CERTIFICATION

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REPORT TITLE:
Environmental Impact Assessment Study Report for the Proposed Residential Flats at NHC Changamwe Estate on Plot No. MN/VI/2584, Changamwe, Mombasa County.
RE. No. NEMA/PR/MSA/5/2/1791

Name:…………………………………………..…………..………..
Designation:………………………………………………

Signed:…………………………………………..…………..………..Date:…………………………………

FIRM OF EXPERTS
This study report on Environmental Impacts Assessment Study has been prepared by Mazingira & Engineering Consultants Ltd: Firm of Experts, Reg No. 1743.

This report has been done with reasonable skills, care and diligence in accordance with the Environmental Management and Coordination Act, 1999 and the Environmental Impact Assessment and Audit Regulations 2003.

I the undersigned, certify that the particulars given in this report are correct to the best of my knowledge.

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Acronyms and Abbreviations

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<tr>
<td>NEMA</td>
<td>National Environmental Management Authority</td>
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<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<tr>
<td>EA</td>
<td>Environmental Audit</td>
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<td>EMCA</td>
<td>Environmental Management and Co-ordination Act, 1999</td>
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<td>EMP</td>
<td>Environmental Management Plan</td>
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<tr>
<td>EHS</td>
<td>Environmental, Health and Safety</td>
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<td>GHG</td>
<td>Greenhouse Gas</td>
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<td>GOK</td>
<td>Government of Kenya</td>
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<tr>
<td>Ha</td>
<td>Hectares</td>
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<tr>
<td>SERC</td>
<td>Standards and Enforcement Review Committee</td>
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<tr>
<td>ISO</td>
<td>International Standard Organization</td>
</tr>
<tr>
<td>ITCZ</td>
<td>Inter-Tropical Convergence Zone</td>
</tr>
<tr>
<td>Kes/Kshs</td>
<td>Kenya Shillings</td>
</tr>
<tr>
<td>km</td>
<td>Kilometres</td>
</tr>
<tr>
<td>m</td>
<td>Metres</td>
</tr>
<tr>
<td>CGM</td>
<td>County Government of Mombasa</td>
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<tr>
<td>MWSC</td>
<td>Mombasa Water and Sewerage Company</td>
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<tr>
<td>NHC</td>
<td>National Housing Corporation</td>
</tr>
<tr>
<td>CO</td>
<td>Carbon Monoxide</td>
</tr>
<tr>
<td>CO$_2$</td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>NO$_x$</td>
<td>Nitrogen oxide</td>
</tr>
<tr>
<td>PPEs</td>
<td>Personal Protective Equipments</td>
</tr>
<tr>
<td>Masl</td>
<td>Metre above sea level</td>
</tr>
<tr>
<td>WRMA</td>
<td>Water Resources Management Authority</td>
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EXECUTIVE SUMMARY

Introduction

This Environmental Impact Assessment Study Report EIAS has been prepared and submitted following review of Environmental Impact Assessment Project Report (EIA) Reference No. NEMA/PR/MSA/5/2/1791 by the National Environment Management Authority (NEMA) and subsequent approval of the terms of reference (TOR) by the authority.

The purpose of this Environmental Impact Assessment Study is to seek approval for the proposed project in accordance with section 58 (1-4) of the Environmental Management Coordination Act (EMCA 1999) and the Environmental Impact Assessment and Environmental Audit Regulations 2003.

Mazingira & Engineering Consultants Ltd is a firm of experts registered by the National Environment Management Authority (NEMA); to carry out Environmental Impact Assessments Study (EIAS), Environmental Impact Assessments (EIA) and Environmental Audits as required by Regulation 14 of the NEMA regulations and were commissioned by the proponent to prepare and submit the EIA Study Report for the proposed development.

The EIAS covered the proposed development which involves construction of residential flats on Plot No. MN/VI/2584, Changamwe, Mombasa County. The project will consist 6 three storey residential blocks comprising of 30 two bedroomed houses and eighteen three bedroomed houses all totaling to forty eight (48) residential units. The project is located within the existing NHC Changamwe Estate approximate 550m from Magongo road and neighbours Changamwe Police Station, Mombasa Municipal Council parking for heavy commercial vehicles, Petroleum Refineries ground among other several industrial and residential premises. The project site lies between longitude 04°01’9.77” South and latitude 03°37’54.0E’ East at an elevation of 64m above sea level.

Objective and methodology

The objective of the EIAS is to examine the environmental, economic, physical, and biological impacts in the areas which may be affected by the project, and to propose mitigation measures. The main sections of the EIA include definition of the legal and institutional frameworks, description of the project and the environment, impacts assessment, identification of mitigation measures, and presentation of an environmental management plan (EMP).

The study was based on a laid down scientific qualitative procedures with most recent methodologies and analysis required in EIAS and strictly adhered to relevant legislative framework governing housing sector. Our investigation examined the potential impact of the project on the immediate surroundings with due regard to all project phases from construction, operation and decommissioning.

The expert also undertook an effective consultation where issues of concern and interest to the neighbours, member of the public and stakeholders were raised, discussed and documented. The proponent's commitment to continuous consultation is important and the experts wish to acknowledge the work of the proponent and the neighbours in identifying relevant issues and responding in a constructive manner.

Legal and Institutional Framework

An overview of the key environmental, health & safety legislation and regulations relevant to each project component were taken into account during the EIA exercise. The most relevant regulations considered during the assessment are the Policy Framework, Environment Management and Coordination Act (EMCA), 1999, The Water Act 2002, Public Health Act, Physical Planning Act, 1999, Occupational Safety and Health Act, 2007, Environmental Impact Assessment and Environmental Audit Regulations, 2003, Waste Management Regulations 2006, Water Quality Regulations 2006, Conservation of Biological Diversity (BD) Regulations 2006, Fossil Fuel Emission Control Regulations 2006 and Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. Based on these regulations, a control framework has been established to guarantee that minimum standards for
water resources, air, health & safety are established as well as protection of the environmental resources potentially affected by the project is ensured.

In addition international conventions and treaties governing conservation of biodiversity and control of greenhouse gases emissions have been considered, and their relevance to each of the components assessed.

**Impact assessment and mitigation**

This study assessed the potential impact/s of the proposed development on the receiving environment (natural and social). The report evaluates issues and concerns raised by Interested & Affected Parties (I&AP) and assesses the significance of the potential impacts on the natural and social environment.

Various potential impacts in different significance are anticipated during either construction and/or operation. Possible impacts on soil, water resources, human amenity, occupational and public health hazards, traffic, noise levels, dust, exhaust emissions; waste water disposal, solid waste disposal and visual impact are anticipated if compliance standards are not met as set by the relevant authorities. However an assessment of impacts indicated that these negative impacts will not be significant as long as mitigation measures are continuously and adequately implemented.

On the other hand, positive impacts are direct beneficial and key goals in the implementation of the project.

Several environmental and socio issues and concerns were raised at the public consultation and participation baraza. However despite the residents raising some genuine environmental issues it was noted that the underlying issue was not mainly environmental concerns but issue to do with rent at the estate and the desire to be offered the chance to purchase the existing houses. This was made evident from numerous court cases relating to rental issue most of which dates back to 1990s resulting in numerous court injunctions. This was also made evident due to two main groups differing during the public baraza with one group claiming that several meeting has been conducted where main issue that arose was rent and not the environment as claimed by the other group. A court case has also been filled at the high court seeking the proponent to have an EIA licence.

**Conclusion**

The EIA report presents the findings of the assessment which include an Environmental Management Plan (EMP) and fulfils the requirements of EMCA 1999. The policy, legal and institutional framework described in this report relates to the housing sector in Kenya.

Following the assessment none of the possible impacts are regarded as having major significant impact to the extent that the intended activity cannot proceed and given that mitigations and recommendations proposed can be implemented and monitored.
1.0 INTRODUCTION

1.1 Background

The EIAS has been undertaken to fulfill the legal requirements as outlined in Sections 58-69 of the Environmental Management and Co-ordination Act (EMCA) 1999 and Part II of the Environmental (Impact Assessment and Audit) Regulations 2003.

1.2 Objective of EIAS

The specific objectives of the EIAS are to:

- Collect and analyse baseline information for physical, biological and socio-economic environments in the project area;
- Discuss the legal and regulatory issues associated with the proposed project;
- Predict and assess the potential impacts of the project;
- Propose appropriate mitigation measures for any negative impacts and enhancement measures for the positive impacts resulting from implementing the project;
- Allow for public participation in order to incorporate views of neighbours, member of public and stakeholders during project implementation;
- Prepare an Environmental Management Plan (EMP);
- Prepare an EIA “Study Report” for submission to NEMA.

1.3 Methodology of EIA

The environmental impact assessment study was based on desk studies, field assessments, discussions with the proponent, Interested & Affected Parties (I&AP). The exercise was carried out through the following key steps:

(i) Screening

This is the first step on evaluation of requirements of EIAS on the proposed project. The project is listed under the Second Schedule of EMCA 1999, as projects that should undergo Environmental Impact Assessment and NEMA has requested for an EIA “Study Report” after review of the EIA “Project Report”.

In addition the regulations require that project screening be undertaken to establish the environmental relevance of a project. The environmental relevance of a project depends on the type, location, sensitivity, and scale of the project, as well as the nature and magnitude of its potential impacts.

(ii) Scoping

The scoping exercise was undertaken to focus on the potentially significant impacts. During scoping, discussions were primarily held with the project proponent; project consultants and stakeholders, and involved clarification of the proposed project and environmental aspects that need to be considered during project implementation.

(iii) Assessment

A checklist was used as a starting point for collecting baseline information and carrying out the assessment. Results of the evaluation were then used in identifying environmental effects which are likely to be key issues in
relation to the environmental impacts and sustainability of the project. The next step involved identification of changes that are most significant and the assessment of the overall impact.

Field data collection was carried out through use of observations, photography, site visits and consultation with neighbours, stakeholders, any interested and affected parties. Visual inspections were carried out in the proposed project area to get an impression of the physical features, land use, vegetation cover, existing infrastructure and land development.

1.4 Report Structure

The scope of the study complied with legislative requirements set out in the EMCA 1999 and also conformed to the provisions of the Environmental (Impact Assessment and Audit) Regulations 2003. This report represents the findings of the EIAS and is structured as follows:

**Preface**
The executive summary which highlights the main results of the EIA

**Section 1**
Provides an introduction to the project and sets out the format and contents of the report

**Section 2**
Outlines the environmental policy, institutional and legislative framework in Kenya relevant to the proposed project. International treaties and agreements on environmental protection and conservation to which the GOK is committed are also outlined.

**Section 3**
Describes the baseline environmental conditions in the project area in sufficient detail to enable an adequate assessment of probable environmental impacts. The baseline studies were desk based, but was supported with secondary data and research.

**Section 4**
Describes the project design and proposed activities.

**Section 5**
Describes the public consultation process that was undertaken and its findings.

**Section 6**
Describes the alternative options for the project.

**Section 7**
Describes the probable environmental impacts of the proposed project. The assessment includes an evaluation of impacts associated with the construction, operation and decommissioning phases.

**Section 8**
Presents mitigation measures proposed.

**Section 9**
Presents Environmental Management Plan (EMP) for the construction, operation and decommissioning phases

**Section 10**
Presents the consultant’s conclusion and recommendations.

The following sections emphasize on the duties of the proponent and contractor during the construction phase as well as the operation phase of the project.

1.5 Duties of the Proponent

- It will be the duty of the proponent to ensure that all legal requirements as pertaining to the development are met as specified by the applicable law.

1.6 Duties of the Contractor

- Prepare and maintain an approved time and progress chart, showing clearly the period allowed for each section of the work.
- The contractor is to comply with all regulations and by-laws from various government authorities including serving of notices and paying of the fees.
During the night, public holidays and any other time when no work is being carried out onsite, the contractor shall accommodate only security personal, site office caretakers and never should a labor camp be allowed onsite.

The contractor shall make good at his own expense any damage he may cause to public and private roads and pavements in the course of carrying out his work.

The architect shall define the area of with the site, which may be occupied by the contractor for use as storage on the site.

The contractor shall provide at his own risk and cost all water required for use in connection with his works including work of subcontractors, and shall provide temporary storage tanks.

The architect shall define the area of with the site, which may be occupied by the contractor for use as storage on the site.

The contractor shall provide at his own risk and cost all water required for use in connection with his works including work of subcontractors, and shall provide temporary storage tanks.

The contractor shall make his own arrangement for sanitary conveniences for his workmen. Any arrangements so made shall be in conformity with the public health requirements for such facilities and the contractor shall be solely liable for any infringement of the requirements.

The contractor shall be responsible for all the action of the subcontractor in first instance.

The contractor shall take all possible precaution to prevent nuisance, inconvenience or injury to the neighboring properties and to the public generally, and shall use proper precaution to ensure that safety of wheeled traffic and pedestrian is maintained.

All work operations, which may produce elevated levels of noise, dust, vibration, or any other discomfort to the member of public, workers and/or persons in vicinity of the project site must be undertaken with care, with all necessary safety precautions taken.

The contractor shall take all effort to muffle the noise from his machineries, equipments and workmen to not more than 85 Decibels.

The contractor shall upon completion of the works, remove and clear away all plant, rubbish and unused materials and shall leave the whole of the site in a clean and tidy state to the satisfaction of the project architect. He shall also continuously remove from the site all rubbish produced in order to maintain the tidiness of the premises and its immediate environs.

No shrubs, trees, bushes or underground shall be removed except with the express approval of the architect.

