ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED RESIDENTIAL CUM COMMERCIAL DEVELOPMENT ON PLOTS TITLE NOS. NAIROBI/BLOCK 43/99 & NAIROBI/BLOCK 43/100 LOCATED ALONG JAMHURI CRESCENT, IN WOODLEY AREA OF NAIROBI CITY COUNTY

This Environmental Impact Assessment (EIA) Project Report is submitted to the National Environmental Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination (Amendment) Act, 2015 and the Environmental (Impact Assessment and Audit) Regulations, 2003.

PROJECT PROPONENT

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SEPTEMBER 2026

DOCUMENT AUTHENTICATION

This Environmental and Social Impact Assessment study report has been prepared by Linge Kitulu (Registered and licensed Lead Expert No. 9332) in accordance with the Environmental Management and Coordination (Amendment) Act of 2015 and the Environmental (Impact Assessment) and Audit regulations 2003 which requires that every development project must have an EIA report prepared for submission to the National Environmental Management Authority (NEMA). We the undersigned, certify that the particulars in this report are correct and righteous to the best of our knowledge.

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EXECUTIVE SUMMARY

Kenya being a developing country is urbanizing very fast and hence experiencing the challenges of urbanization **GD BB ONE DEVELOPMENT LIMITED,** herein referred to as proponent has identified an investment opportunity along Jamhuri Crescent, of Woodley area, Nairobi City County. The proponent intents to construct a residential cum commercial development comprising of studio units, one-bedroom units, two-bedroom units, penthouses, and commercial units, complete with all attendant facilities. According to Nairobi City County Planning Department, this is an area zoned for Single Dwelling Residential Use but the proponent has applied for a change of use to Mixed-use (Residential and commercial) use and has obtained approval for the same from the Nairobi City County Government.

Housing is regarded as a basic human need in every society and is considered a fundamental right of every individual. The right to housing is embedded in various international instruments including the United Nations Human Rights Declaration of 1948, the International Covenant on Economic, Social and Cultural Rights of 1966, the Istanbul Declaration and Habitat Agenda of 1996 and the Declaration on Cities and other Human Settlements of 2001(Republic of Kenya, 2004). The right to housing is further embedded in the Constitution of Kenya 2010. Article 43 (1b) of the Constitution provides that every person has the right to accessible and adequate housing, and to reasonable standards of sanitation. Nabutola (2004) has equated shelter to food, which is a human need, so much, so that those who cannot afford it still need it. It is for this reason that every opportunity and an investor intending to develop and increase the housing stock in the country should be given a chance to do so provided that they are within the law. With the ever-increasing rates of urbanization and increasing population growth rates the housing sector in Kenya if not well addressed is bound to impact negatively on the environmental attributes of the project areas and its surroundings.

The Kenyan government has attempted to provide decent housing to its urban population through several strategies one of which is through the private sector. This is intended to stimulate economic and social development of the residents through the provision of social amenities and services that would make life both meaningful and honorable. This Environmental Impact Assessment examined the potential positive and negative impacts of the project on the immediate surroundings with due regard to all the phases from construction, occupation and decommissioning. It encompassed all aspects pertaining to the physical, ecological, socio-cultural, health and safety conditions at the site and its environs during and after construction.

Environment, Health and Safety (EHS) section addresses environmental, health and safety concerns during projects' cycle. The main objective of the EHS on the proposed project is to develop guidelines for protecting, managing and responding, processes, situations/conditions that might compromise health, safety and security of workers and ecological wellbeing. To avoid or reduce negative environmental impacts, mitigation measures were proposed and an environmental management plan (EMP) formulated. The proponent is also expected to observe recommendations in the Environmental Management Plan (EMP) and carry out annual environmental audits once the project is in operation.

