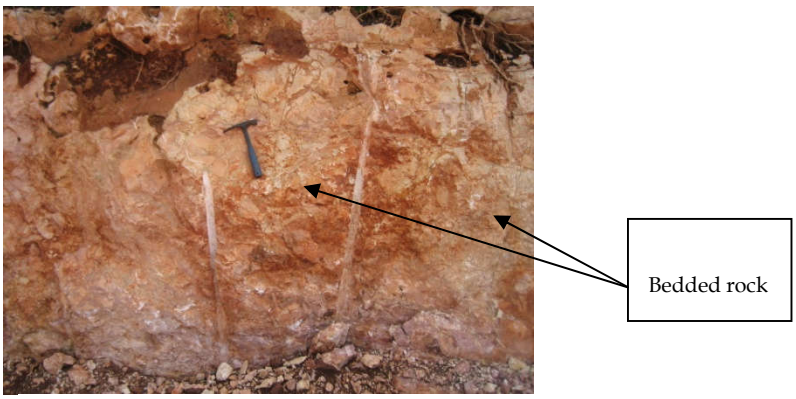
Excavated limestone to create burial plots at Meadowrest Memorial Gardens

Terracing for burial sites created on sloping ground

Drainage infrastructure

Elongated limestone hill (background) towards the south eastern end of the site

Flat to gentle sloping land with trees and scrubland vegetation



Limestone showing bedded structures

Browns Town Limestone- partly recrystallised

Reddish brown lateritic silty clay soil derived from limestone weathering

Measurement taken to determine fall in water level in test pit

Buttress wall to protect the lower terrace of burial site

Earth stockpiled forming a buffer/screen

Disturbed natural vegetation on the property

Residences in Green Acres overlooking the MMG cemetery

TERMS OF REFERENCE

FOR AN

ENVIRONMENTAL IMPACT ASSESSMENT

FOR A
PROPOSED CEMETERY DEVELOPMENT

AT
Part of Whittaker's Mountain, Spanish Town, St. Catherine

BY
MEADOWREST MEMORIAL GARDENS

FINAL DRAFT

1. BACKGROUND

Meadowrest Memorial Gardens (The United Church Corporation) Cemetery has applied to the Agency for the expansion of an existing cemetery development at Part of Whittaker's Mountain, Spanish Town, St. Catherine.

Further to a field inspection conducted by the National Environment and Planning Agency (NEPA), it was determined that given the nature and scope of the proposed development, the existing vegetation cover, the expected loss of biodiversity and the potential negative environmental impacts, an Environmental Impact Assessment (EIA) will be required to support any decision regarding the proposed development.

The purpose of this document is therefore to establish the Terms of Reference (TOR) for the EIA.

The EIA report will be produced in accordance with this TOR as approved by NEPA.

The Terms of Reference to conduct the Environmental Impact Assessment are as follows:

2. EXECUTIVE SUMMARY

A brief statement on the content of the EIA report. Include relevant background information, the main findings, analyses and conclusions in the report.

3. INTRODUCTION

Gives the context of the project and the EIA, the delineation and justification of the boundary of the study area, general methodology, assumptions and constraints of the study.

The study area shall include at least the area within 1km radius of the boundaries of the proposed site.

4. LEGISLATION AND REGULATORY CONSIDERATION

Outline of the pertinent regulations, standards, government policies and legislation governing environmental quality, safety and health, protection of sensitive areas, protection of endangered species, siting and land use control at the national and local levels. The examination of the legislation to include at minimum, legislation such as the Natural Resources Conservation Authority Act, the Natural Resources (Permits and Licences) Regulations, the Public Health Act, the Housing Act, the Town and Country Planning Act, Building Act and Codes and Standards promulgated there under, Development Orders and Plans and all appropriate international convention/protocol/treaty where applicable. Describe traditional land use and advise of any prescriptive rights including public access rights.

5. PROJECT DESCRIPTION

Prepare a detailed description of the project. This section will provide information on the proposed project and should include:

- History and background of the project.
- A location map at a scale of 1:12,500 (or an appropriate scale).