The standard of workmanship shall not be inferior to the Building Codes and/or the Kenya Bureau of Standards where applicable. No materials for use in the permanent incorporation into the works shall be used for any temporary works or purpose other than that for which it is provided. Similarly, no material for temporary support may be used for permanent incorporation into the works.

All the materials and workmanship used in the execution of the project shall be of the best quality and description. Any material condemned by the architect shall immediately be removed from the site at the contractors cost.
2.0 POLICY, LEGAL AND REGULATORY FRAMEWORK

2.1 Policy Framework

The Kenya Government’s environmental policy aims at integrating environmental aspects into national development plans. The broad objectives of the national environmental policy include:

- Optimal use of natural land and water resources in improving the quality of human environment;
- Sustainable use of natural resources to meet the needs of the present generations, while preserving their ability to meet the needs of future generations;
- Integration of environmental conservation and economic activities into the process of sustainable development;
- Meeting national goals and international obligations by conserving bio-diversity, arresting desertification, mitigation effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.

2.1.1 National Environmental Action Plan (NEAP)

According to the Kenya National Environmental Action Plan (NEAP, 1994) the government recognized the negative impacts on ecosystems emanating from industrial, economic and social development programs that disregard environmental sustainability. Following on this, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been accomplished and/or are in the process of development. Under the NEAP process Environmental Impact Assessments were introduced targeting the industrialists, business community and local authorities.

2.1.2 National Housing Policy and Housing Needs in Kenya

In August 2003, the government of Kenya through a sessional paper spelt out a housing policy whose overall goal was to facilitate the provision of adequate shelter and healthy living environment at an affordable cost to all socio-economic groups in Kenya in order to foster sustainable human settlements. The aim is to minimize the number of citizens living in shelters that are below the habitable living conditions.

Among other things, the policy aims at facilitating increased investment by the formal and informal private sector, in the production for low and middle-income dwellers. The estimated current urban needs are 150,000 units per year, which can be achieved if the existing resources are fully utilized by the private sector with the enabling hand of the government. It is estimated that the current production of new housing in urban areas is only 20,000-30,000 units annually, giving a short fall of over 120,000 units per annum. The shortfall in housing has been met through the proliferation of squatter and informal settlements and overcrowding.

To alleviate the huge shortfall of urban housing mentioned above and to curb the mushrooming of informal settlements/slums, various interventions and strategies have to be adopted. In the policy paper, the government correctly accepts the fact that it cannot meet the housing shortfall on its own and that the best policy is to encourage the private sector to chip in while the government provides an enabling environment for development. The government will provide an enabling environment by doing the following:

- Facilitating the supply of serviced land at affordable prices in suitable locations
- Expanding and improving infrastructure facilities and services.
- Using research findings as well as innovative but cheap conventional building materials and technologies to improve production of housing units.
- Harmonizing the Banking Act, the Building Society Act, the Insurance Act and the various Acts that have so far proved to be a hindrance to the sourcing of housing finance.
- Generally easing the path of funds from the private investor/government to the development project.
- Issuing workable guidelines on estate management and maintenance.
The promotion of this development is therefore well within the government current and long term policies of ensuring housing for all by 2020. The housing policy does not address the demand for high-income housing needs, which are addressed by this report.

2.2 Legal Framework

2.2.1 Environment Management and Coordination Act (EMCA), 1999

The Environmental Management and Co-ordination Act (EMCA) 1999 is an act of parliament to provide for the establishment of an appropriate legal and institutional framework for the management of the environment and for related matters.

National Environment Management Authority is a body established under the Act. NEMA has the legal authority to exercise general supervision and co-ordination over all matters relating to the environment, and is the principal instrument of the Government charged with the implementation of all policies relating to the environment.

Part II of the EMCA 1999, states that every person is entitled to a clean and healthy environment and has the duty to safeguard the same. It is worth noting that the entitlement to a clean and healthy environment carries a correlative duty. Hence, there is not only the entitlement to a clean and healthy environment, but also the duty to ensure that the environment is not degraded in order to facilitate one’s own as well as other persons’ enjoyment of the environment.

According to section 58 of the act, an environmental impact assessment study needs to be carried out on all projects specified in the second schedule of the act that are likely to have a significant impact on the environment. This proposed project is considered to fall under the second schedule of the Act. All EIA reports are submitted together with a submission fee payable to NEMA and equivalent to 0.05% of the proposed project cost.

2.2.2 The Water Act 2002

The purpose of the Water Act is to provide for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water, to provide for the regulation and management of water supply and sewerage services. Except for waters that are wholly situated in a private landowner’s domain, the Act vests the rights over all surface and ground water in the state. This is only subject to the rights which users may acquire under license from time to time.

Part II, section 18 of the act provides for national monitoring and information systems on water resources. Following on this, sub-section 3 allows the Water Resource Management Authority to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specified information, documents, samples or materials on water resources may be kept by a water user and the information thereof furnished to the authority.

Section 94 of the act makes it an offence to through or convey or cause or permit to be thrown or conveyed, any rubbish, dirt, refuse, effluent, trade waste or other offensive or unwholesome matter or thing into or near to water resources in such a manner as to cause, or be likely to cause, pollution of the water resource.

2.2.3 Public Health Act

Part IX section 115 of the Act states that no person or institution shall cause nuisance or condition liable to be injurious or dangerous to human health.

Section 116 requires that local Authorities take all lawful necessary and reasonable practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to injuries or dangerous to human health.
2.2.4 Physical Planning Act, 1999

The said Act section 29 empowers the local Authorities to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section allows for prohibition or control of the use and development of an area.

Section 30 state that any person who carries out development without development permission will be required to restore the land to its original condition. It also states that no other licensing authority shall grant license for commercial or industrial use or occupation of any building without a development permission granted by the respective local Authority.

2.2.5 Building Code 2000

Section 194 requires that where sewer exists, the occupants of the nearby premises shall apply to the local Authority for permit to connect to the sewer line and all the wastewater must be discharged in to sewers. The code also prohibits construction of structures or building on sewer lines.

2.2.6 Occupational Safety and Health Act, 2007

This is an Act of Parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. It applies to all workplaces where any person is at work, whether temporarily or permanently. During the construction phase the works contractor must adhere to the requirements of this Act.

(i) Safety and Health committee rules of 2004

These rules state that any employer/proponent/occupier who employs more than twenty persons must establish a committee to address the health, safety and welfare of workers. The employer must also cause to be carried out a health and safety audit of all his operations on an annual basis by a registered health and safety advisor who should forward such a report to the Director of Occupational Health and Safety Services.

(ii) First Aid Rules

These have details on first aid requirements in terms of facilities and capacity building among non medical workers.

(iii) Hazardous Substances Rules

These regulate the handling, transportation and use of certain listed chemicals which may have negative effects on the body when one is exposed.

(iv) Noise Prevention and Control Rules of 2005

These rules have set minimum maximum exposure limits beyond which workers and members of the public should not be exposed to noise without adequate means of protection. The rules also have limits for exposure out of workplaces. The rules have several recommendations on a comprehensive noise control program for workplaces that includes a requirement for medical examination of workers who are exposed to noise. The rules have also set the minimum noise levels that should emanate from a facility to public/neighbouring areas by day or by night

(v) Medical Examination Rules

The rules offer a guide on the need and target of workers who have to undergo regular medical examination to identify the symptoms of hazardous exposures on the body. This is with a sole purpose of monitoring exposure for remedial action.
(vi) Building Operations and Works of Engineering Rules

The rules guide health and safety matters in all building/construction and civil engineering works.

These rules state clearly that it is the duty of the proponent to ensure health, safety and welfare of workers and authorized visitors to the site before commencement of operations, the proponent should notify the Director of Occupational Health and Safety Services of the intention so that from then on the Director advises and follows up on the necessary conditions to safeguard the health, safety and welfare of workers on site.

The rules also state that qualified and experienced persons must be appointed to act as safety supervisors by the proponent. These should supervise the enforcement of standards to achieve the objectives mentioned above.

The rules have specific sections on excavations, transport, demolitions, formwork and scaffolds, lifting and lifting equipment and other safety measures.

2.2.7 Traffic Act (Cap 403)

This is an Act of Parliament that consolidates the law relating to traffic on the roads. The act it prohibits obstruction of traffic, either by persons or facilities which are constructed in such a way as to interfere with the flow of traffic on roads or road reserves.

2.2.8 Occupier’s Liability Act Cap. 34

The act regulates the duty that an occupier of premises owes to his visitors in respect of dangers due to the state of the premises or to things done or omitted to be done on them. It requires that the occupier warn the visitors of the likelihood of dangers within his premises to enable the visitor to be reasonably safe.

2.3 Regulatory Framework

2.3.1 Environmental Impact Assessment and Environmental Audit regulations, 2003

The regulations apply to all policies, plans, programmes, projects and activities specified in Part IV, Part V and the Second Schedule of the Act.

The regulation state as follows:

4. (1) No proponent shall implement a project -

(a) Likely to have a negative environmental impact; or

(b) For which an environmental impact assessment is required under the Act or these Regulations; unless an environmental impact assessment has been concluded and approved in accordance with these Regulations.

(2) No licensing authority under any law in force in Kenya shall issue a licence for any project for which an environmental impact assessment is required under the Act unless the applicant produces to the licensing authority a licence of environmental impact assessment issued by the Authority under these Regulations.

(3) No licensing authority under any law in force in Kenya shall issue a trading, commercial or development permit or license for any micro project activity likely to have cumulative significant negative environmental impact before it ensures that a strategic environmental plan encompassing mitigation measures and approved by the Authority is in place.
2.3.2 EMCA (Waste Management) Regulations 2006

These are described in Legal Notice No. 121 of the Kenya Gazette Supplement No. 69 of September 2006. These Regulations apply to all categories of waste as provided in the Regulations. These include:

- Industrial wastes;
- Hazardous and toxic wastes;
- Pesticides and toxic substances;
- Biomedical wastes;
- Radioactive substances.

These Regulations outline requirements for handling, storing, transporting, and treatment / disposal of all waste categories as provided therein.

2.3.3 EMCA (Water Quality) Regulations 2006

These are described in Legal Notice No. 120 of the Kenya Gazette Supplement No. 68 of September 2006. These Regulations apply to drinking water, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife and water used for any other purposes. This includes the following:

- Protection of sources of water for domestic use;
- Water for industrial use and effluent discharge;
- Water for agricultural use.

These regulations outline:

- Quality standards for sources of domestic water;
- Quality monitoring for sources of domestic water;
- Standards for effluent discharge into the environment;
- Monitoring guide for discharge into the environment;
- Standards for effluent discharge into public sewers;
- Monitoring for discharge of treated effluent into the environment

2.3.4 Conservation of Biological Diversity (BD) Regulations 2006

These regulations are described in Legal Notice No. 160 of the Kenya Gazette Supplement No. 84 of December 2006. These Regulations apply to conservation of biodiversity which includes Conservation of threatened species, Inventory and monitoring of BD and protection of environmentally significant areas, access to genetic resources, benefit sharing and offences and penalties.

2.3.5 Fossil Fuel Emission Control Regulations 2006

These regulations are described in Legal Notice No. 131 of the Kenya Gazette Supplement no. 74, October 2006. The regulations include internal combustion engine emission standards, emission inspections, the power of emission inspectors, fuel catalysts, licensing to treat fuel, cost of clearing pollution and partnerships to control fossil fuel emissions. The fossil fuels considered are petrol, diesel, fuel oils and kerosene.

2.3.6 Noise and Excessive Vibration Pollution) (Control) Regulations, 2009

Section 14 (1) says, where defined work of construction, demolition, mining or quarrying is to be carried out in an area, the Authority may impose requirements on how the work is to be carried out including but not limited to requirements regarding -

(a) Machinery that may be used, and
(b) The permitted levels of noise as stipulated in the Second and Third Schedules to these Regulations.
(3) Any person carrying out construction, demolition, mining or quarrying work shall ensure that the vibration levels do not exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source.

On Permissible noise levels, section 5 say No person shall make, continue or cause to be made or continued any noise in excess of the noise levels set in the First Schedule to these Regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property.

2.4 Institutional Framework

2.4.1 Institutions under EMCA 1999

The Government established the following institutions to implement the EMCA 1999.

- National Environmental Council
- National Environmental Management Authority
- Provincial and District Environmental Committees
- Public Complaints Committee
- Standards and enforcement Committee

2.4.2 Water Resources Management Authority

The Water Resources Management Authority (WRMA) is of particular relevance to the project. Its mandate covers some sectoral issues which are applicable to environmental management, such as use of water resources, human settlement and administration of activities in the scheme.

Part III of the Water Act 2002 defines the powers and functions of WRMA which include:

- Developing principles, guidelines and procedures for the allocation of water resources;
- Monitoring the national water resources management strategy;
- Receiving and determining applications for permits for water use;
- Monitoring and enforcing conditions attached to permits for water use;
- Regulating and protecting water resources quality from adverse impacts;
- Managing and protecting water catchments.

2.5 International Conventions and Treaties

Kenya has ratified or acceded to numerous international treaties and conventions. Those that have implications on the project are described below:

Convention on Biological Diversity (CBD) 1993: The CBD adopts a broad approach to conservation. It requires Parties to the Convention to adopt national strategies, plans and programmes for, the conservation of biological diversity, and to integrate the conservation and sustainable use of biological diversity into relevant sectoral and cross-sectoral plans, programmes and policies. The proposed project is expected to conserve biodiversity, especially the rare and endangered species in the project area and its environs in compliance with the Environmental Management and Co-ordination (Conservation of Biological Diversity) Regulations, 2006.