Overview of the Project

The proponent proposes to construct **a residential comprised of seventy-six (76) studio units, seventy-six (76) one-bedroom units, one hundred and fifty-two (152) two-bedroom units and two (2) penthouses making a total of three hundred and six (306) housing units. The development shall also comprise of children's play area, equipment rooms, club house, a fitness area, a residential lobby, one hundred and ten (110) car parking spaces and other associated amenities.** The detailed distribution of the units per floor is as described below:

Basement 1 – comprised twenty-four (24) car parking spaces

Ground floor – comprised of children's play area, equipment rooms, a club house, a fitness area, and a residential lobby

Mezzanine 1 – comprised of twenty-four **(24)** car parking spaces

Mezzanine 2 – comprised of thirty **(30)** car parking spaces

Mezzanine 3 – comprised of thirty-two **(32)** car parking spaces

First floor – comprised of four **(4)** studio units, four **(4)** one-bedroom units, and eight **(8)** two-bedroom units

Typical 2nd-19th floors – comprised of four **(4)** studio units, four **(4)** one-bedroom units, and eight **(8)** two-bedroom units per floor making a total of two hundred and eighty-eight **(288)** housing units in the eighteen floors.

Roof terrace floor – comprised two **(2)** penthouses

Roof floor – comprised of flat roof

Summary of housing units

Type of housing unit	No. of housing units
Studio units	**76**
One-bedroom units	76
Two-bedroom units	152
Penthouses	2
Total	**306**

Environmental Impacts and Mitigation Measures

The potential negative environmental impacts of the proposed project and possible mitigation measures are summarized below:-

Potential Impact	Mitigation Measures
Air Pollution	▪ Use of dust screens/nets around the construction site to contain and arrest dust. ▪ Regular sprinkling of water on work areas to prevent fugitive dust violations. ▪ Ensure no burning of waste such as paper and bottles on non-designated areas. ▪ Regular covering and watering of all exposed stockpiles on site. ▪ Regular and prompt maintenance of construction machinery and equipment to minimize generation of hazardous gases.
Noise Pollution	▪ Construction works shall be carried out during the day. ▪ The contractor shall use noise shields on noisy equipment such as corrugated iron sheet structures. ▪ All noisy activities shall be scheduled concurrently during the construction to reduce the exposure period. ▪ Operation of the noisy machinery shall be carried out when necessary and switched off when not in use. ▪ Provide and enforce the use of Personal Protective Equipment (PPE) by the workers at all times during the construction phase. ▪ Monitor noise levels as per NEMA & NCC guidelines.
Oil pollution	▪ Proper storage, handling, and disposal of new/used oil and related oil wastes. ▪ Routine maintenance of the construction equipment to avoid oil leaks. ▪ Maintenance of the construction equipment to be carried out in the contractor's yard (off the site).
Solid waste	▪ Engage the services of the NEMA waste contractor to handle the waste. ▪ Covering of the trucks when transporting building materials and waste. ▪ Segregation of the waste at source before disposal to designated areas. ▪ Use of an integrated solid waste management system through a hierarchy of options: source reduction, recycling, composting and reuse.

	▪ Efficient use of the materials to reduce waste and recycling/reuse where feasible. ▪ Monitor waste as per the waste management regulations.
Liquid waste	▪ Channel all liquid waste to the NCWSC were line serving the area ▪ Conduct routine inspection and monitoring of the internal drainage system to identify and repair any leakages and blockages. ▪ Provision of adequate sanitary facilities to the workers during the construction. ▪ Regular inspection and maintenance of the internal sewer system.
Water demand	▪ Connect to the existing water supply after the acquisition of the relevant permits. ▪ Drill a borehole to supplement the existing water supply. ▪ Use of water efficient fittings/fixtures for plumbing products and white goods. ▪ Provision of adequate water tanks for water storage. ▪ Prompt detect and repair of the water fixtures and fittings.
Energy Demand	▪ Use of solar energy as an alternative source of energy. ▪ Install and routine maintenance of energy efficient fixtures and fittings. ▪ Turn off the machinery and equipment when not in use. ▪ Put off all the lights immediately when not in use.
Increased Traffic	▪ Ferry building materials during off-peak hours. ▪ Employ traffic marshals to control traffic in and out of site. ▪ Provide billboards at the site/entrance to notify motorists and the general public about the proposed project. ▪ Enforce speed limits for construction vehicles especially along the adjacent roads. ▪ Develop a traffic management plan to ensure that the site vehicles do not interfere with the regular traffic along the access roads.
Insecurity	▪ Engage services of security guards ▪ Install and regular maintenance of the CCTV cameras ▪ Place hotline numbers on strategic places ▪ Sensitize residents on security precautions ▪ Sensitize the residents on "*Nyumba Kumi Initiative"*
Storm water Drainage	▪ Proper design and maintenance of the drainage structures. ▪ Construct internal drains within the property for storm water management. ▪ Proper installation of cascades to break the impact of water flowing in the drains. ▪ Rainwater harvesting to reduce surface runoff. ▪ The proponent will ensure drainage facilities are fitted with adequate functional oil-water separators and silt traps.
Health and safety of workers	▪ Register the construction site as a workplace with DOSHS. ▪ Provide PPE to the workers and ensure that they wear them at all times. ▪ Provide first aid kit for the workers on the site. ▪ All workers to be adequately insured against accidents. ▪ All workers shall be sensitized before construction begins on how to control accidents related to construction. ▪ Keep a record of the public emergency service telephone numbers including Police, Fire brigade, and Ambulance at strategic points.