- The total area of the site. That is, the respective areas (in square metres) of the existing cemetery and areas of the site earmarked for the proposed expansion.
- A site layout plan showing the various components and design elements of the proposed development.
- A comprehensive description of all components e.g. chapel and the various design elements of the project.
- The spatial allotments for the various design elements of the project, such as the quantum of land to be reserved for buildings, roads, burial and landscaping and the number of parking bays.
- The total number and types (single/double) of vaults proposed.
- The burial density; i.e. the number of vaults per hectare/square metres.
- The typical design proposed for the vaults.
- Expected project components and alternatives that may be considered by the developer,
- Schematic plans.
- Assessment of the impact of blasting on existing and proposed vaults.
- Proposed buffer zone for future blasting activities.
- The proposed density of the cemetery i.e. burial plots per hectare.
- Parking areas.
- Age friendly design features.
- A detailed landscape plan highlighting grading and proposed changes in topography.
- Details of proposed access(es) to the site to be used for pre-construction, construction and operational phases.
- Details on infrastructure development including design plans for all components of the development including the proposed wastewater/sewage treatment system and disposal of treated effluent must be clearly outlined.
- A comprehensive drainage assessment. This assessment should take into consideration existing natural drainage channels, proposed man-made drainage/water features or any proposed changes in topography. Potential issues of increased surface runoff and sediment loading must also be addressed. Special emphasis should also be placed on the storm water run-off, drainage patterns, characteristics of the aquifer, including the level and status of the groundwater.
- In addition plans for providing utilities, particularly details relating to the source of potable water and electricity generation, roads and other services should be clearly stated.
- A Waste Management Plan which clearly outlines expected quantities of construction waste during the construction phase, general waste arising from material consumption of the workforce, as well as, all expected waste during the operational phase should be completed. Details should also be provided for any central disposal area(s) being considered to serve the proposed development.
- Details of equipment and machinery to be involved, how these will be mobilized and areas to be used for storage of machinery and material should be clearly indicated.
- Details of workforce, including proposals for mobilization and accommodation should be indicated.
- All phases of the project should be clearly defined, the relevant time schedules provided and phased maps, diagrams and appropriate visual aids included in the Environmental Impact Assessment report.
- The study area should be clearly delineated and referenced. Taking into account the types of resources located in the area and the magnitude of the associated impacts, the study area should be large enough to include all valued resources that might be significantly affected by the project.

6. DESCRIPTION OF THE ENVIRONMENT

A natural resources survey of the proposed development site should be conducted for both the wet and dry seasons. This information will form the basis upon which impacts of the project will be assessed.

The following aspects should be described in this section:

6.1 PHYSICAL ENVIRONMENT

- **Topography, soils, climate, drainage, geology** (including but not limited to seismicity and faults), geomorphology of the site and hazard vulnerability including impacts on current landscape, aesthetic appeal and hydrology should be examined. Special emphasis should be placed on storm water runoff, drainage patterns. Percolation tests should also be conducted within the proposed study area.
- **Water quality** for wells in the vicinity of the development. Quality Indicators should include but not be limited to Nitrate, Phosphate, Faecal Coliform, and Total Suspended Solids.
- **Climatic conditions and air quality** in the area of influence including particulates
- Noise levels of undeveloped site and the ambient noise in the area of influence.
- Sources of pollution existing and extent of contamination.
- Availability of solid waste management facilities.

6.2 CARRYING CAPACITY

- The ecological carrying capacity of the site should be assessed.

6.3 NATURAL HAZARDS

- Hurricanes, Earthquakes
- Landslides, Flooding
- Natural hazard risk assessment should take in account climate change projections.

6.4 BIOLOGICAL ENVIRONMENT

Description of terrestrial habitats, flora and fauna surveys inclusive of a species list; commentary on the ecological health, function and value in the project area, threats and conservation significance.

This should include:

- A detailed qualitative and quantitative assessment of terrestrial habitats in and around the proposed project sites and the areas of impact. This must also include flora and fauna surveys and should include species lists. Special emphasis should be placed on rare, endemic, protected or endangered species. Migratory species should also be considered. There may be the need to incorporate micro-organisms to obtain an accurate baseline assessment. Generally, species dependence, habitats/niche specificity, community structure and diversity ought to be considered. An assessment of nocturnal species, including but not limited to bats, should be undertaken.