United Nations Framework Convention on Climate Change 1992: Sets an ultimate objective of stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system. Development projects in Kenya such as the proposed
project are expected to take climate change considerations into account, to the extent possible, in their relevant social, economic and environmental policies and actions.

United Nations Convention to Combat Desertification 1994: Addresses the problem of the degradation of land by desertification and the impact of drought, particularly in arid, semi-arid and dry semi-humid areas. This convention is domesticated in EMCA 1999 via Section 46 where District Environment Committees are required to identify areas that require re-forestation or afforestation as well as to mobilise the locals to carry out these activities.
3.0 ENVIRONMENTAL BASELINE INFORMATION

3.1 Introduction

The following baseline information details the environmental, socio-economic and bio-physical characteristics of the project area.

3.2 Geographic location

The project is located within the existing NHC Changamwe Estate approximate 550m from Magongo road and neighbours Changamwe Police Station, Mombasa Municipal Council parking for heavy commercial vehicles, Petroleum Refineries ground among other several industrial and residential premises. This site lies between longitude 04°01'9.77'' South and latitude 039°37'54.0E' East at an elevation of 64m above sea level.

Changamwe is located in the mainland of Mombasa County which borders Kilifi County to the North and the Indian Ocean to the east, Kwale County to the southwest and Taita-Taveta County to the West.

Mombasa city with a population of 939,370, as per the 2009 census, is located on Mombasa Island and sprawls to the surrounding main lands. The island is separated from the mainland by two creeks: Tudor Creek and Kilindini Harbour. It is connected to the mainland to the north by the Nyali Bridge, to the south by the Likoni Ferry and to the west by the Makupa Causeway, alongside which runs the Kenya-Uganda Railway. The port serves both Kenya and countries of the interior, linking them to the Ocean. The city is served by Moi International Airport located in the northwest mainland suburb of Chaani, northwest of Changamwe area.

The city is mainly occupied by the Mijikenda and Swahili people. Other communities found are the Arabs, Akamba, Luo and Kikuyu. The major religions practiced are Islam and Christianity. Over the centuries, there have been many immigrants and traders who settled in Mombasa, particularly from the Middle East, Somalia, and the Indian sub-continent, who came mainly as traders and skilled craftsmen.

3.3 Climate

The climate and oceanographic conditions of Mombasa are similar to those of the Coast Region. They follow a monsoonal cycle driven by the north-south migration of the Inter-Tropical Convergence Zone (ITCZ). Two main seasons i.e. the North-East Monsoons (NEM) and the South-East Monsoons (SEM), occur along this coast, characterized by marked differences in physical and biological oceanographic conditions. During the NEM (October to March) winds are light allowing for water column stratification; temperatures are warmer therefore productivity is higher than during the SEM (higher zooplankton and phytoplankton abundance) and lower benthic algal biomass (Bryceson, 1982, McClanahan, 1988). The inshore currents move southwards along the coast during this time. During the SEM (April-September), conditions are opposite of the NEM with high winds, lowered temperatures, reduced phytoplankton and zooplankton abundance and higher benthic algal mass.

Transition periods of change of direction of flow of the winds occur in the months of March-April and September-October. East African Coastal currents also flow year round and are formed by the northward deflection of the Southern Equatorial Current and is accelerated during the southeast monsoon, but slowed during the northeast monsoon.
The above climatic regime favors the existence of a bimodal rainfall pattern exhibited across the main administrative regions of the Kenyan coast. In Mombasa (Project area) the rainfall range is between 72 to 678mm/month

The mean rainfall amounts recorded for the north coast area vary between 500-900mm. The south coast area records the highest amounts of rainfall of up to 1600mm. The rains occur during the inter-monsoonal period, with the long rains starting from March to June (Kusi), while the short rains occur from October to December (Kaskasi). Except for the months of January and February when there are long dry spells, many parts of the Kenyan coast receive minimal rainfall amounts throughout the year.

The diurnal temperature range is moderate with mean minimum and maximum temperatures ranging between 20°C and 33°C. Mean monthly evaporation rates range from 1650-2300mm/year in the north to 1300-2200mm/year in the south (UNEP, 1998). Relative humidity is consistently high throughout the year peaking to 90% during the wet months of the south east monsoons. There is however a marked diurnal change in humidity, particularly in Mombasa where the moisture content of the air increases from around 60-70% in the afternoon to 92-94% during the night and into the early morning (UNEP, 1998).

**Summary climatic data for Mombasa**

<table>
<thead>
<tr>
<th>Climate data for Mombasa</th>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Year</th>
</tr>
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<tbody>
<tr>
<td>Average high °C (°F)</td>
<td></td>
<td>32.0</td>
<td>32.3</td>
<td>32.6</td>
<td>31.2</td>
<td>29.3</td>
<td>28.4</td>
<td>27.7</td>
<td>27.9</td>
<td>28.8</td>
<td>29.6</td>
<td>30.6</td>
<td>31.6</td>
<td>30.17</td>
</tr>
<tr>
<td>Average low °C (°F)</td>
<td></td>
<td>23.2</td>
<td>23.6</td>
<td>24.2</td>
<td>23.9</td>
<td>23.9</td>
<td>22.7</td>
<td>21.3</td>
<td>20.4</td>
<td>20.3</td>
<td>20.8</td>
<td>22.0</td>
<td>23.1</td>
<td>22.4</td>
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<tr>
<td>Precipitation mm (inches)</td>
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<td>72</td>
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<td>92</td>
<td>75</td>
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<tr>
<td>Avg. days precipitation</td>
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<td>2</td>
<td>5</td>
<td>10</td>
<td>14</td>
<td>10</td>
<td>11</td>
<td>9</td>
<td>9</td>
<td>10</td>
<td>9</td>
<td>7</td>
<td>100</td>
</tr>
<tr>
<td>Mean sunshine hours</td>
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<td>257.1</td>
<td>269.7</td>
<td>225.0</td>
<td>204.6</td>
<td>207.0</td>
<td>210.8</td>
<td>244.9</td>
<td>246.0</td>
<td>272.8</td>
<td>264.0</td>
<td>260.4</td>
<td>2,932</td>
</tr>
</tbody>
</table>

*Source: World Meteorological Organization*

### 3.4 Topography, geology and soils

Being a coastal town, Mombasa is characterized by a flat topography. The city of Mombasa is centred on Mombasa Island, but extends to the mainland. The island is separated from the mainland by two creeks, Port Reitz in the south and Tudor Creek in the north.

The project site area is characterized by a slightly undulating terrain and is typically 64 masl and sloping towards the Ocean. The soils on much of the project site area were observed to be mainly composed of rock outcrop with patches of brown loamy soil. In general, however, the lithology of Mombasa is composed of sedimentary rocks of the Mesozoic and Cainozoic eras. The sedimentary rocks consist of a variety of sandstones, siltstones, shales and limestone.
3.5 Protected areas

Gazetted forests, kayas and marine parks constitute the protected areas in Mombasa County. The gazetted forests include a section of the Arabuko Sokoke forest and mangrove forests mainly found at Takaungu, Mombasa creek, Bamburi creek and part of the Mida creek in Uyombo, with an area of approximately 880 Ha. The kayas (sacred forests) include Chonyi, Kambe, Ribe, Jibana, Kauma and Kayafungo. The marine parks and reserves include, part of the Mombasa marine and National Reserve, Watamu-Malindi Marine National park and Reserve (coral gardens) and part of the Malindi Marine and National Reserve. The part of Arabuko Sokoke forest which falls in Mombasa constitutes 19,000 Ha out of the 37,000 Ha. The forest is situated between Mombasa creek and the Sabaki River. The forest has a very high biological diversity. It is one of the important sites for bird conservation in Kenya (Ksley and Langton). Six of the bird species listed as rare in the ICBP/IUCN Bird red data book occurs in this forest. Two of these bird species, the Sokoke Owl (Otus arena) and the clerk’s weaver (Ploceus golandi) are found nowhere else in the world except in this forest. In addition to the endemic bird species, Arabuko Sokoke is also home to other terrestrial fauna. For instance it is the only known home for the endangered Cephalophus adersi, the frog Leptopelis flavomacculatus, and two butterfly species, the Charaxes protocles and the Charaxes lasti.

3.6 Flora and Fauna

Human interference and particularly settlement have greatly modified the original floral and faunal status of the county. Several vegetation types including coastal dunes, woodlands, bush lands and savannas are encountered from the shoreline inland.

3.7 Land use

A land use classification study (UNEP/FAO/PAP/CDA, 1999) indicated that only 31.2% of the total land area in Mombasa municipality was under residential settlements. The direction of growth in human settlements being northwards, concentrated in Kisauni. Current situation shows that expansion of housing has been on the rise in areas of Likoni where there existed large tracks of under developed land. Where expansion is impossible has entailed to crowding of many people in small areas with serious social implications. The emergence of unplanned, crowded human settlements has the poorest sanitation and generally poor infrastructure facilities, resulting in a myriad of environmental problems (Gatabaki-Kamau et al., 2000).

Mombasa lacks a master plan to guide land-use planning. Development and land use activities have largely been uncontrolled leading to the proliferation of slums, informal settlements and piece meal land-use changes. For the proposed area, the patterns of land use are mixed meaning that there exist industrial, commercial enterprises alongside residential areas, undeveloped land and social institutions.

3.8 Demographic characteristics

3.8.1 Population and settlement

As it is the case with other major coastal towns, the population of Mombasa town has been on the rise mainly due to factors ranging from urban-urban and rural-urban migration. In the Kenyan Coast as a whole, population distribution in the inter-lands is mainly affected by rainfall distribution, altitude, agro-ecological zones and administrative policy through which a number of settlement schemes have been created. The coastal population
in Kenya is culturally heterogeneous. The largest indigenous ethnic group being the Mijikenda which is comprised of nine sub-tribes namely: Giriama, Digo, Rabai, Duruma, Kauma, Chonyi, Kambe, Ribe, and Jibana. Other indigenous coastal ethnic groups are: Taita, Pokomo, Bajuni, Orma, Sagala, and Swahili. Due to its socio-economic dynamics which offer great opportunities for livelihoods and leisure, the Kenyan Coast and Mombasa in particular has over the years attracted a multiplicity of ethnic and racial groups.

The county has various settlement schemes namely Jomvu Kuu, Bububu A, Shikaadabu, Vyemani, Mwembelegeza and Majaoni. Despite the efforts being made to settle people, the county still has a very large number of landless people most of who live in the city’s slums of Mishomoroni, Junda and Kisumu Ndogo in Bamburi Division and Shika Adabu and Ngomeni in Likoni district.

According to the 2009 Census Report (Source KNBS) Mombasa county population stood at 939,370 and is projected to increase to 1,241,928 by sunset of 2015. The high population increase in Mombasa County as compared to other Counties in Coastal region is attributed to the net immigration from upcountry and investor targeting the tourism industry.

**County Information**

<table>
<thead>
<tr>
<th>Area in Sq Km</th>
<th>212.48 Sq Km</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Constituencies:</td>
<td>6</td>
</tr>
<tr>
<td>No. of County Assembly Wards:</td>
<td>30</td>
</tr>
</tbody>
</table>

**Constituencies**

<table>
<thead>
<tr>
<th>Name</th>
<th>Population (2009 National Census)</th>
<th>Area (Sq. Km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changamwe</td>
<td>147,613</td>
<td>16.00</td>
</tr>
<tr>
<td>Jomvu</td>
<td>102,566</td>
<td>29.00</td>
</tr>
<tr>
<td>Kisauni</td>
<td>194,065</td>
<td>88.70</td>
</tr>
<tr>
<td>Nyali</td>
<td>185,990</td>
<td>22.88</td>
</tr>
<tr>
<td>Likoni</td>
<td>166,008</td>
<td>41.10</td>
</tr>
<tr>
<td>Mvita</td>
<td>143,128</td>
<td>14.80</td>
</tr>
</tbody>
</table>

**County Assembly Wards**

<table>
<thead>
<tr>
<th>Name</th>
<th>Population (2009 National Census)</th>
<th>Area (Sq. Km)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port Reitz</td>
<td>31,720</td>
<td>4.00</td>
<td>Part of Port Reitz Sub—Location Mombasa County</td>
</tr>
<tr>
<td>Kipevu</td>
<td>29,100</td>
<td>2.10</td>
<td>Part of Chaani Sub—Location of Mombasa County</td>
</tr>
<tr>
<td>Airport</td>
<td>31,721</td>
<td>4.00</td>
<td>Part of Port reitz Sub—Location of Mombasa County</td>
</tr>
<tr>
<td>Miritini</td>
<td>25,934</td>
<td>3.80</td>
<td>Miritini Sub—Location of Mombasa County</td>
</tr>
<tr>
<td>Chaani</td>
<td>29,138</td>
<td>2.10</td>
<td>Part of Chaani Sub—Location of Mombasa County</td>
</tr>
<tr>
<td>Total</td>
<td>147,613</td>
<td>16.00 Sq. Km</td>
<td></td>
</tr>
</tbody>
</table>

Source: Independent Electoral and Boundaries Commission (IEBC)
3.8.2 Suburbs

(i) Mombasa Island

Kizingo: Considered the prime residential area of Mombasa. The State House Mombasa, Provincial Headquarters, The Mombasa Law Courts, The Municipal Council (now County Government) are located in Kizingo. The Aga Khan Academy, Aga Khan High School, Serani Primary School, Serani High School, Santokben Nursery School, Coast Academy, Jaffery Academy, Mombasa Primary School, Loreto Convent, Mama Ngina Girls’ High School and the Government Training Institute (GTI) Mombasa are all part of Kizingo.

Kibokoni: Part of Old Town with Swahili architecture. Fort Jesus is in Baghani.