	▪ Ensure that the workers are registered with NHIF / NSSF and remit appropriate fees. ▪ Prepare a comprehensive contingency plan before construction begins on accident response.

Conclusions and Recommendations'

The EIA process started early in the pre-feasibility stage and environmental aspects were therefore considered during the project design stages the proposal to have a comprehensive waste reticulation system that shall involve connection with the NCWSC mains sewer line serving the area. This proactive approach resulted in many significant environmental impacts being avoided, as the project team was able to amend design in order to manage environmental impacts, rather than manage the environmental impacts of particular designs.

In conclusion, results from EIA study show that the proposed residential cum commercial development project has significant impacts on the environment. Implementation of an Environmental Management Plan will assist in dealing with environmental issues during the project cycle. There are also guidelines for addressing environmental health and safety. This project is recommended for approval by the National Environment Management Authority (NEMA) for issuance of an EIA license subject to annual environmental audits after operating for one year. This will be in compliance with the Environmental Management and Coordination (Amendment) Act of 2015 and the Environmental Impact Assessment and Audit regulations, 2003.

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ABBREVIATIONS

EIA	-	Environmental Impact Assessment
NEMA	-	National Environment Management Authority
EMCA	-	Environmental Management and Coordination Act
NBSAP	-	National Bio-diversity Strategy and Action Plan
CBD	-	Convention on Biological Diversity
NEAP	-	National Environmental Action Plan
EMP	-	Environmental Management Plan
EHS	-	Environmental Health and Safety
KPLC	-	Kenya Power and Lighting Company
OHS	-	Occupational Health and Safety
TOR	-	Terms of Reference
EHS	-	Environmental Health and Safety

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CHAPTER ONE: INTRODUCTION

1.1 Background and Rationale for the EIA

Housing is regarded as a basic human need in every society and is considered a fundamental right of every individual. The right to housing is embedded in various international instruments including the United Nations Human Rights Declaration of 1948, the International Covenant on Economic, Social and Cultural Rights of 1966, the Istanbul Declaration and Habitat Agenda of 1996 and the Declaration on Cities and other Human Settlements of 2001(Republic of Kenya, 2004). The right to housing is further embedded in the Constitution of Kenya 2010. Article 43 (1b) of the Constitution provides that every person has the right to accessible and adequate housing, and to reasonable standards of sanitation. Nabutola (2004) has equated shelter to food, which is a human need, so much, so that those who cannot afford it still need it. It is for this reason that every opportunity and an investor intending to develop and increase the housing stock in the country should be given a chance to do so provided that they are within the law.

The principal measure of sustainable development is that all activities which are carried out to achieve development must take into account the needs of environmental conservation. The sustainability of the ecosystem requires the balance between human settlement development and the natural ecosystem, which is a symbiotic relationship. This can be achieved through careful planning and the establishment of appropriate management systems. In modern times, the need to plan activities has become an essential component of the development process. Consequently, a number of planning mechanisms have been put in place to ensure that minimum damage is caused to the environment. Environmental planning is also integrated with other planning processes such as physical planning, economic planning, and development planning. Environmental Impact Assessment (EIA) is considered part of environmental planning. EIAs are undertaken for proposed activities that are likely to have a significant 0adverse impact on the environment and are subject to a decision of a competent national authority. In Kenya, the competent authority is the National Environment Management Authority (NEMA).