The field data collected should include, but not be limited to:

- Vegetation profile
- Species lists must be provided for each community
- A habitat map of the area

6.5 HERITAGE

Loss of and damage to artifacts, archaeological, geological and paleontological features.

7. SOCIO-ECONOMIC ENVIRONMENT

Demography, regional setting, location assessment and current and potential land-use patterns (of neighbouring properties); description of existing infrastructure such as transportation, electricity, water and telecommunications, and public health safety; cultural peculiarities, aspirations and attitudes should be explored; and other material assets of the area should also be examined. A socio-economic survey to determine public perception of the project should also be complete and this should include but not be limited to potential impacts on social, aesthetic and historical/ cultural values.

8. PUBLIC PARTICIPATION

Describe the public participation methods, timing, type of information provided and collected from public and stakeholder target groups meetings. The instrument used to collect the information must be included in the appendix. Sampling methodology employed should be appropriate for the population size and distribution and must be weighted towards the communities in closest proximity to the proposed development. Stakeholder meetings should also be held to inform the public of the proposed development and the possible impacts, and will also gauge the feeling/response of the public toward the development.

The issues identified during the public participation process should be summarized and public input that has been incorporated or addressed in the EIA should be outlined.

Public Meetings should be held in accordance with the Guidelines for Conducting Public Presentation at a time and location signed off by the National Environment and Planning Agency (NEPA). A public meeting will be held to present the findings of the EIA once the EIA is completed and submitted for consideration. All relevant documents are required to be made available to the public. In addition, any material change to the design of the project will require a further public meeting to be undertaken by the developer and all changes made to the document should be clearly outlined to the public.

9. IMPACT IDENTIFICATION

A detailed analysis of the project components should be done in order to: identify the major potential environmental and public health impacts of the project; distinguish between significant positive and negative impacts, reversible or irreversible direct and indirect, long term and immediate impacts and identify avoidable as well as irreversible impacts.

Cumulative impacts should also be evaluated taking into account previous developments and any proposed development immediately adjacent to the subject development within the area. The identified impacts should be profiled to assess the magnitude of the impacts. The extent and quality of the available data should be characterized, explaining significant information deficiencies and any uncertainties associated with the predictions of impacts. A major environmental issue is determined after examining the impact (positive and negative) on the environment and having the negative impact significantly outweigh the positive. It is also determined by the number and magnitude of mitigation strategies which need to be employed to reduce the risk(s) introduced to the environment. Project activities and impacts should then be ranked as major, moderate and minor and presented in separate matrices for all the phases of the project (i.e. preconstruction, construction and occupation and operational).

The impacts to be assessed will include but not be limited to the following:

9.1 PHYSICAL

- Impacts of construction activities such as site clearance, earthworks and spoil disposal.
- Impacts of accidental oil and chemical spills
- Impacts on Air Quality
- Impacts on Water Quality (pollution of potable, surface and ground water
- Demands/requirements of the following must be quantified
  - Water Supply
  - Drainage
  - Sewage Disposal - Empirical data must be provided to show that the sewage treatment facility has the capacity to remove the nutrients to meet the National Sewage Effluent Standards;
  - Wastewater Disposal
  - Trade Effluent Discharges
  - Solid Waste Disposal
  - Electrical Power(fossil fuels, wind, sun)
  - Communications and other utility requirements
  - Transport Systems and supporting infrastructure required including all internal roadways and drainage infrastructure proposed to serve the development.
- Operation and maintenance – waste disposal, site drainage, sewage treatment and disposal solution, and air quality;
- Impacts on visual aesthetics and landscape
- Noise
- Change in drainage pattern
- Carrying capacity of the proposed site

9.2 NATURAL HAZARD

Impact of Natural Hazards: Hurricanes, Earthquakes, Flooding and Landslide potential

9.3 BIOLOGICAL

Direct and indirect impact on ecology and on the terrestrial habitats. Emphasis should be placed on any rare, endangered, and endemic species found. This should include habitat loss and fragmentation, loss of species and natural features due to construction and operation. Impact of noise and vibration especially on terrestrial mammals and reptiles should be examined, as well as, the impact of light pollution.