Englani: Part of Old town between Kibokoni and Makadara

Kuze: Part of Old Town with Swahili culture and architecture. Originally flourishing with Swahili people but currently becoming a more cosmopolitan neighbourhood.

Makadara: Part of Old Town consisting of a high number of descendants of Baluchi former soldiers who settled within this area before it developed into a town. The name is derived from the Arabic word Qadr-ur-Rahman meaning fate of God.

Ganjoni: Primarily a middle class residential, home of second biggest dry dock of Africa after the one in South Africa.

Tudor: Another middle class residential area with homes and shops. The Mombasa Polytechnic University College (MPUC) is situated in this neighborhood

(ii) North Coast

Nyali: Also considered a prime and up-market residential area, it is on the mainland north of the island and is linked by the New Nyali Bridge. It has numerous beach front hotels in the area known as the "North Coast". Nyali has two distinct sections - the posh Old Nyali and the upcoming New Nyali. For many residents, Nyali has now become a self-contained residential area, with two Nakumatts, a multiplex cinema, shopping malls, banks, schools and post offices. This often eliminates the need for residents to cross the bridge and to go into the congested Mombasa city centre. Nyali is home for the Nyali Cinemax complex, Mamba Village, the Nyali Golf Club, and some of the most prestigious academic institutions of the Coast Province.

Kongowea: Kongowea Location is a densely populated area with 15 villages, two sub-locations and an estimated population of 106,180 residents. Kongowea is a cosmopolitan settlement mainly inhabited by people from mainland who migrated into the city in search of employment, mainly in service and manufacturing sector. The area is adjacent to the rich suburb of Nyali which employs a portion of the village residents. They are mainly hired as cheap labour as watchmen, gardeners, masons for upcoming houses and house help. The most well known villages inside Kongowea include Kisumu Ndogo, Shauri Yako and Mnazi Mmoja, despite being located in this prime area, many residents live under extreme conditions – poor sanitation, high crime rate and lack of basic essential amenities like schools, hospitals and tap water. Kongowea is also home to one of the largest open-air markets in Eastern Africa.

Bamburi: also an outlying township (fifteen minutes drive) on the way to the town of Malindi. Bamburi is the location of Bamburi Portland Cement Company. Other notable features in the area are the Mijikenda public beach and Haller Park, a nature trail and wildlife conservatory.

Other areas include, Shanzu, Mkomani, Bombolulu, Kisauni, Mtwapa and Kilifi.

The North Coast is famous for its broad entertainment industry which attracts locals and tourists as well
(iii) South Coast

Likoni: is a lower income and lower-middle-class neighborhood connected to Mombasa Island by ferry. It is south of Mombasa Island and made up of mostly non-Swahili tribes. The ferry was the target of the Likoni Riots of 1997.

Diani Beach: a beach resort area situated over the Likoni Ferry on the south coast of Mombasa. It is located some 36 km (22 mi) south of Mombasa city on the mainland coast and is a prime resort for many local and international tourists. Diani Beach has an airport at Ukunda town to cater for tourists who fly there directly from Nairobi Wilson or any other airports and airfields in the country.

(iv) Mombasa Mainland

Magongo: is an outlying township 20 minutes driving distance northwest of Mombasa Island, situated on the Nairobi Highway. This fringe community lacks any effective electricity, water or sewer systems, with a general lack of infrastructure. Poverty, lack of sanitation, and unemployment continue to be the greatest issues for the Mikindani Township, which have ensured low health and safety standards for its residents. Poor, lower class housing is widespread, ranging from simple stone, two storey structures to mud and earth homes fitted with corrugated iron roofs. Much of the community works outside of the township, within Mombasa Island itself as there is a lack of employment and industry. There are number of small health clinics, shops, and a few public primary schools: Nazarene primary is one school, which is known in particular as being staffed by a revolving volunteer teacher base from Western, and predominately English speaking nations. This small town that serves as a link between the city and Moi International Airport. Magongo is also home to the Akamba Handicraft Cooperative.

Mikindani, a suburban area: This is an outlying township on the mainland along the Nairobi Highway. It is built in the heavy industrial sections of Changamwe and mainly accommodates the working class who either work in the industries, the town centre on the Island and the Port at Kilindini harbor.

Miritini: outlying township on the Mombasa Nairobi Highway which is first growing as a suburban area.

Changamwe: Industrial area which contains the Kipevu power generation projects, the Kenya Oil Refinery Company facility and housing estates such as Changamwe NHC Estate (project site) and is the gateway to the Moi International Airport. The area has administrative offices of the D.O and the chiefs who serve the administrative division.

Migadini and Chaani: They are two adjacent estate that are located east of Airport road and east of Kenya Port Authority. They are bordered by Port Reitz, Magongo and KPA

Port Reitz: Is a suburb on the mainland which contains a beach, oil refineries, housing estates etc. Moi International Airport and the Port Reitz District Hospital are in Port Reitz.

3.8.3 Socio-economic

The economic foundations of urban life in Mombasa are maritime commerce, large industrial and energy facilities, small workshops and tourism, fishing and mangrove harvesting. As the numbers of permanent residents and visitors continue to increase, retail trade and the service sector can also be expected to make an increasing contribution to Mombasa municipality economy. Tourism mainly depends on the rich biological diversity and the health of environment. Increasing human pressure and associated unsustainable practices pose threat to the natural resources. Degradation of coral reefs and mangrove forests, for instance, has caused reduced near shore fisheries productivity and coastal erosion. This is in turn impoverishing the socio-economic livelihoods of the local people in the affected areas (GOK, 2002).

Mombasa is a major trade centre and home to Kenya’s only large seaport, the Kilindini Harbour. Kilindini is an old Swahili term meaning “deep”. The port is so-called because the channel is naturally very deep. Kilindini
Harbor is an example of a natural geographic phenomenon called a ria, formed millions of years ago when the sea level rose and engulfed a river that was flowing from the mainland.

Mombasa is a centre of coastal tourism in Kenya. Mombasa Island itself is not a main attraction, although many people visit the Old Town and Fort Jesus. The Nyali, Bamburi, and Shanzu beaches are located north of the city. The Shelly, Tiwi, and Diani beaches are located south of Mombasa. Several luxury hotels exist on these beaches, while the less expensive hotels are located further away.

Mombasa’s northern shoreline is renowned for its vibrant 24-hour entertainment offers, including both family entertainment (water parks, cinemas, bowling, etc.), sports (water sports, mountain biking and gokarting), culinary offers (restaurants offering a wide range of specialties from Kenya, China, Japan, India, Italy, Germany and other countries) and nightlife (bars, pubs, clubs, discothèques, etc.).

Other local industries include an oil refinery with a capacity of 80,000 barrels a day, and a cement factory capable of producing over 1.1 Million tons per year. The major intercontinental undersea telecom cables reach shore next to Mombasa, connecting East Africa to the rest of the world and supporting a fast-growing call centre business in the area.

3.8.4 Poverty

The immediate cause of poverty in the Mombasa County has been attributed to landlessness, high and increasing cost of living, inaccessibility to credit facilities, lack of entrepreneurial skills, unemployment, low incomes and HIV/AIDS and discrimination at places of work. In general, poverty has led to over-use and destruction of natural resources where short-term development goals are pursued at the expense of long-term environmental sustainability. There is need to ensure that environmental concerns are integrated into development planning and that development plans lead to empowerment of local communities to engage in sustainable livelihood activities.

3.8.5 Culture

A major cultural hub in Kenya and East Africa, Mombasa’s proximity to South Asia, Zanzibar, and Nairobi as well as its large shipping and maritime industries gives it a diverse mosaic of cultures. Music is a main feature of Mombasa’s culture.

3.9 Solid waste and sewerage management

The main waste generation sources in the county are domestic, commercial ventures, hotels, markets, industries and institutions including health facilities. The types of waste that are generated can be classified as follows.

- **Mixed heavy plastics** - Soft drink bottles, detergent bottles, cooking oil/fat bottles, household plastics etc
- **Mixed light plastics** - Shopping bags, wrapping films, waste collection bags
- **Rubber** - Old tires, shoe soles etc.
- **Mixed paper** - Books, office paper, newspapers carton pieces etc
- **Metals** - Pieces and sheets of aluminium, steel and other metals
- **Mixed glass** - Colored and non-colored, broken or whole glass bottles, panes, household glass items etc.
- **Organics** - Food remnants, wooden debris, yard waste etc.
- **Biomedical waste** - Waste from hospitals, dispensaries and medical clinics.
All types of waste are transported to the dumpsite including hazardous types containing pesticides, heavy metals, oils, batteries, acids, domestic and hospital wastes. The private sector has initiated ways to address the problem of waste management through construction of compost pits in areas where collection is limited and providing waste disposal services to complement those provided by the Municipal council.

Less than 300,000 of Mombasa’s one million residents have access to sewerage services, according to the Coast Water Services Board’s (CWSB) report of 2012. The report says that households in Mombasa generate about 337 million litres of waste a day but the town faces a major challenge in disposal as only residents of Changamwe mainland west have access to the service. Mombasa has two sewerage treatment plants of Kizingo and Kipevu, but it’s the later that is fully functional after undergoing rehabilitation at Sh297 million.

Reports indicate that the town has been facing serious sewage disposal challenges, with majority of island’s population having no access to sewerage services because the Kizingo treatment plant collapsed 20 years ago. About Sh300 million is required for the rehabilitation of the plant. Due to lack of a functional sewerage system on the island, some residents empty effluent into the Indian Ocean. The only functional sewage treatment plant at Kipevu serves residents of Changamwe, Port Reitz, Magongo and Jomvu.

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### 3.10 Public amenities and infrastructure

#### 3.10.1 Water supply

Mombasa is generally water scarce both in terms of surface and ground water and largely depends on piped water from the Mzima springs and Baricho water. The only permanent river is the Sabaki River which feeds the Baricho water works and crosses the northern part of Mombasa. The others are temporary due to few catchment areas, sandy soils which have high infiltration rates and high evapo-transpiration rates. Ground water resources are exploited along the coastline through shallow wells and bore holes which however diminish as one move inland. This is because inland boreholes have to be deep and in most cases the water quality is poor; hard, mineralized and saline.

#### 3.10.2 Telecommunications

The site being in a residential, commercial and industrial area is served by all types of telecommunication facilities such as majority of mobile networks and fixed landlines.

#### 3.10.3 Energy supply

The main source of energy supply in the area is electricity from the Kenya Power and Lighting Company. Additionally some premises back up the supply with diesel powered generators. A number of premises have also ventured into harnessing solar energy by use of solar panels and accumulators. Wind energy has also been sparsely used especially in pumping water from boreholes in the remote parts of the county. In the rural areas, main energy sources are fuel wood, charcoal and paraffin.

#### 3.10.4 Transport

**(v) Air**

Moi International Airport serves the city of Mombasa. It is located in Port Reitz area, also known locally as Chaani area on the mainland metropolitan area. Flights to Nairobi and other Kenyan, European and Middle Eastern destinations depart from the airport. Besides Mombasa and Nairobi is well connected by chartered flights operated via Wilson airport.
(vi) **Train**

Mombasa has a railway station and Kenya Railways runs overnight passenger trains from Mombasa to Nairobi, though the service is less extensive than it used to be.

(vii) **Road**

Driving in Mombasa is straightforward and the majority of the roads are tarmacked. Main roads include; Jomo Kenyatta Avenue, Digo Road, Nyerere Road, Nkurumah Road, Moi Avenue, Mama Ngina Drive, Barack Obama Road, Nairobi Highway and Nyali Road. Highways connect Mombasa to Nairobi, Dar es Salaam while northward road link to Malindi and Lamu, which also extends towards the border with Somalia.

The existing road networks within the county are greatly influenced by existence of important industrial, tourism, commercial centres, institutions and residential areas. The proposed development area has a good road network and adequate transport linkages with Magongo road about 550m from the site. The road connects the project area to Mombasa Island, Moi International AirPort among other area.

(viii) **Matatu**

Within Mombasa, most local people use Matatus (mini-buses) which are extremely common in Kenya, to move around the city and its suburbs.

(ix) **Tuk-Tuk**

A Tuk-Tuk is an auto rickshaw, a motor vehicle with three wheels. Being fairly cheap than Matatus, it is widely used by people as a transport to move around the city and its suburbs.

(x) **Boda-boda**

A boda-boda is originally a bicycle taxi. Especially in cities, the bicycles are more and more replaced by motorbikes.

(xi) **Sea**

Mombasa’s port is the largest in Kenya, with 17 deep water berths and two oil terminals. Rail connects the port to the interior. There is little or no scheduled passenger service. International cruise ships frequent the port often.

(xii) **Ferry**

There is no bridge between Mombasa Island and south coast; instead the distance is served by ferries operated by the Kenya Ferry Service from Kilindini and Mtongwe to Likoni in the south coast of Mombasa. In 1994, a ferry serving Mtongwe route sank, 270+ people perished.

As a result of the major developments of more luxurious hotels in South Coast and a lack of a direct bridge linking the South Coast to the North Coast, visiting tourists have the option of flying directly into the South Coast airstrip using the domestic airlines.
4.0 PROJECT DESCRIPTION

4.1 Background

The National Housing Corporation (NHC) is a statutory body established by an Act of Parliament Cap. 117 as was amended in 1967. The primary mandate of NHC is to play a principal role in the implementation of the Government’s Housing Policies and Programmes. The Corporation Board of Directors consisting of the Principal Secretaries in the Ministry of Housing, Land and Urban Development and Ministry of National Treasury. It also includes 5 other persons appointed by Cabinet Secretary from the private sector.