As part of the EIA process, it is necessary to devise alternatives to avoid undesirable impacts. Besides the alternative, identification of impacts may also lead to the development of mitigation measures i.e., means of reducing the impacts. As a tool of environmental planning, EIA is therefore precautionary in nature. EIA is neither antidevelopment nor does it stop actions which impact the environment. It only requires that those impacts be considered. Most development activities impact the environment hence a “no impact” interpretation of environmental impact assessment could lead to no development. But a

"considerable impact" interpretation of EIA will lead to better development. If environmental impacts are ignored, the project may not be sustainable in the long-run, in which case the money invested in it will have been wasted.

Environmental Impact Assessment studies were carried out as per the provisions of Environmental (Impact Assessment and Audit) Regulations, 2003. This report is a product of the entire study and will be used in various decision-making platforms including consideration for issuance of an EIA license by the National Environment Management Authority (NEMA).

It is well known that there is a significant urban housing facilities deficit in Kenya with an estimated 100,000 housing units being required per annum just to meet the current demand over the next 10 years. Therefore, this development shall be a welcome idea to help address the limitations of living space and commercial space in the city and its suburbs.

1.2 Need for the project

Rapid urbanization is a trend seen across the developing world, with the fastest rates of growth seen in Sub-Saharan Africa. Much of this is due to rural urban migration of people in search of jobs and or higher education or higher standards of living. Urbanization rates in Kenya have mirrored those seen in other Africa countries and just like in other areas, the housing sector is not growing in tandem with the rates of urbanization.

It must be appreciated that there is scarcity of residential premises in our urban areas. This has seen more and more residential buildings coming up to cater for the increased demand. The result of this has seen more and more agricultural land being converted to residential use and most urban areas set aside/ low rise residential cum commercial developments convert to high raise multi-family dwelling developments.

There is a glaring gap between the demand and availability of affordable residential facilities in various sections of Nairobi and the large metro region. This has been largely so because most of the more recent large-scale developments in areas near the major towns have tended to focus more on commercial and office use developments.

The conceived project is designed to be within character of the current housing trend for Woodley area in particular, where this survey revealed that residential apartments are allowed and are guaranteed of attracting the desired clientele. A survey sponsored by the proponent has established that demand exists for such development and that the target clientele would cherish an environment that meets the following criterion:

- A residence within reasonable distances to Nairobi CBD
- An environment that will allow occupants to interact but with strict rules regarding
    - Individual Privacy
    - Security of residents

The need therefore exists for providing flexible, modern and cost-effective Housing estate.

1.3 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 provision of housing units 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 (like the proponent) 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 e.g. the construction of by-passes and expansion of Mombasa Road
- 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 2030 (Vision 2030). The housing policy does not address the demand for affordable residential houses, which are addressed by this report.

1.4 Scope of the Project

The scope of the study includes carrying out of environmental investigations in line with current provisions on environmental legislations. This has been done in line with the requirements of Environmental Management and Coordination (Amendment) Act (EMCA) 2015 and Environmental (Impact Assessment) and Audit regulations 2003. The report is aimed at analyzing the physical extent of the project site and its immediate environs, implementation works of the proposed development (ground preparations, foundation, walling, roofing, fixtures and fitting among other activities) and installation of key utilities and other facilities required for the project to function optimally.

1.5 Overall objective of the project

The proposed project has the overall objective of developing a residential comprised of seventy-six (76) studio units, seventy-six (76) one-bedroom units, one hundred and fifty-two (152) two-bedroom units and two (2) penthouses making a total of three hundred and six (306) housing units. The development shall also comprise of children's play area, equipment rooms, club house, a fitness area, a residential lobby, one hundred and ten (110) car parking spaces and other associated amenities. The development shall also comprise other ancillary facilities.