9.4 HERITAGE

Loss of and damage to: artifacts, archaeological, geological and paleontological features

9.5 HUMAN/SOCIAL/CULTURAL

Effects on socio-economic status such as changes to public access & recreational use, impacts on existing and

potential economic activities, public perception, contribution of development to national economy and development of surrounding communities. Socio-economic and cultural impacts to include land use/resource effects.

9.6 PUBLIC HEALTH ISSUES OF CONCERN

The impact of the proposed development on soil and air should be examined. An assessment of existing and potential pest infestation on the existing and proposed expansion area should also be undertaken.

9.7 RISK ASSESSMENT

Analyze the risks to human health and ecosystems associated with the development from both human activities, such as, blasting, and natural phenomenon. This should include: 1) Identifying the hazards 2) Assessing the potential consequences 3) Assessing the probability of the consequences and 4) Characterizing the risk and uncertainty. The monetary costs of the risks, the costs of emergency response and/or avoidance of risks should also be considered.

10. RESIDUAL IMPACTS

Identify any residual negative impacts that potentially have no solution for mitigation.

11. ANALYSIS OF ALTERNATIVES

This should include the no action alternative and project design alternatives**.** These should be assessed according to the physical, ecological and socio-economic parameters of the site. The examination of project alternatives should incorporate the use history of the overall area in which the site is located and previous uses of the site itself. A rationale for the selection of any project alternative should be provided.

Conduct a Cost Benefit Analysis of the Project. The Cost Benefit Analysis should include the use-change as per the proposed project and the existing state and a comparison of the annual value of the lost welfare associated with impacts of the project with the net social gain from the project.

12. ENVIRONMENTAL, HEALTH, SAFETY, MANAGEMENT AND MONITORING PLAN

An environmental monitoring and management plan should be developed which will detail the requirements for construction and operational phases of the project. This should include, but not be limited to training for construction and operation staff, as well as include recommendations to ensure the implementation of mitigation measures and long term minimization of negative impacts

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

Introduction outlining the need for a monitoring programme and the relevant specific provisions of the permit license(s) granted.

- The activity being monitored and the parameters chosen to effectively carry out the exercise.
- The methodology to be employed and the frequency of monitoring.
- The sites being monitored. These may in instances, be pre-determined by the local authority and should incorporate a control site where no impact from the development is expected.
- Frequency of reporting to NEPA

The Monitoring report should also include, at minimum:

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

Energy and Conservation measures should also be outlined.

13. LIST OF REFERENCES

Documents consulted during Literature Review

14. APPENDICES

The appendices should include but not be limited to the following documents:

14.1 Reference documents
14.2 Photographs/ maps
14.3 Data Tables
14.4 Glossary of Technical Terms used
14.5 Terms of Reference
14.6 Composition of the consulting team, team that undertook the study/assessment, including name, qualification and roles of team members
14.7 Notes of Public Consultation sessions
14.8 Instruments used in community surveys

Team Leader/Project Manager:	Beverline Brown Smith, MURP, B.A (Hons), Dip- Mgmt. of the Env.
Project Design:	Michael Lorde, B.Sc, Architect (Deceased)
Physical Resources & Hazard Assessment:	Norman Harris B.Sc. M.Sc. (Engineering Geology)
Biological Resources:	Marlon Beale, M. Phil, Zoology (Deceased)
Socio-Economic Impact Assessment:	Beverline Brown Smith, MURP, B.A (Hons), Dip- of the Env. In consultation with Robert Kinlocke, PhD (Survey Specialist).
Rapid Traffic Impact Assessment:	EPN Consultants Limited