The National Housing Corporation (NHC) has its origins in 1953 when the Colonial Government of Kenya created a Central Housing Board through the Housing Ordinance. The Board was the principal medium through which the colonial Government could promote the development of houses for Africans. In 1959, the Board’s activities were extended beyond the promotion of African housing in order to cater for Europeans and Asians. In 1965, the Board decided to undertake direct construction of dwelling in areas where Local Authorities were unable or unwilling to do so. In the same year through an amendment of Housing Ordinance of 1953, National Housing Corporation (NHC) was established thereby replacing the Central Housing Board. The Corporation was mandated to continue the functions of the Board, with wider powers to promote low-cost houses, stimulate the building industry and encourage and assist housing research.

The NHC became the Government’s main agency through which public funds for low cost housing would be channelled to Local Authorities, and for providing the technical assistance needed by those authorities in the design and implementation of their housing schemes. The Corporation has assisted Wananchi and Local Authorities in building decent affordable houses through its various schemes such as Tenant Purchase, Outright Sale, Rural and Peri-Urban Housing Loans and Rental Housing.

4.2 Project location

The project is located within the existing NHC Changamwe Estate approximate 550m from Magongo road and neighbours Changamwe Police Station, Mombasa Municipal Council parking for heavy commercial vehicles, Kenya Petroleum Refineries ground. This site lies between longitude 04°01’9.77” South and latitude 039° 37’54.0E’ East at an elevation of 64masl. The area is served with good infrastructure developments including good road network, electricity supply, water supply and sewer line and drainage system. Also in proximity of the project site are; Changamwe Police Station, Changamwe Post Office, Al Riyadh Medical Clinic, Saint Valeria Medical Clinic, Magongo Primary School, St Charles Lwanga Secondary School, Brightons Academy Primary School, Gome Primary School, Changamwe Secondary School and Migadini Complex High School. Religious institutions include St Marys Catholic Church, Noor Mosque, Changamwe Methodist Church and Emmanuel Anglican Church of Kenya.

4.3 Project justification

Suitable, affordable shelter and housing is a basic human need and basic requirement. A homeless or unsettled person cannot work, function properly or even contribute to the well-being of the society. They become a burden on society and in essence a refugee in their own country.

National Housing Policy aims on increasing the number of low cost housing so as to achieve the Government’s objective on housing which encourages home ownership and improvement of quality of life in existing and proposed settlements.
In order to promote this basic need the proponent has envisages an environmentally sound development that will assist in the remedy of the shortfall in housing within Mombasa City. Economically, the opportunities for employment will arise for contractors, construction workers, business opportunities for suppliers of construction equipments and materials and players in the real estate market.

The project is also justified on the backdrop of Kenya’s long term development goals, vision 2030, that encourages initiative aimed at stimulating economic growth in both the public and private sectors.

4.4 Project design

The project will consist development of 6 three storey residential blocks comprising of 30 two bed roomed houses and eighteen three bed roomed houses all totaling to forty eight (48) residential units.

Basically, the buildings structures will consist of concrete appropriately reinforced with metal (steel and iron). The roof will consist of pitched roof with roofing tiles on GCI roofing sheets with structural timber members. The buildings will be provided with a well-designed concrete staircase and plaster and wall paint finish. The buildings will have a bush hammered quarry stone exterior finishing.

There will be adequate provision for safety measures within the buildings including facilities such as water and carbon dioxide fire extinguishers. The buildings will have adequate natural ventilation through provision of permanent vents in all habitable rooms, adequate natural and artificial light, piped water stored in water tanks.

4.5 Project infrastructure

4.5.1 Roads and accessibility

The project is accessible via a tarmac road connecting Magongo Road about 550m from the site. The new development will have paved parking and drive ways, associated drainage and civil works. The driveway and the parking area will be paved with cabro blocks. The car parks will be well demarcated spacious and provided with lights. The parking areas will be inclined to a degree that does not allow stagnation of water and thus linked to storm water drainage system.

The access roads to the new buildings will follow the existing road layout as closely as possible, compatible with design standard requirements. New drainage structures will be constructed while junctions and access will be developed in line with building access, safety and capacity requirements.

4.5.2 Water supply

The site will be connected to MWSC water mains which will be used during construction and operation phases. After completion there will be several overhead water tanks in the buildings attics to serve the premise during low water pressure periods.

4.5.3 Energy resources

The site will be connected to the KPLC electricity mains and will be used in all phases of the project. Necessary guidelines and precautionary measures relating to the use of electricity shall be adhered to.
4.5.4 Waste disposal

(i) Solid Waste Disposal

The collection and disposal of solid waste will be contracted to the CGM or licensed waste company. The proponent will provide facilities for handling solid waste generated within the new buildings which will include a refuse storage chambers for temporarily holding waste before final collection and disposal by CGM or a license waste company.

(ii) Sewage

The new buildings will be connected to the MWSC sewer line for disposal of sewerage through connection to the existing main truck sewer serving the estate.

4.5.5 Drainage

Storm water from the new buildings will be discharged through down pipes into the existing storm water drainage channels. There will be storm water drains running along the buildings to which all other storm water galleys will link and thus enable proper collection. Drainage pipes will be of PVC type and will be laid under buildings and driveway encased in concrete. There shall be soil water pipes (SVP) provided at the heads of all drainage systems. All drains passing beneath buildings and driveways will be encased in 150mm concrete surround.

The driveway to the building will be equipped with culverts and drains that will ensure provision of proper drainage, decreased flooding, proper channeling of surface run off thus longevity of the roads. The culverts will consist cross and access culverts with concrete surroundings and headwalls.

4.5.6 Landscaping and open space

Planting of indigenous trees that thrive in the local environment will be encouraged to soften the visual impact making the buildings as visually recessive and unobtrusive as possible. This will be in addition to preservation of any trees that are marked for preservation.

4.6 Construction Activities

4.6.1 Excavation works

Most of excavations have already been done, however some excavation will have to be carried out to prepare the site for construction of pavements and drainage systems.

4.6.2 Sourcing and transportation of building materials

Building materials will be transported to the project site from their extraction, manufacture, or storage sites using transport trucks. The building materials to be used in construction will be sourced from Mombasa and neighbouring areas. Greater emphasis will be laid on procurement of building materials from within the local area, which will make both economic and environmental sense as it will reduce negative impacts of transportation of the materials to the project site through reduced distance of travel by the materials transport vehicles.

4.6.3 Storage of materials

Building materials such as rough stones, ballast, sand and steel will be carefully piled on site. To avoid piling large quantities of materials on site, the contractor will order bulky materials such as sand, gravel and stones in bits. Materials such as cement, paints and glasses among others will be stored in temporary storage structures, which will be constructed within the project site for this purpose.
4.6.4 Masonry, concrete work and related activities

Construction of the buildings walls, foundations, floors, pavements, drainage systems among other facilities will involve a lot of masonry work and related activities. General masonry and related activities will include stone shaping, concrete mixing, plastering, slab construction, construction of foundations, and erection of building walls and curing of fresh concrete surfaces. These activities are known to be labour intensive and will supplement by machinery such as concrete mixers.

4.6.5 Structural steel and roofing works

The buildings will be reinforced with structural steel for stability. Structural steel works will involve steel cutting, welding and erection. Roofing activities will include raising and fastening the roofing materials.

4.6.6 Electrical work

Electrical work during construction of the project will include installation of electrical gadgets and appliances including electrical cables, lighting apparatus, sockets etc. In addition, there will be other activities involving the use of electricity such as welding and metal cutting.

4.6.7 Plumbing

Installation of pipe-work for water distribution will be carried out within the building. In addition, pipe-work will be done to connect sewage from the buildings to the sewer line system, and for drainage of storm water from the rooftop into the storm water drainage system. Plumbing activities will include metal and plastic cutting, the use of adhesives, metal grinding and wall drilling among others.

4.6.8 Landscaping

To improve the aesthetic value or visual quality of the site once construction ceases, the proponent will carry out landscaping. This will include establishment of flower gardens and planting trees. It is noteworthy that the proponent will use plant species that are available locally preferably indigenous ones for landscaping.

4.7 Operation Activities

4.7.1 Solid waste and waste water management

The proponent will provide facilities for handling solid waste generated within the new buildings. These will include refuse storage chambers for temporarily holding waste before final collection and disposal by CGM. Sewage generated from the premise will be discharged into MWSC sewer line, while storm water from the project area will be channeled into the existing storm water drainage system. The buildings will also be cleaned regularly by individual tenants and will involve use of substantial amounts of water.

4.7.2 General repairs and maintenance

The buildings will be maintained regularly during the operation and will include activities such as repair of buildings walls and floors, repairs and maintenance of electrical gadgets and equipments, repairs of leaking water pipes, painting, and maintenance of flower gardens and grass lawns among others.
5.0 PUBLIC CONSULTATION

5.1 Public Participation Process

Public consultation is an integral part of the EIA process as it ensures that views (on the proposed development) of the local community, affected/interested parties and stakeholders are taken into account. The public consultation for this project was done through a public and stakeholders meeting/baraza on 18th April 2013 outside the NHC offices at Changamwe. Most of residents present mainly came from within the NHC Changamwe Estate (project site). Other presents included, County Assembly Representatives in Mombasa County, Chief Changamwe, Representative of Municipal Council of Mombasa, CDE – NEMA (Mombasa) among others.

5.2 Objectives of Public Consultation

The objectives of public consultations for an EIA exercise are to ensure that:

- All stakeholders and interested parties, are fully informed of the proposed project and have the opportunity to raise their concerns;
- Any genuine issues resulting from this process are addressed in the EIA and incorporated into the implementation of the project.
- Consultation is done on sensitive issues and mitigation measures are established for management of any impacts that may arise during construction and operation phases of the project.

5.3 Legal Requirements

5.3.1 EIA and Audit Regulations

Section 17 of the Environmental (Impact Assessment and Audit) Regulations 2003 states that an EIA should "seek the views of persons who may be affected by the project."

Wider public consultation will be done through advertisements in the print media as required by NEMA

5.4 Analysis of the public consultation

5.4.1 Issues and concerns raised

Issues and concerns raised at the public and stakeholder baraza mainly touched on environmental and social aspects.

The issues raised included the following:

- There will be lack of open spaces for play grounds, fire assembly points,
- The existing facilities and utilities such as sewer line, drainage and water supply may not accommodate the new development.
- The residents within the estate feared that intentions of the proponent is to demolish all existing old houses and put up new ones, thereby evacuating all the current tenants and replacing them with new...
tenants once the new houses are complete. The residents needed an assurance that their houses would not be demolished.

→ Some residents claimed that the construction was illegal mainly because it did not have approved building plans, and that the ones obtained were forged.
→ That the current spaces that were left during construction of the current houses were left intentionally with specific reasons; the newly proposed buildings would eat-up to these spaces.
→ The current houses have big windows, specific doors and spaces for emergency reasons something that the proposed building would not provide.
→ Some residents claimed that the contractors were not professional.
→ Some residents claimed that the rent fees were not uniform to all houses.
→ That the existing buildings has asbestos roof which pose a health risk to the residents (this was experienced in 2003 where the Public Health had ordered National Housing to remove all asbestos roofing).
→ The contractor had deposited excavated soils near the residents houses and this posed health hazards from the dust.
→ The contractor had done major excavations which could act as bleeding ground for mosquitoes.
→ There is increased noise pollution and de-vegetation.

5.4.2 Conclusion of public consultation

The overall conclusion from the interviews and analysis of the public and stake holder consultation led to determination of the following:

- The proposed project is likely to generate some environmental impacts which include dust generation, construction waste, noise and blockage of drains among other environmental issues raised by the residents. However all these impacts are synonymous with most if not all housing development hence the most important aspect is mitigation measures on these impacts.
- Despite the residents raising genuine environmental issues it was noted that the underlying issue was not mainly the environmental concerns but issue to do with rent at the estate. This was made evident from numerous court cases most of which dates back to 1990s resulting in numerous court injunctions. This was also made evident due to two main groups differing during the public baraza where one Mr. Chege who is the Chairman of a separate welfare association said that the allegations that residents were not consulted before construction started was not true, he recalled that they organized the meeting and all these issues of drainage were raised. He recalled that one Mr. Dominic Miguna and Kutwa were actually selected to inspect the drainage and that it was ridiculous for them to claim they were not aware of the project. He confirmed that during the meeting, the main issue that arose was rent and not the environment issues as they claimed later.
- Assessment of the site indicated that the project site had a lot of open spaces and adequate parking areas especially outside the tenants’ houses and that the proposed development would not affect this.
- No existing buildings have been earmarked for demolition to pave way for this proposed project as feared by some of the residents. The proponent intends to use areas left for future development.
- Asbestos poses a health risk and the proponent will have to budget for replacement of the asbestos roof. This however will have to be done through proper procedures as the tenants will have to move out of houses to pave way for asbestos stripping. Asbestos materials are considered cacogenic hence the proponent will have to conduct an EIA and have a license to commencing with replacement of the roof.
- Contrary to accusation by some residents that the buildings plans were not approved and ones produced were forged, it was established that the buildings plans were genuine. This was clarified by Nixon Kilokumi of Environment Department at Mombasa Municipal Council who was present at the meeting. He indicted that the plans were properly approved and it was misleading for some residents to indicate otherwise.
- Inspection of public amenities such as sewer system, water supply, electricity, roads and drainage indicated that they have capacities to support the proposed development.
- Consultation with the proponent indicated that the tenants main concern is the desire to be offered the chance to purchase the existing houses and the fear that the new houses will be let at higher rate.
- Local residents should be given priority for jobs created during construction and operation of the project.
6.0 ANALYSIS OF ALTERNATIVES

In order to enable the proposed project to seek different ways of minimizing its impacts on the environment and at the same time achieve its objectives several alternatives were assessed.