1.6 Terms of Reference (TOR)

The TORs for this Project Report is the production of an EIA report to address the effects and impacts (Positive and Negative) of the proposed construction of residential apartments complex. The EIA firm of experts is under instructions from the project proponents to do a thorough environmental assessment with the aim getting approval from the National Environment Management Authority before commencement of the project. This report addresses the following key specific objectives:

- To review existing legal and institutional framework related to the proposed apartments complex project development.
- To collect and collate baseline information relevant to the proposed mixed development
- To collect primary data through the community participatory process
- To identify and assess positive and negative impacts of the proposed project
- To identify and analyze alternative options for the proposed project
- To develop mitigation measures and cost estimates for the negative impacts of project.
- To design an Environmental Management Plan (including cost estimates) and a monitoring framework for the environmental impact of the project

1.7 Content of project

The project assessment investigates and analyses the anticipated environmental impacts of the proposed development in line with the Environmental Impact Assessment and Audit regulations 2003 and in particular part II S 7[1] a-k. Consequently, the report will provide the following

- Nature of project
- The location of the project including the physical area that may be affected by the project's activities.
- The activities that shall be undertaken during the project construction operation and design of the project
- The materials to be used, products and by-product including waste to be generated by the project and the methods of disposal.
- The potential environmental impacts of the project and mitigation measures to be taken during and after the implementation of the project.
- An action plan for prevention and management of possible accidents during the project cycle
- A plan to ensure the health and safety of the workers and the neighbouring communities

- The economic and social cultural impacts to local community and the nation in general
- The project budget cost
- Any other information that the proponent may be requested to provide by NEMA.

All these aspects will be considered accordingly. This report also seeks to ensure that all the potential environmental impacts are identified and that workable mitigation measures are adopted. The report also seeks to ensure compliance with the provision of the EMCA 1999, and Environmental (Impact Assessment and Audit) Regulations 2003 as well as other regulations. The report emphasizes the duties of the proponent and contractor during the construction phase as well as the operation phase of this project.

1.8 Methodology

1.8.1 Environmental Screening.

Environmental screening was carried out to determine whether an EIA study is necessary for this project and at what level of evaluation. This took into consideration the requirements of the Environmental Management and Coordination (Amendment) Act (EMCA), 2015 and specifically the second schedule of the same act. From the screening process, it was understood that this project will cause significant impacts on the environment.

1.8.2 Environmental Scoping.

In scoping, focus was on environmental impacts of great concern. Environmental issues were categorized into physical, natural/ecological and social, economic and cultural aspects. Impacts were also classified as immediate and long-term impacts. This will include assessment of the proposed project in respect of but not limited to:

- Project Background: this will give the brief history of the proposed project site, the parties involved and justification of the project in terms of demand or lack of the same, the project area, relevant policy and legislation, identification of any associated project, or any planned projects including products within the region which may compete for the same resources; the project including products, by-products, processes both at implementation and operational level, resources required for successful implementation and operation of the project and the different options considered
- The proposed project objectives; both in the short and long run; and how they are linked to the overall objectives.

- Present environmental conditions; description of the project site, ecological zoning as well as the state of the environment and its surroundings- Attempts will state if it is already suffering from degradation, causes of the original degradation if any established.
- Identification of Environmental Impacts; the report will distinguish between significant positive and negative impacts, direct and indirect impacts and immediate and long-term impacts which are unavoidable and / or irreversible,
- Community/ Stakeholder Consultations: these will be undertaken to determine how the project will affect the local people / various stakeholders.
- Cost- Benefit Analysis; to evaluate the economics of the project and establish its viability in terms of the expected environmental concerns and measures
- Development of an Environmental Management Plan (EMP); to mitigate negative impacts, recommending feasible and cost-effective measures to prevent or reduce significant negative impacts to acceptable levels,
- Development of a Monitoring Plan; this will be used in monitoring the implementation of the mitigation measures and the impacts of the project during construction and operational phases, including an estimate of capital and operational costs, and make necessary recommendations pertaining to the proposed development.

1.8.3 Desktop Study.

This involved review of project documents, architectural drawings, past EIA, relevant policy, legal and institutional frameworks. Documents containing climatic, demographic and hydrological data for Nairobi City County were also relied upon.

1.8.4 Site Visits and Public Participation.

Field visits were meant for physical inspections of the project site in order to gather information on the state of environment. Several photos of the project site were taken for inclusion in this report. The study also sought public opinion/views through Consultation and Public Participation (CPP) exercise. Questionnaires were administered to the public and interviews held with neighbours. The questionnaires have been included in this report (annexed).