RESULTS AND SURVEY INSTRUMENT

Code	1	2	2a	3.	4.	5. I	6.	7.	8.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.
1 GA	3	1	1	1	3	1	2	Contractor	LIME	Road/Drainage	Emp. For yth, roads	1	1	1	1	3	cemetery	2	quiet, peaceful, serene
2 GA	3	2	1	1	2	1	1	Educator	UWI	Road	Drainage	2	1	1	1	3	cemetery	2	nice place, organized, clean
3 LFC	3	2	2	1	2	1	2	Shopkeeper	LFC	Road	Road	1	1	1	1	3	-	2	beautiful, clean, nice
4 (Max)	3	1	1	1	1	1	2	Groundsman	MMG	Road, water	Road	1	1	1	1	3	cemetery	2	peaceful, jobs, quiet
5 FC	1	1	1	1	1	1	1	Groundsman	MMG	Better water	good road	1	1	1	1	1	cemetery	1	good, provide jobs
6 RP	3	2	1	1	1	1	2	Cashier	KFC	Road, water	Road	1	1	1	1	3	cemetery	2	quiet, beautiful, landscaping ok.
7 FC	3	1	-	3	1	2	2	Groundsman	MMG	road	water, road, light	1	1	1	1	1	cemetery	2	peaceful, quiet, beautiful
8 FC	3	1	2	3	1	2	2	Groundsman	MMG	road	water, light	1	1	1	1	1	cemetery	2	beautiful,quiet,peaceful
9 LFC	3	1	1	1	1	1	1	Landscaper/ engineer	MMG	road	water. light	1	2	3	1	1	cemetery	2	quiet, peaceful, safe
10 Max	2	1	-	3	1	1	2	welder	St. Johns Rd.	road, light	light	1	1	1	1	1	cemetery	2	beautiful. quiet
11 FC	3	2	-	1	1	1	2	Bartender	FC	road	water	2	1	1	1	1	cemetery	2	quiet, peaceful
12 LFC	3	2	2	3	1	1	2	Hairdresser	Home	road	water	2	1	1	1	3	cemetery	2	beautiful, peaceful. Calm
13 RP	3	2	1	1	2	1	3	shopkeeper	RP	road	road	1	3	1	1	3	cemetery	2	beautiful. Quiet, peaceful
14 RP	3	2	2	2	1	1	2	shop attendant	RP	road	road	1	1	1	1	3	cemetery	2	serene
15 RP	2	1	1	2	1	1	2	Security guard	Guardsman	road/water	road	1	1	1	1	3	cemetery	2	quiet, peaceful, beautiful
16 RP	3	1	1	1	1	3	2	taxi driver	SpanisTwn/ Red Pond	road	Road	1	1	1	1	3	cemetery	2	quiet, clean, nice
17 RP	3	1	1	3	2	2	3	taxi driver	St. Johns Rd.	road	road	1	1	1	1	3	cemetery	2	quiet, peaceful, safe
18 RP	3	1	1	1	1	1	3	Gardner	GA	Road, water	Road. Drainage	1	1	1	1	3	cemetery	2	nice place, beautiful.
19 GA	3	2	2	1	1	1	2	cashier	supermarket	road	road	1	1	1	-	3	cemetery	2	Peaceful, clean
20 RP	3	1	1	1	3	3	3	cook	Old Harbour Rd	road	road	1	2	1	1	3	housing, cemetery	2	quiet, beautiful
21 FC	3	2	2	1	1	1	2	gas station atten.	St. Johns Rd.	road, drainage	road	1	1	1	-	3	cemetery	2	quiet, peaceful. Create jobs
22 GA	1	2	2	1	2	1	2	nurse	SpanisTwn Hosp.	road	road, water	2	1	3	1	3	housing,	2	
23 RP	3	1	1	1	2	1	3	farmer	Inswood	road	road	1	1	1	1	3	cemetery	2	peaceful
24 GA	3	1	1	1	3	1	2	dentist	Sp. Town	road	bushing open clean drains, bush	1	1	1	1	3	housing	2	beautiful. Peaceful, quiet
25 GA	2	1	1	2	2	1	2	engineer (civil)	Paving Co.	drainage, road	common areas	1	1	1	1	3	cemetery	2	well kept, clean, safe
26 FC	3	1	1	3	1	2	1	Groundsman	MMG	water, road	road	1	1	1	1	2	cemetery	2	beautiful, good service
27 GA	3	1	2	2	2	1	3	auditor	Scotiabank	road	fix road	2	2	1	1	3	cemetery	2	quiet, serenity,