6.1 The Zero Option

The “zero option” represents a situation which would result if the project was not implemented. In this case, both the positive and negative impacts of construction and operation the project would not occur. This option will however, involve several losses both to the landowner and the country as a whole. The landowner continues to pay rent on the land while the property remains underutilized. The major impact of not proceeding would be the loss of expected benefits. These include:

- Lack of housing units.
- The economic status of the proponent and Kenyans would remain unchanged.
- The local skills would remain under utilized.
- No employment opportunities will be created

From the analysis above, it is apparent that the No Project alternative is no alternative to the investor, Kenyans, and the government of Kenya.

6.2 Alternative land use/site

Relocation option to a different site was assessed. It this case the proponent will have to look for another land to implement the project. However due to scarcity and high cost of acquiring land in the area, the option may not be viable. In addition the project site will continue to remain under utilized and this will lead to a situation like No Project Alternative option.

Based on the existing condition of the project site, development into other uses appears inadequate especially considering the site already exists as residential developments. Moreover increase in demand for housing in the area is a clear indication that the proposed site would be most beneficial to the community. In consideration of the above concerns and assessment of the current proposed site, relocation and alternative land use is not a viable option.

6.3 Alternative construction materials and technology

Alternative building technologies available include use of conventional brick and mortar style, prefabricated concrete panels, or even temporarily structures. Due to cost and durability, the natural stones and mortar style is the most popular more so in Kenya. The scale and extent of the project is determined by design, the plot size and funds available. Other various technologies available include: concrete frame construction, timber construction, prefabricated space frame construction, steel frame and aluminum frame.

The technology to be adopted will be the most economical and one sensitive to the environment. Heavy use of timber during construction will be discouraged because of destruction of forests. The exotic species will be preferred to indigenous species in the construction where need will arise.
6.4 Alternative schedule

This option entails carrying out the project at a later time thereby offsetting the possible impacts at the current time. The only benefit is the hope that in future there may be improvements in baseline conditions and implementation technologies. However these conditions are not guaranteed and may only amount to delays in the project implementation. Therefore carrying out the proposed project with the proposed mitigations would be the most preferred option due to future uncertainties. In addition carrying out the proposed project at later time may lead to more operational and logistic costs due to increasing inflation and standards of living.

6.5 Alternative designs

This option entails undertaking the project but with different project designs. However the current building plans has been achieved by considering all the options available that would ensure cost-effectiveness and avoid or reduce environmental and social impacts as much as possible.

6.6 Waste water management alternatives

6.6.1 Wastewater/sewage management

(i) Waste water treatment plant

This involves construction of a plant and use of chemicals to treat the effluents to locally accepted environmental standards before it is discharged into the environment. It is usually expensive to construct and maintain, and need more space, but it is the most reliable, efficient and cost-effective in the long term. The sludge obtained can be composted and used for agricultural and gardening purposes. The option is not preferable due to lack of space and the existing alternatives as outlined below.

(ii) Use of stabilization ponds/lagoons

This refers to use of a series of ponds/lagoons that allow several biological processes to take place, before the water is released back to the river. The lagoons can be used for aquaculture purposes and irrigation. However, they occupy a lot of space but are less costly. No chemicals are used, heavy metals sink and decomposition processes take place. However they are usually a nuisance to the public because of odour from the lagoons/ponds. This option is not preferable in the area due to these factors.

(iii) Use of Constructed/Artificial wetland

This is one of the powerful tools/methods used in waste management in the developing countries. Constructed wetland plants act as filters for toxins. The advantages of the system are the simple technology, low capital and maintenance costs required. However, they require space and a longer time to function. Long term studies on plant species on the site will also be required to avoid weed biological behavioural problems. Hence not the best alternative because of the large amount of land required.

(iv) Use of septic tanks

This involves construction of underground concrete-made tanks to store the sludge with soak pits. This option is viable in instances where the project is far from a sewer line. The method is made expensive due to construction technology and regular exhaustion.
Connection to a sewer line

This involves connecting into a sewer line managed by the local water provider who runs a sewage treatment plant. This is the best option in municipalities and towns. The estate is already served by a sewer line hence will be the best option for the new development.

6.6.2 Solid waste management alternatives

Waste management alternative will include the following.

- Waste reduction at source: recycling, reuse and composting of the waste.
- Collection and disposal by CGM or a licensed waste company

In conclusion the collection and disposal by the local authority is the most viable option. However measures on waste reduction at the sources, segregation, recycling and reuse will also enhance waste management.

6.7 Conclusion on project alternatives

Implementation of the project with the proposed mitigation measures is the most preferred option as it entails carrying out the project with mitigation measures to prevent, offset or avoid its negative impacts thereby maximizing it gains. This option will therefore lead to achieving the project’s objectives sustainably and contribute to the achievement of other sectoral and policy goals and objectives.
7.0 POTENTIAL ENVIRONMENTAL IMPACTS

In order to assess the significance of the proposed project’s impacts, the impacts were first identified from their source which are the project’s activities/equipment/processes/materials and then the impact receptor which are the baseline environmental and social conditions.

The impacts were then classified as either positive or negative and in which project phase they would occur. The impacts were lastly analyzed in terms of their characteristics on the aforementioned baselines to define their significance. Lastly through literature reviews, professional knowledge, engagements with the proponent and stakeholders, mitigation measures were developed commensurate to the significance of impacts. This facilitated development of the Environmental Management Plan in this report.

7.1 Negative Impacts during construction

(i) Impact on bio diversity

Vegetation has a great effect on the general and localized environment and normally can modify microclimate. Usually, the flora creates a good environment for habitats thus the two may go together more often than not. In consequence, de-vegetation during construction may result to negative effects on the fauna by creating a disturbance. However this will be insignificant since the project site is not rich in vegetation cover.

(ii) Impacts on water resources

No major on-site impacts on water resources are anticipated during the construction phase. Care should however be exercised when handling fuel and oil (hydraulic, transmission, engine, etc.). Measures should also be taken to avoid spillage of construction material to the ground, as these would eventually reach the groundwater. Dumping excavated and construction material into nearby drainage should be prohibited. Additionally, all earth-moving and other equipments should be in good working condition and well maintained (no leaks). Off-site impacts on water resources may occur from the reckless disposal of domestic waste. Where proper waste segregation and disposal is practiced, the likelihood of these impacts to occur will be negligible, if not nil.

(iii) Impact on soil and drainage

Excavation works will lead to increased soil erosion at the project site and release of sediments into the drainage systems. Such waste materials can be injurious to the environment through blockage of drainage systems which can lead to stagnation of water hence bleeding grounds for mosquitoes. Uncontrolled soil erosion can have adverse effects on the local water bodies. However the volume of soil that would be excavated during construction is relatively small and thus may not lead to major erosion problems and impacts on soils.

Soil pollution from on-site as well as off-site works may occur by the intentional or accidental leakage of used chemicals, fuel, or oil products (from equipment and vehicles) on construction sites. Such practices should be strictly avoided and utmost precautions and workmanship performance should be adopted for the disposal of such hazardous products.

(iv) Impacts on biodiversity

The main construction activities having negative results on the biodiversity are excavations and effluent discharges. However, the potential negative impacts are not considered very significant, and will not affect any sensitive or critical area.
(v) Extraction and use of building materials

Building materials such as hard core, ballast, cement, rough stone and sand required for construction will be obtained from quarries, hardware shops and sand harvesters who extract such materials from natural resource banks such as rivers and land. Since substantial quantities of these materials will be required for construction, the availability and sustainability of such resources at the extraction sites will be negatively affected, as they are not renewable in the short term. In addition, the sites from which the materials will be extracted may be significantly affected in several ways including landscape changes, displacement of animals and vegetation, poor visual quality and opening of depressions on the surface leading to several human and animal health impacts.

(vi) Impact on air

Construction activities will also produce various air pollutants which can have both negative effects on both human and environmental health. One of major pollutants is dusts which may be generated form soil excavation, material stock piles and truck movements. Excavations and use of cement and sand among other like-materials are bound to increase the dust and particle levels in the air around the development area. Emission of large quantities of dust may lead to significant impacts on construction workers and the local residents, which will be accentuated during dry weather conditions. Such effects should be avoided through the use of dust screens. Workers at the site should also be provided with protective clothing to avoid negative health effects.

Use of fossil fuels (vehicular and generators) will exhaust emission such as oxides of Carbon, Sulphur and Nitrogen, and which can pose risks to human and environmental health. Welding operations will also emit gases and fumes such as ozone, chromium particularly in its hexavalent state (Cr6+), nickel (potential carcinogens), cadmium and lead, whilst others include: NOx, NO2, CO, CO2, O3 from mild and stainless steel welding. The health effects of exposure to these fumes can include irritation of the upper respiratory tract (nose and throat), tightness in the chest, wheezing, metal fume fever, lung damage, bronchitis, pneumonia or emphysema. While particulate welding fume is usually fairly easy to see, gaseous fumes are invisible.

(vii) Noise and vibration

The construction activities may generate noise above the ambient levels of the area. The construction works, delivery of building materials by heavy tucks and use of machinery/equipments including generators, metal grinders and concrete mixers will contribute to high levels of noise and vibration within the construction site and the surrounding area. Elevated noise levels within the site can affect adjacent tenants, project workers, passers-by and other persons in within the vicinity of the project site.

(viii) Population Influx and increased pressure on utilities

During construction phase there will be an influx of people mainly working in the project site. There will also be an increase of population due to the opportunities presented in providing goods and services to primary population increment for the construction activities and employees. This secondary increase will mainly entail retailers of foodstuffs and other commodities. Waste from such commodities might pollute the area if a designated dumping place is not allocated. The population will increase since the opportunities may be open to both local and people from other areas and thereby increasing the population.

This increase in population will create pressure on utilities as well as present social risks through interaction of people. Though not significant the construction activities may place added pressure on infrastructure and utilities such as roads, water, drainage and energy.

(ix) Increased Heavy Traffic

The main roads leading to the site area will serve the additional vehicles used for transportation of materials, equipment and staff to the site. Heavy trucks do not have the risk of causing accidents due to their limited
manoeuvrability but also place added pressure on the roads and can lead to failure (cracks and potholes).
This is failure is however a combination of factors including:

- The total of trips of heavy trucks
- The strength of the roads in context of carrying the heavy loads, and
- The resilience of the roads towards weathering.

Although the access road is made of tarmac there may be risk of failure or dilapidation from the cumulative pressure placed on them by the construction trucks.

(x) Generation of Construction Waste

The construction activities will lead to generation of construction wastes from the civil works. These wastes include: metal cuttings, rejected materials, surplus materials, surplus spoil, excavated materials, paper bags, empty cartons, empty paint and solvent containers, broken glass, stone chips, ceramics, bricks, glass, cardboard, cement, asphalt, sand, concrete, plastics, sealants, adhesives, fasteners, construction effluent (grey water) among others.

Construction waste poses risks to both human and environmental health and thus the proposed project would require an adequate waste management strategy, occupational health and safety strategy, and hazardous material safety plan. Some environmental impacts related to construction waste include soil contamination, water and air pollution, whereas health risks include: breathing complications and respiratory diseases, cancer, skin disorders, poisoning etc.

(xi) Effects of altering the landscape and visual impact

Successful developments generally blend landscaping and architecture to achieve a consistent, unified and unique project character. In terms of thematic design, use of boulders, rock outcrops and local trees can provide both a sense of enclosure and integration with the existing landscape.

The visual impact is generally classified as an obstruction or an intrusion. An obstruction may be defined as some feature which obscures the view and is categorized as high, moderate or slight. An intrusion is essentially subjective and is the impact on the visual impression of the area.

Appropriate landscape designs should be used to ensure the above is feasible. Good design can offer elements of texture, shadows, fragrances and colour where the purists shall take pleasure socializing. It should also be noted that the visual appearance of the site may be unpleasant during the construction stage due to stockpiling of masonry stones, aggregates, pipes and other building materials. However such a situation will only be temporary.

(xii) Impacts on public and occupational safety

In any civil works, public as well as construction staff, safety risks can arise from various constructions activities such as excavations, operation and movement of heavy equipment and vehicles, storage of hazardous materials, disturbance of traffic, and exposure of workers to waste water. Because of the short duration and non-complexity of the construction phase, such activities are controlled and consequently the associated risks are minimal. Proper supervision, high workmanship performance, and provision of adequate safety measures will suppress the likelihood of such impacts on public and occupational safety.

(xiii) Energy consumption

Fossil fuels (mainly diesel) will be used to run construction machinery and trucks. Fossil energy is non-renewable and its excessive use may have serious environmental implications on its availability, price and sustainability.
The project will also use electricity supplied by KPLC. Electricity in Kenya is generated mainly through natural resources, namely, water and geothermal resources. In this regard, there will be need to use electricity sparingly since high consumption of electricity negatively impacts on these natural resources and their sustainability.

(xiv) Water Use

Construction activities will require a lot of water mainly for concrete mixing, curing, sanitary and cleaning purposes. Excessive water use can have negative impact on water sources and its sustainability.

7.2 Negative Impacts during operation

(i) Waste generation and management

The project is expected to generate a lot of solid waste during its operation phase. The bulk of the solid waste generated will consist of paper, plastic, glass, metal, textile and organic wastes. Large quantities of solid waste will also be generated during maintenance works. Such waste materials can be injurious to the environment through blockage of drainage systems and negative impacts on human and animal health. This may be accentuated by the fact that some of the waste materials contain hazardous substances such as paints, cement, adhesives and cleaning solvents, while some of the waste materials including metal cuttings and plastic containers are not biodegradable and can have long-term and cumulative effects on the environment.