1.8.5 Reporting.

In the entire exercise, the proponent and EIA experts contacted each other on the progress of the study and signing of various documents. The proponent will have to submit ten (10) copies of this report

alongside a CD to the National Environment Management Authority for review and issuance of an EIA license. All the materials and workmanship used in the execution of the work shall be of the best quality and description. Any material condemned by the architect shall be removed from the site at the contractor's cost. Environmental concerns need to be part of the planning and development process and not an afterthought. It is therefore advisable to avoid land use conflicts with the surrounding area through the implementation of the Environmental Management Plan (EMP).

CHAPTER TWO: POLICY, LEGAL AND LEGISLATIVE FRAMEWORK

2.0 Introduction

Environmental Impact Assessment is an instrument for environmental management and development control. It is now accepted that development projects must be economically viable, socially acceptable and environmentally sound. It is a condition of the Kenya Government for developers to conduct Environmental Impact Assessment (EIA) on the development Projects. Pursuant to Sections 58 and 138 of the Environmental Management and Coordination (Amendment) Act (EMCA) No. 5 of 2015 and Section 3 of the Environmental (Impact Assessment and Audit) Regulations, 2003 (Legal Notice No.101), construction of buildings require an Environmental Impact Assessment project report prepared and submitted to the National Environment Management Authority (NEMA) for review and eventual licensing before the development commences. This was necessary as many forms of developmental activities cause damage to the environment and hence the greatest challenge today is to maintain sustainable development without interfering with the environment.

2.1 Policy Framework.

Environmental policies cut across all sectors and government departments. As such policy formulation should be consultative steered by interdisciplinary committees. Recent policies which the government is working on include; Draft Wildlife Policy; Draft National Land Policy; and Wetlands Management and Conservation Policy among others.

2.1.1 National Environmental Action Plan (NEAP).

National Environmental Action Plan was a deliberate policy effort to integrate environmental concerns into the country's development initiatives/plans. This assumed a consultative and multi-sectoral approach. Such an approach ensured that environmental management and the conservation becomes integral in various decision-making platforms.

As a result of its adoption and implementation, 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 Shelter Strategy to the Year 2000

Kenya adopted this strategy following the International Year of Shelter for the Homeless in 1987. This advocates for the involvement of various actors to come in and assist the government in providing housing. This took cognizance of the governments' inability to provide sufficient shelter for all its citizens. The government was to simply facilitate other actors such as developers to invest in shelter.

2.1.3 The National Poverty Eradication Plan (NPEP).

The objective NPEP is to alleviate poverty in rural and urban areas by 50 percent by the year 2015; as well as the capabilities of the poor and vulnerable groups to earn income. It also aims to narrow gender and geographical disparities and a healthy, better educated and more productive population. This plan has been prepared in line with the goals and commitments of the World Summit for the Sustainable Development (WSSD) of 1995. Since poor housing is among the indicators of poor societies, pursuits to address it build individuals capacity to relieve poverty.

2.1.4 National Policy on Water Resources Management and Development

While the National Policy on Water Resources Management and Development (1999) enhances a systematic development of water facilities in all sectors for promotion of the country's socio-economic progress, it also recognizes the by-products of this process as wastewater. It, therefore, calls for development of appropriate sanitation systems to protect people's health and water resources from institutional pollution. This implies that Industrial and business development activities should be accompanied by corresponding waste management systems to handle the waste water and other waste emanating there from. The same policy also requires that such projects undergo comprehensive EIAs that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighbourhood and further downstream are not negatively impacted by the emissions. As a follow-up to this, EMCA, 1999 requires annual environmental audits to be conducted in order to ensure that mitigation measures and other improvements identified during EIAs are implemented.

In addition, the policy provides for charging levies on waste water on the basis of quantity and quality. The "polluter-pays-principle" applies in which case parties contaminating water are required to meet the appropriate cost of remediation. Consequently, to ensure water quality, the policy provides for establishment of standards to protect water bodies receiving wastewater, a process that is ongoing. The standards and measures to prevent pollution to water resources are provided for in the Environmental Management and Coordination (Water Quality) Regulations, 2006 which is a supplementary legislation to EMCA, 1999.

2.1.5 Policy Paper on Environment and Development (Sessional Paper No. 6 of 1999):

The key objectives of the Policy include: -

(i) To ensure that from the onset, all development policies, programmes and projects consider environmental considerations.