28 GA	2		2		1	1	1		1	teacher	Eltham PS	road	emp. For yth	2	1	1	1	3	cemetery	2	heavenly lonely, quiet, serene
29 GA	3		1		2	3	1		3	Driver	Best Auto	road	Drainage	1	1	1	1	3	cemetery	2	peaceful, beautiful, quiet
30 GA	2		2		1	2	1		2	business woman	Spanish Twn.	water, road	Drainage	2	1	2	1	2	housing	2	quiet, create emp. Provide key service
31 GA	3		1		2	1		1	2	caregiver	Nursing Home	Road, water	road	1	1	1	1	3	cemetery	2	lawn, well kept, beautiful place, quiet
32 GA	2		2		1	1	1		1	business woman	St.. John's Rd.	road	employm ent	1	1	1	1	1	cemetery	2	quiet
33 GA	3		1		1	3	1		2	businessma n	Green Acres	water, road	road	1	1	1	1	3	cemetery	2	serenity
34 Max	3		1	1	2	1	1		2	mechanic	Red Pond	road, water	road	1	1	1	1	3	cemetery	2	lovely
35 Max	2		2	2	1	1		1	2	bartender	FC	Road, water	road	1	1	1	1	3	cemetery	2	quiet, nice place, jobs
36 LFC	3		1	1	1	2	1		3	driver	Tankweld	Road, water	road	1	1	1	1	3	cemetery	2	peace, beautiful, quiet
37 RP	3		2	2	2	1		1	2	hairdresser	RP	road, water	road	2	1	1	1	3	cemetery	2	quiet, clean, nice
38. RP	3		2		3	1	3		3	Hairdresser	RP	road	road, drainage	1	1	1	1	3	cemetery	2	clean, quiet, beautiful
39 RP	3		1		2	1		1	1	barber	RP	water, road	road	1	1	1	1	3	cemetery,	2	quiet peaceful.
40 RP	3		1	1	1	2		1	3	mason	RP	road	road	2	1	1	1	3	Cemetery. housing	2	Beautiful landscaping
41 RP	3		1	1	1	3	3		3	truck driver	Inswood	road, water	road, garbage collection	1	1	1	1	3	cemetery	2	clean, organized, quiet
42 RP	3		2	2	1	2	1		1	teacher	St. Johns PS.	road, water	road	1	1	1	1	3	cemetery	2	peaceful, clean, beautiful
43 RP	1		2	2	2	1		1	2	nurse aid	Spanish Twn.	road	road	2	2	1	1	3	cemetery	2	beautiful
44 RP	3		2	1	1	1	3		1	labourer	St. Cath. HS	road	road	1	1	1	1	3	cemetery	2	lovely, quiet, clean
45 LFC	3		1	1	1	1		3	3	welder	St. Johns Rd.	water, road	road	1	1	1	1	3	cemetery	2	quiet, provide jobs, beautiful.
Total 1	3	26		22	28	27	35	9	0			0	0	35	40	42	43	7	0	1	0	
Total 2	7		19	12	10	12	4	24	0			0	0	10	4	1	0	2	0	44	0	
Per cent 1	6.67	57.78		48.89	62.22	60.00	77.78	20.00	0.00			0.00	0.00	77.78	88.89	93.33	95.56	15.56	0.00	2.22	0.00	
Per cent 2	15.56	42.22		26.67	22.22	26.67	8.89	53.33	0.00			0.00	0.00	22.22	8.89	2.22	0.00	4.44	0.00	97.78	0.00	
Total 3	35	0		0	7	6	6	12	0			0	0	0	1	2	0	36	0	0	0	
Per cent 3	77.78	0.00		0.00	15.56	13.33	13.33	26.67	0.00			0.00	0.00	0.00	2.22	4.44	0.00	80.00	0.00	0.00	0.00	

Key

RP - Red Pond
LFC - Lower Frasers Content
UFC - Upper Frasers Content
GA - Green Acres
Max - Maxim

QUESTIONNAIRE

PROPOSED EXPANSION OF THE MEADOWREST MEMORIAL GARDENS CEMETERY, WHITTAKER'S MOUNTAIN, ST. CATHERINE

Interviewer _____ Location_____Date _____ 2014

Housing

1. How long have you lived here? _____
2a. Male _____ Female _____ Are you the head of your household? Yes__ No__
2. Do you a. own your home? _____b. rent? _____c. lease?_____
3. What is the size of your dwelling (no. of rooms)?- _____
4. What is the main construction material used on your house? _____
5. What is the size of your family?_____