During operation the project is expected to have an increased demand for sanitation facilities and sewage disposal. If not properly disposed the effluents from the estate may have adverse impacts on the environment. Proper measures must therefore be taken to ensure there are adequate disposal facilities for domestic effluents from the residential units.

The primary objectives of an effective waste water system should ensure that:

→ No contamination of the drinking water supply occurs by waste water
→ No public health hazard occurs
→ No pollution of ground and surroundings occur
→ Sewage system should not be connected to the surface run off system

(ii) Increased storm water

Built up areas, paved surfaces, roads and structures created from the construction phase can lead to increased run-off by preventing the natural percolation of water through the soil. This can lead to increased amounts of storm water entering the drainage systems, resulting in overflow and damage to such systems.

Additionally increased run-off can lead to soil erosion in the areas where the water drains off to or drainage blockages by overloading the present drainage systems in the area. The increased run-off from the project and other similar projects in the area can also cumulatively cause urban flooding and inundation of low lying areas during the rainy season.

(iii) Energy consumption

During operation a lot of electrical energy will be used mainly for lighting, cooking, running of air conditioning equipments and running of refrigeration systems. Since electricity generation involves utilization of natural resources, excessive electricity consumption will strain the resources and negatively impact on their sustainability.
(iv) **Water use**

The activities during the operation phase will involve use of large quantities of water which can lead to increased demand on current water.

(v) **Micro-Climate Modification**

Though the project area is quite small to cause any considerable microclimate change it bears the potential of adding to cumulative effects of other infrastructural development that together emit GHGs.

(vi) **Increased Traffic**

From the increased population and subsequent demand for goods and services will lead in more vehicles plying the roads around the project. This may lead to increased traffic and hazards in the area especially if the roads in the area are not upgraded to cater for this demand.

(vii) **Fire Hazards**

In absolute terms, the possibility of a fire outburst at any of the residential households will always exist. Such an occurrence will inevitably have an environmental bearing on the atmosphere and safety of other residents.

The project’s internal water reticulation network should therefore be fitted with fire-hydrants for the purpose of achieving a speedy and readily available supply of water to re-fill the fire tankers for the fire-fighting purposes. The required number and types of fire hydrants should be installed after consultations with the Fire Services Department during project implementation stage.

(viii) **Security Threats**

The proposed project will attract a variety of people to the area either as residents, business people, suppliers, visitors and customers. Their variety of economic and social activities will also generate income and increase both the economic and social capital in the area. These may attract thieves to the area since they may target either the businesses or the people themselves and their belongings. Also the diversity of people in the project during its operational phase can affect the security.

(ix) **Socio-cultural Impacts**

The proposed project involves residential development which will attract different Kenyans to the site. Social cohesion and blending with the existing communities may pose some conflicts in the short term since the influx population will come with their differing cultural and social practices. The locals may also be forced to move from the area if the house rents increase. Thus they may face a loss of social control and ownership to the area if this happens and economic segregation may occur on the basis of richer middle and upper class moving into the area and displacing the natives. However this may be treated as a minor impact since most communities in Kenya are welcoming and easy to interact with. Also the areas around Mombasa are a predominantly urban and developed area that has a higher level of social permissiveness.

Social interactions and increased population may also present public health risks from communicable diseases such as respiratory diseases, HIV/AIDS, typhoid and cholera amongst others. The latter two diseases can be caused as result of increased population without commensurate services in sanitation, whilst the increase in population alone will place pressure on available medical and health care.
7.3 Expected Socio-Economic Contribution

(i) Creation of employment opportunities

The development is envisaged to provide several new jobs during construction and operation phases. These direct employment opportunities will in turn enhance the socio-economic status of the employees’ dependants. Secondary spin off jobs in the off-site service industry, could also lead to additional employment opportunities once the project has been established.

(ii) Provision of market for supply of building materials

The project will require supply of building materials and essential services most of which will be sourced locally. This will provide ready market for material suppliers such as quarrying, hardware shops and individuals.

(iii) Revenue to national and local governments

Through payment of relevant taxes, rates and fees to the government and the local authority, the project will contribute towards the national and local revenue earnings.

(iv) Increased commercial viability

The establishment of the project in the area will increase commercial viability of the area and will consequently increase the land values in the surrounding area due to the potential high returns after development. This will attract more high income investors into the area as well as more middle income groups.

(v) Increased housing

The project will promote housing sector in the country through provision of affordable residential units. Housing is challenge in the county mainly due to the high population growth rate therefore the project will contribute to solving this problem and in line with development policies such as Vision 2030.
8.0 IMPACTS MITIGATION AND MONITORING

8.1 General

In this chapter, recommendations are provided to mitigate potential negative impacts. Mitigation measures are summarized in an Environmental Management Plan (EMP) which is, basically, a synthesis of potential negative impacts and proposed mitigation measures, responsibility and costs.

8.2 Construction Phase

8.2.1 Minimization of run-off and soil erosion

- Minimize soil erosion and associated sediment release from the project site during construction works,
- Restrict construction vehicles to designated areas to avoid soil compaction within the project site.
- Contractor should avoid heaping excavated soil around adjacent residential houses. This will minimize soil from blocking the drainage systems and avoiding any possible health risks.

8.2.2 Mitigating Impact on biodiversity

- Design a landscape plan that enhances landscape aesthetic value using local and native vegetation.
- All waste resulting from construction works or any other activity should be collected and disposed properly in an approved disposal site. Littering in the project area and surrounding areas should be avoided.
- Ensure proper demarcation of the project area to be affected by the construction works in order to restrict any disturbance of flora only on the actual project area and to avoid spill over effects on the neighbouring areas.
- Have strict control of construction vehicles to ensure that they operate only within the area to be disturbed by access routes and other works.

8.2.3 Minimization of construction waste

- Segregate waste by separating hazardous waste from non-hazardous waste for appropriate disposal
- Provide adequate and suitable solid waste collection containers
- Containers for storing hazardous waste including used oil should be securely bunded, labelled and disposed as required by Waste Management Regulations, 2006
- Contract a NEMA licensed waste company or CGM to collect solid waste from the site for appropriate disposal at approved sites.
- Accumulate scrap metals in a scrapping yard and contract a scrap metal dealer with a valid license for appropriate disposal/recycling
- Minimize waste generated by adopting cleaner production methods such as conserving raw materials, enabling recovery and re-use of the waste product where possible
- Use durable, long-lasting materials which will not need to be replaced as often, thereby reducing the amount of construction waste generated over time.
- Provide facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements of nature i.e. sunshine, wind, rain etc
- Use building materials that have minimal packaging to avoid generation of excessive packaging waste
8.2.4 Efficient sourcing and use of raw materials

 Source building materials such as sand, ballast and hard core from registered quarry and sand mining companies, who have undergone satisfactory environmental impact assessment/audit and received NEMA approval. These companies are expected to apply acceptable environmental performance standards so that the negative impacts of their activities at the extraction sites are considerably well mitigated.
 Have an accurate budget and estimation of actual construction requirements in order to ensure that materials are not extracted or purchased in excessive quantities.
 Ensure that wastage, damage or loss (through run-off, wind, etc) of materials at the construction site is kept minimal.
 Consider reusing building materials and use of recycled ones in order to reduce the amount of raw materials extracted from natural resources as well as reducing impacts at the extraction sites.

8.2.5 Reduction of dust generation and exhaust emission

 Provide dust screens to minimize air pollution especially to the adjacent residential buildings.
 Dust emissions from piles of soil or from any other material during earthwork, excavation, and transportation should be controlled by wetting surfaces.
 Piles and heaps of soil should not be left over after construction is completed.
 Excavated sites should be covered with suitable solid material and vegetation growth induced after construction completion, no soil surface should be kept bare subject to erosion.
 Minimize dust during construction through strict enforcement of on site speed controls as well as limiting unnecessary traffic within the project site.
 Ensure that traffic routes on site are sprinkled with water regularly to reduce amount of dust generated by the construction trucks.
 Sensitize truck drivers to avoid unnecessary racing of vehicle engines at loading/offloading areas, and to switch off or keep vehicle engines at these points.

8.2.6 Minimization of noise and vibration

 Temporary noise pollution due to construction works should be controlled by proper maintenance of equipment and vehicles, and tuning of engines and mufflers.
 Construction works should be completed in as short a period as possible.
 Minimize noise and vibration in the project site and surrounding areas through sensitization of drivers to switch off vehicle engines while offloading materials unless they are tipper types.
 Instruct the drivers to avoid unnecessary gunning of vehicle engines or hooting especially when passing through sensitive areas such as churches, residential areas and hospitals.
 Insulate all generators and heavy duty equipments or place them in enclosures to minimize high noise levels.

8.2.7 Mitigating public and occupational health hazards

 Provide workers with insurance cover for such as workmen’s compensation.
 First aid facilities should be availed at the site office. These include properly stocked first aid boxes and properly trained and licensed personnel to handle first aid.
 Provide proper scaffolds for construction at high level.
 Document and display on-site emergency procedures.
 Use appropriate signage to direct and control flow of traffic.
 The construction site should be registered as per OSHA 2007 and the DOHSS should be notified of the construction works before commencement.
 A general accidents register should be kept on-site.
- Provide and enforce use of personal protective equipments - during construction all workers should wear protective clothing including overalls, helmets, safety boots and gloves among others where necessary.
- Ensure proper storage of materials and equipments to avoid accidents occurring from falling.
- Provide temporally sanitary facilities during construction.
- Water surfaces before and during excavation and construction to reduce dust generation.
- Restrict un-necessary movement of public to the site in order to avoid accidents. All access to the hazardous areas should be secured with a fence and warning notices in English and Kiswahili.
- Ensure portable fire extinguishers are provided and in working condition near probable ignition sources.
- Adequate and clean water supply for drinking.
- Maintain environmental management records on site during and after construction period.

8.2.8 Reduction of energy consumption

- Staff should be sensitized to switch off equipments and lights when not being used.
- Consider the possibility of using alternative sources of energy especially renewable ones such as solar.
- Monitor energy use during construction activities and set targets for efficient energy use.
- Have proper planning of transportation of materials in order to save fossil fuels (diesel, petrol).

8.2.9 Minimization of water use

- Any water leaks through damaged pipes should be fixed promptly.
- Sensitize the staff to use water efficiently/sparingly.
- Enhance rain water harvesting by use of tanks and other containers.
- Install automatic water taps.

8.2.10 Minimization of traffic impacts

- The contractor shall take all possible precaution to safeguard the safety of wheeled traffic and pedestrian.
- Ensure strict enforcement of on and off -site speed limits as well as limiting unnecessary traffic within the project site.
- Provide parking areas for the trucks and avoiding parking on the road sides.
- Provide entry and exit points into the sites.
- Erect proper warning signs at a safe distance on the access roads to warn motorist of heavy vehicle turning.
- Ensure trucks do not damage the road structures and drainage systems.
- Ensure only serviceable trucks are used during transportation hence less break downs.
- Ensure that transportation of the materials and construction works take the shortest period possible.
- Transport most of the construction materials during off peak hours when the traffic is low.

8.3 Operation Phase

8.3.1 Efficient solid waste management

- Proponent should provide proper waste handling facilities such as waste storage chamber/receptacles for temporarily holding solid waste generated at the estates.
- Ensure segregation of waste by separating hazardous waste from non-hazardous waste for appropriate disposal.
- Contract a NEMA licensed waste company or CGM for proper waste disposal.

8.3.2 Minimization of sewage release

- Connect the premise to MWSC sewer line.
• Ensure proper maintenance of internal sewer network.
• Ensure that sewage pipes are not blocked or damaged since such vices can lead to release of the effluent, resulting in land and water contamination.

8.3.3 Ensure efficient energy consumption

• Install energy-efficient lighting systems within the premise.
• Sensitize workers on energy conservation through efficiency use of energy in their domestic activities.