(ii) To ensure that an independent environmental impact assessment (EIA) report is prepared for any industrial venture or other development before implementation,

(iii) To come up with effluent treatment standards that will conform to acceptable health guidelines.

Under this paper, broad categories of development issues have been covered that require a "sustainable development" approach. These issues relate to waste management and human settlement. The policy recommends the need for enhanced re-use/recycling of residues including wastewater, use of low or non-waste technologies, increased public awareness raising and appreciation of a clean environment. It also encourages participation of stakeholders in the management of wastes within their localities. Regarding human settlement, the paper encourages better planning in both rural and urban areas and provision of basic needs such as water, drainage and waste disposal facilities among others.

2.2 *Legal and Legislative Framework*

2.2.1 *Environmental Management and Coordination (Amendment) Act No.5 of 2015*

This project report has been undertaken in accordance with the Environment (Impact Assessment and Audit) Regulations, 2003, which operationalizes the Environmental Management and Coordination Act, 2015 (amendment). The report is prepared in conformity with the requirements stipulated in the Environmental Management and Coordination (EMCA) (Amendment) Act No. 5 of 2015 and the Environmental Impact Assessment and audit Regulations 2003, Regulation 7 (1) and the Second Schedule.

Part II of the said act states that every person is entitled to a clean and healthy environment and has the duty to safeguard the same. In order to achieve the goal of a clean environment for all, new projects listed under the second schedule of Section 58 of EMCA (Amendment) Act No. 5 of 2015 shall undergo an Environmental Impact Assessment. This includes development activities such as this new housing development. In addition to the legal compliance above, the following legal aspects have also been taken into consideration or will be taken into consideration before commencement of construction:

The Environment Management and Coordination (Amendment) Act (EMCA), 2015 provides for the establishment of an umbrella legal and institutional framework under which the environment in general is to be managed. EMCA is implemented by the guiding principle that every person has a right to a clean and healthy environment and can seek redress through the High court if this right has been, is likely to be or is being contravened.

Pursuant to section 25 (4) of EMCA, National Environmental Management Authority (NEMA) is required to restore degraded environmental sites using the National Environmental Restoration Fund. Currently, the restoration fund consists of 0.1 % levied from industries and other project proponents through the EIA process. Section 58 of the Act makes it mandatory for an Environmental Impact Assessment study to be carried out by proponents intending to implement projects specified in the second schedule of the Act which are likely to have a significant impact on the environment. Similarly, section 68 of the same Act requires operators of existing

projects or undertakings to carry out environmental audits in order to determine the level of conformance with statements made during the EIA study. The proponent is required to submit the EIA and environmental audit reports to NEMA for review and necessary action.

Section 72 of the Act prohibits discharging or applying poisonous, toxic, noxious or obstructing matter, radioactive or any other pollutants into aquatic environment. According to section 73 of the act, operators of projects which discharge effluent or other pollutants into the aquatic environment are required to submit to NEMA accurate information on the quantity and quality of the effluent. Section 76 provides that all effluent generated from point sources are to be discharged only into the existing sewerage system upon issuance of prescribed permit from the local authorities.

Section 87 (1) makes it an offence for any person to discharge or dispose of any wastes, whether generated within or outside Kenya, in such a manner as to cause pollution to the environment or ill health to any person.

The proponent will have to ensure that environmental protection facilities or measures to prevent pollution and ecological deterioration such as sewerage connections, solid waste management plans, and landscaping and aesthetic improvement programme are implemented and maintained throughout the project cycle. As well the; proponent will have to ensure that appropriate measures to prevent pollution of underground and surface water are implemented throughout the project cycle.

2.2.2 The Environmental Management and Co-ordination (Waste Management Regulations 2006) Legal Notice No. 121: Section 4-6

Part II of the Environmental Management and Co-ordination (Waste Management) Regulations, 2006 states that: - 4. (1) No person shall dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle.

(2) Any person whose activities generate waste shall collect, segregate and dispose or cause to be disposed of such waste in the manner provided for under these Regulations.