Employment

6. What is your occupation?_____
7. Where do you work?_____
8. What is your average monthly income?_____

Social Services /Physical Infrastructure

9. List any public service/public infrastructure that needs improvement.

   _____

   _____

Community Concerns

10. What, if any, do you consider to be the most urgent community needs?_____

    _____

Meadowrest Memorial Gardens Cemetery (MMG)

11. Are you aware of plans for the expansion of MMG cemetery? Yes__ No__
12. Do you have family or friend buried at MMG? Family_____Friend _____
13. What are your views on having a cemetery/cemeteries located within your community? (e.g. environmental/ health effects) _____

    _____

14. Do you think the MMG expansion will contribute to the economy of the area? Y/N ____
15. What effect do you think it has on the value of lands in the area?

    Positive_____ Negative_____ No effect_____

16. What use/s would you recommend for the proposed expansion area ?_____

_____

17. Cemeteries tend to generate some degree of traffic congestion based on their location; do you think the cemetery affects traffic flow in the area? Yes__ No__
18. Use three words or phrases to describe the MMG cemetery.

_____

_____

14. ACTIVITIES

In order to effectively and efficiently conduct the Environmental Impact Assessment it was necessary to carry out various activities which include:

14.1 DOCUMENTATION REVIEW

All documentation pertaining to the development was reviewed. These include, the project profile, site plan, drainage plan, and plan approved plan by the St. Catherine Parish Council.

14.2 ANALYSIS OF ALTERNATIVES

Alternatives to the site location, project design and operation conditions were analyzed including the "no-action" alternative. The "no-action" alternative was assessed based on the physical, ecological and socio-economic parameters of the site. Justification was made for the selection of the chosen alternative(s). The physical, biological and sociological settings provided the framework in which to assess project alternatives.

14.3 IMPACT ASSESSMENT

The consultant carried out a detailed impact assessment of the project components (pre-construction, construction and operation stages) in order to identify the potential impacts (positive, negative and cumulative impacts) that will be associated with the project. The significance and magnitude (major, moderate and minor) of the impacts identified was evaluated through the use of a weighted matrix.

The impacts to be assessed included:

- Effects of project design and engineering;
- Effects on visual aesthetics and landscape;
- Effect of noise and vibration;
- Effects of construction activities such as site clearance and geological formation, earthworks, hurricanes, access routes, transportation networks and spoil disposal;
- Effects of operation and maintenance activities such as waste disposal, traffic management, site drainage, sediment, sewage, public access and air quality; and
- Effects on ecology including effect on terrestrial and marine habitats

Emphasis was placed on any rare, endangered, and endemic species found
Effects on socio-economic status such as changes to public access, recreational use, existing and potential agricultural activities, contribution of development to national economy and development of surrounding communities were assessed.

The physical, biological and sociological status provided the framework in which to assess the impacts of the proposed project.

14.4 IMPACT MITIGATION

Mitigation and abatement measures were developed for each potential negative impact identified. These included recommendations for the enhancement of beneficial impacts and quantify and assign financial and economic values to mitigating methods. Green building technology was examined. Strategies were included on how energy and water are conserved in relation to the development.

Findings in the EIA report reflect the headings in the body of the TOR. Fifteen hard copies and an electronic copy of the report are submitted. One copy of the document was perfect bound.

The report includes an appendix with items such as maps, site plans, the study team, drawings, and other relevant information as outlined below:-

15. OUTLINE OF A TYPICAL EIA REPORT

The report should contain an introduction explaining the need for, and context of the project. This document should have the following basic aspects included in the Table of Contents, unless specified otherwise in the Terms of Reference.

- Executive Summary
- Policy, Legal and Administrative Framework
- Description of the Existing Environment
- Description of the Proposed Project in detail
- Identification and Assessment of Potential Environmental Impacts
- Physical
- Natural Hazard Risk
- Biological
- Human/Social
- Cumulative Impacts
- Positive Impacts
- Public Involvement
- Recommended Mitigation Measures
- Identification and Analysis of Alternatives
- Environmental Management of the Project
- Environmental Quality Objectives
- Training
- Draft Outline Monitoring Programme
- List of References
- Appendices including:
    - Reference documents
    - Photographs/ maps
    - Data Tables
    - Terms of Reference
    - Composition of the consulting team
    - Notes of Public Consultation sessions