8.3.4 Ensure efficient water use

• Install water-conserving automatic taps.
• Fix promptly any water leaks, damaged pipes and faulty.
• Sensitize the workers to use water efficiently.
9.0 ENVIRONMENTAL MANAGEMENT PLAN

9.1 Environmental Management Plan - Construction Phase

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Measures</th>
<th>Time Frame</th>
<th>Responsible Persons</th>
<th>Budget (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural stability of the buildings</td>
<td>→ Ensure the building and structural plans are approved by CGM.</td>
<td>During construction</td>
<td>Proponent/engineer</td>
<td>Implementation budget</td>
</tr>
<tr>
<td></td>
<td>→ Ensure the right construction and quantity of materials are used</td>
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<td></td>
<td>→ Ensure the premise construction is supervised by qualified personnel</td>
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<tr>
<td></td>
<td>→ Ensure the inspection and structural design are done by a registered engineer</td>
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<tr>
<td>Impact on Biodiversity and soil erosion</td>
<td>→ Design a landscape plan that enhances landscape aesthetic value using local and native vegetation.</td>
<td>During construction</td>
<td>Contractor</td>
<td>Implementation budget</td>
</tr>
<tr>
<td></td>
<td>→ All waste resulting from construction works or any other activity should be collected and disposed properly in an approved disposal site. Littering in the project area and surrounding areas should be avoided.</td>
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<td>→ Ensure proper demarcation of the project area to be affected by the construction works in order to restrict any disturbance of flora only on the actual project area and to avoid spill over effects on the neighbouring areas.</td>
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<td>→ Have strict control of construction vehicles to ensure that they operate only within the area to be disturbed by access routes and other works.</td>
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<td></td>
<td>→ Minimize soil erosion and associated sediment release from the project site during construction works,</td>
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<td></td>
<td>→ Restrict construction vehicles to designated areas to avoid soil compaction within the project site.</td>
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<td></td>
<td>→ Excavated materials should be controlled and properly disposed to avoid blocking of storm water drainage system and subsequent soil erosion.</td>
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<tr>
<td>Minimization of accidents and hazards</td>
<td>→ All excavations, shafts, pits or openings more than two metres deep should be covered or barred by suitable means when access is not needed.</td>
<td>During construction</td>
<td>Contractor</td>
<td>Implementation budget</td>
</tr>
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<td></td>
<td>→ No materials should be stored near such excavations.</td>
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<td></td>
<td>→ All excavation wall over 1.2 metres deep should be reinforced with timber to prevent collapse to persons working inside.</td>
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<td>→ Supervision of such works should include collaboration with safety supervisors.</td>
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</tbody>
</table>
### Impact Mitigation Measures

<table>
<thead>
<tr>
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<th>Responsible Persons</th>
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</table>
| Noise pollution and excessive vibrations                               | → Temporary noise pollution due to construction works should be controlled by proper maintenance of equipment and vehicles, and tuning of engines and mufflers.  
  → Construction works should be completed in as short a period as possible.  
  → Minimize noise and vibration in the project site and surrounding areas through sensitization of drivers to switch off vehicle engines while offloading materials unless they are tipper types.  
  → Instruct the drivers to avoid unnecessary gunning of vehicle engines or hooting especially when passing through sensitive areas such as churches, residential areas and hospitals.  
  → Insulate all generators and heavy duty equipments or place them in enclosures to minimize high noise levels | During construction | Contractor/Proponent |             |
| Management of construction waste and efficient sourcing and use of raw materials | → Segregate waste by separating hazardous waste from non-hazardous waste for appropriate disposal  
  → Provide adequate and suitable solid waste collection containers  
  → Containers for storing hazardous waste including used oil should be securely bunded, labelled and disposed as required by Waste Management Regulations, 2006  
  → Contract a NEMA licensed waste company or CGM to collect solid waste from the site for appropriate disposal at approved sites.  
  → Accumulate scrap metals in a scrapping yard and contract a scrap metal dealer with a valid license for appropriate disposal/recycling  
  → Minimize waste generated by adopting cleaner production methods such as conserving raw materials, enabling recovery and re-use of the waste product where possible  
  → Use durable, long-lasting materials which will not need to be replaced as often, thereby reducing the amount of construction waste generated over time.  
  → Provide facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements of nature i.e. sunshine, wind, rain etc  
  → Use building materials that have minimal packaging to avoid generation of excessive packaging waste  
  → Source building materials such as sand, ballast and hard core from registered quarry and sand mining companies, who have undergone satisfactory environmental impact assessment/audit and received NEMA approval. These companies are expected to apply acceptable environmental performance standards so that the negative impacts of their activities at the extraction sites are considerably well mitigated. | During construction | Contractor | Implement |
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| Dust generation and exhaust emissions | → Provide dust screens to minimize air pollution especially to the adjacent residential buildings  
→ Dust emissions from piles of soil or from any other material during earthwork, excavation, and transportation should be controlled by wetting surfaces.  
→ Piles and heaps of soil should not be left over after construction is completed.  
→ Excavated sites should be covered with suitable solid material and vegetation growth induced after construction completion, no soil surface should be kept bare subject to erosion.  
→ Minimize dust during construction through strict enforcement of on site speed controls as well as limiting unnecessary traffic within the project site.  
→ Ensure that traffic routes on site are sprinkled with water regularly to reduce amount of dust generated by the construction trucks.  
→ Sensitize truck drivers to avoid unnecessary racing of vehicle engines at loading/offloading areas, and to switch off or keep vehicle engines at these points | During construction | Contractor     | Implementation budget |
| Oil spills                      | → Ensure that all transport and construction equipments are in good serviceable condition and no service is carried out on site.  
→ Ensure that no fuels or oils are stored on site but procure them when needed. | During construction | Contractor     | Implementation budget |
| Storm-water drainage            | → Construct storm water drains  
→ Contractor should avoid heaping excavated soil around adjacent residential houses. This will minimize soil from block the drainage systems and avoid health risks. | During construction | Contractor     | Implementation budget |
<table>
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<tr>
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→ Provide workers with insurance cover for such as workmen’s compensation.  
→ First aid facilities should be availed at the site office. These include properly stocked first aid boxes and properly trained and licensed personnel to handle first aid.  
→ Provide proper scaffolds for construction at high level  
→ Document and display on-site emergency procedures  
→ Use appropriate signage to direct and control flow of traffic  
→ The construction site should be registered as per OSHA 2007 and the DOHSS should be notified of the construction works before commencement.  
→ A general accidents register should be kept on-site.  
→ Provide and enforce use of personal protective equipments - during construction all workers should wear protective clothing including overalls, helmets, safety boots and gloves among others where necessary.  
→ Ensure proper storage of materials and equipments to avoid accidents occurring from falling.  
→ Provide temporarily sanitary facilities during construction.  
→ Water surfaces before and during excavation and construction to reduce dust generation.  
→ Restrict un-necessary movement of public to the site in order to avoid accidents. All access to the hazardous areas should be secured with a fence and warning notices in English and Kiswahili  
→ Ensure portable fire extinguishers are provided and in working condition near probable ignition sources  
→ Adequate and clean water supply for drinking.  
→ Maintain environmental management records on site during and after construction period. | During construction | Contractor | Implementation budget |
| Energy consumption          | → Staff should be sensitized to switch off equipments and lights when not being used  
→ Consider the possibility of using alternative sources of energy especially renewable ones such as solar  
→ Monitor energy use during construction activities and set targets for efficient energy use  
→ Have proper planning of transportation of materials in order to save fossil fuels (diesel, petrol) | During construction | Contractor | Implementation budget |
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</table>
| Water use      | → Any water leaks through damaged pipes should be fixed promptly.  
→ Sensitize the staff to use water efficiently/sparsely.  
→ Enhance rain water harvesting by use of tanks and other containers.  
→ Install automatic water taps                                                                                                                        | During construction | Contractor           | Implement budget                  |
| Traffic impacts | → The contractor shall take all possible precaution to safe guard the safety of wheeled traffic and pedestrian.  
→ Ensure strict enforcement of on and off-site speed limits as well as limiting unnecessary traffic within the project site  
→ Provide parking areas for the trucks and avoiding parking on the road sides.  
→ Provide entry and exit points into the sites.  
→ Erect proper warning signs at a safe distance on the access roads to warn motorist of heavy vehicle turning.  
→ Ensure trucks do not damage the road structures and drainage systems.  
→ Ensure only serviceable trucks are used during transportation hence less break downs.  
→ Ensure that transportation of the materials and construction works take the shortest period possible.  
→ Transport most of the construction materials during off peak hours when the traffic is low                                                                 | During construction | Contractor           | Implement budget                  |
### 9.2 Environmental Management Plan - Operation Phase

<table>
<thead>
<tr>
<th>Activity</th>
<th>Mitigation measures</th>
<th>Time frame</th>
<th>Responsible persons</th>
<th>Cost</th>
</tr>
</thead>
</table>
| Sewerage disposal                | → Connect the premise to MWSC sewer line.  
→ Ensure proper maintenance of internal sewer network.  
→ Ensure that sewage pipes are not blocked or damaged since such vices can lead to release of the effluent, resulting in land and water contamination | Continuous | Residents committee/residents               | -     |
| Energy consumption               | → Switch off equipments and lights when not being used.  
→ Consider the possibility of using alternative sources of energy especially renewable ones such as solar  
→ Install energy-efficient lighting systems within the premise.  
→ Sensitize workers on energy conservation through efficiency use of energy in their domestic activities | Continuous | Residents committee/NHC                    | -     |
| Efficient waste management       | → Provide proper waste handling facilities such as waste storage chamber/receptacles for temporarily holding solid waste generated at the estates.  
→ Contract a NEMA licensed waste company or CGM for proper waste disposal  
→ Raise awareness among occupants and workers about waste management  
→ Dispose waste more responsibly by dumping at designated sites only  
→ Employ or contract regular cleaning services on corridors and passages. | Continuous | Residents committee/residents/NHC          | -     |
| Efficient water use              | → Put in place measures for quick detection and repair of pipe and tank leaks  
→ Sensitize occupants to use water more efficiently  
→ Ensure taps are not running when not in use  
→ Install water-conserving automatic taps. | Continuous | Residents committee/NHC                    | -     |
| Emergency/hazard response/prepareness plan | → There must be a well designed and documented emergency preparedness plans including fire emergency procedures | Continuous | Residents committee/NHC                    | -     |
| Fire protection                  | → Regular inspection and servicing of the extinguishers should be undertaken by a reputable service provider and records of such inspections maintained  
→ Fire safety signs should be prominently displayed within the new buildings  
→ Residents should be sensitized on fire safety | Continuous | Residents committee/NHC                    | -     |
Electrical Safety
→ Circuits must not be overloaded
→ Distribution board switches must be clearly marked to indicate respective circuits
→ There should be no live exposed connections
→ Electrical fittings near all potential sources of ignition should be flame proof
→ All electrical equipments should be earthed

Continuous
Residents committee/residents//NHC
-

Housekeeping
→ Floor areas should be free of debris, spillage and tripping hazards
Continuous
Residents committee/residents
-

General safety and security
→ Provide day-night security guards and adequate lighting within and around the estate
Continuous
Residents committee/NHC
-

9.3 Environmental Management Plan - Decommissioning Phase

In addition to the mitigation measures provided in table above, it is necessary to outline some basic mitigation measures that will be required to be undertaken once all operational activities of the proposed project have ceased. The necessary objectives, mitigation measures, allocation of responsibilities, time frames and costs pertaining to prevention, minimization and monitoring of all potential impacts associated with the decommissioning and closure phase of the proposed project are outlined in table below.

<table>
<thead>
<tr>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Demolition waste management</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. All buildings, foundations, equipments, structures and partitions that will not be used for other purposes must be removed and recycled/reused as far as possible</td>
<td>Contractor/NHC</td>
<td>One-off</td>
<td>-</td>
</tr>
<tr>
<td>2. Dispose reusable demolished facilities as prescribed by public procurement and disposal Act 2005, Cap 412C.</td>
<td>Contractor/NHC</td>
<td>One-off</td>
<td>-</td>
</tr>
<tr>
<td>3. Where recycling/reuse of the equipments, implements, structures, partitions and other demolition waste is not possible, the materials should taken to a licensed waste disposal site</td>
<td>Contractor/NHC</td>
<td>One-off</td>
<td>-</td>
</tr>
</tbody>
</table>
10.0 CONCLUSION AND RECOMMENDATION

10.1 Recommendations

In ensuring proper mitigation measures are instituted the proponent and contractor will need to ensure the following:

- They are involved in every stage of the project implementation and particularly on the management of the anticipated wastes and emissions into the environment as well as other concerns that may touch on the neighbouring residents especially control of dust, noise and management of construction waste.
- Environmental management issues are considered during annual budgets for sustainability,
- Ensure that the project implementation will not cause any unnecessary disruption to public utilities, storm water/surface runoff drainage systems, ecological systems and human settlement. Whenever any of these problems or any other impact highlighted in this report are anticipated, then the concerned parties should take appropriate mitigation actions.
- Take all necessary technological considerations that will prevent wastes/effluent and emissions into the receiving environment. In this regard, the management should be expected to constantly consult with an environmental expert.
- Ensure that the contractor installs all the systems to the specifications developed and agreed upon in the building plan.
- Conservation measures are implemented that ensure sustainable use of energy and natural resources

(i) Wastewater management

The following actions are recommended mainly with regard to health and safety of the workers and residents;

- Ensure there is minimal obstruction to storm water flow and prevent surface run off from entering the sewers,
- Location of inspection chambers/manholes to take into consideration the workers and residents movements, access by children with respect to the level of safety risks.

(ii) Solid Waste Management

For effective management of the solid wastes;

- Provide solid waste collection facilities at strategic locations in the estate.
- Allocate a suitable yard on an accessible corner of the estate for collection, segregation and storage of all solid wastes that will be generated from the site

10.2 Conclusion

In conclusion the proposed project will have several positive economic impacts during its different phases that include: creation of employment; stimulating development through revenue, taxes and income, creating a market for goods and services, and creating business opportunities for various companies and individuals. These will contribute to the achievement of vision 2030 and contribute to improving housing need in the country.

In general several environmental impacts during the construction and operation phase will be encountered. Notable these impacts include noise pollution, exhaust and dust emission, increased water demand, energy consumption and increased waste water, solid waste generation and occupational health and safety impacts, among others. However these impacts are synonymous with housing development and can adequately be
migrated through implementation of the EMP prepared. In addition the contractor and proponent are committed on implementing the measures as outlined in the EMP as well as adhering to all relevant national and international environmental, health and safety standards, policies and regulations that govern housing developments.

Several environmental concerns were also been raised by area residents, specifically those residing within the estate. These impacts can be adequately mitigated through implementation of the EMP. However it was observed that the main concern with the residents is the desire to be offered the chance to purchase the existing houses and the fear that the new houses will be let at higher rate.

Our conclusion is that the project is important for economic development and improvement of housing in the area and country at large and its benefit out weight its shortcomings. We therefore recommend that an EIA license for the proposed project be issued.
REFERENCES

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- Kenya gazette supplement Acts Local Authority Act (Cap. 265) government printer, Nairobi
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