(3) Without prejudice to the foregoing, any person whose activities generates waste has an obligation to ensure that such waste is transferred to a person who is licensed to transport and dispose off such waste in a designated waste disposal facility. In addition, the Regulations state that:

5. (1) a waste generator shall minimize the waste generated by adopting the following cleaner production methods

a). Improvement of production process through:-

i.Conserving raw materials and energy;

ii. Eliminating the use of toxic raw materials; and

iii. Reducing toxic emissions and wastes

b). monitoring the production cycle from beginning to end by:-

i. Identifying and eliminating potential negative impacts of the product;

ii. Enabling the recovery and re-use of the product where possible;

iii. Reclamation and recycling

c). Incorporating environmental concerns in the design and disposal of a product.

6. A waste generator shall segregate waste by separating hazardous wastes from non hazardous waste and shall dispose of such wastes in such facility as shall be provided by the relevant local authority.

(23) No person shall engage in any activity likely to generate any hazardous waste without a valid Environmental Impact Assessment license issued by Authority under the provisions of the Act.

The proponent shall ensure that the main contractor adopts and implements all possible cleaner production methods during the construction phase of the project. During the construction phase of the project, the proponent shall ensure that the main contractor implements the above-mentioned measures as necessary to enhance sound Environmental Management and Coordination (Noise management of waste).

2.2.3 Waste Water Management;

Legal Notice No. 120; Part II – Protection of Sources of Water for Domestic Use.

4. (1) every person shall refrain from any act which directly or indirectly causes, or may cause immediate or subsequent water pollution, and it shall be immaterial whether or not the water resource was polluted before the enactment of these Regulations

(2) No person shall throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution

5. All sources of water for domestic uses shall comply with the standards set out in the First Schedule of these Regulations.

The proponent and project Architect as well as engineer are urged to ensure that drainage channels are well designed during the construction phase of the project, and upon completion it shall be connected to the NCWSC sewer line serving the area.

2.2.4 Public Health Act Cap 242

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 reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to injuries or dangerous to human health.

2.2.5 Physical and Land Use planning Act, No 13 of 2019

The said Act section 15 empowers the County Physical and Land Use Planning Consultative Forums to provide effective coordination and integration of physical and land use development and sector planning. The same section provides a forum for consultation on County and Inter-County Physical and Land Use Development Plans. Part IV of the Act expounds on development control clearly elaborating on the objectives of development control in Section 55. Section 60 provides that a developer wishing to carry out development in a particular County must make application to the County Planning and Land Use Department for evaluation before approval.

2.2.6 The water Act, 2016

The Water Act, 2016 is an act of parliament that regulates the utilization of water resources in the country. This Act covers the entire scope of extraction of water, its commercial, and domestic use, as well as resolution of disputes that could come up as a result of utilization of water resources. The purpose of this Act is to provide for the regulation, management and development of water resources and water and sewerage services in line with the Constitution. The Cabinet Secretary, the Authority, the Regulatory Board, county governments and any person administering or applying this Act shall be guided by the principles and values set out in Articles 10, 43, 60 and 232 of the Constitution. Individual water users apply for supply of water from water suppliers in accordance with this Act.

The proponent will operate within the provisions of this Act by apply for supply of water from Nairobi City Water and Sewerage Company (NCWSC), that has water distribution system within the area.

2.2.7 The traffic Act, CAP 403

The Traffic Act makes provisions for the regulation of and enforcement of traffic rules by the National Traffic Regulatory Authority (NTSA). The Act helps maintain sanity in Kenyan Roads by regulating road usage by people using various modes of transport, as well as regulating the issuance of licenses to operate the various modes of road transport. In accordance with the provisions of this Act, the NTSA works in conjunction with other regulatory bodies to enforce all traffic regulations to ensure responsible road transport system. The Traffic Act provides for all traffic offenses and their corresponding punishments. The relevance of the Traffic Act with regards to the proposed development is to regulate traffic along the access road and adjacent roads to the proposed residential cum commercial development.

The proponent shall comply with the Traffic Act by preparing and implementing a Traffic Management Plan throughout the entire project cycle.

2.2.8 Building code 2000

A person who erects a building or develops land or changes the use of a building or land, or who owns or occupies a building or land shall comply with the requirements of these by- laws. For the purpose of this by- laws and the following operations shall be deemed to be the erection of a building:-

a) The alteration or extension of a building.
b) The changing of the use or uses to which land or building is put.
c) The formation or lying out of an access to a plot.

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.

2.3 *Other relevant Provisions*

The following are the relevant environmental treaties to which Kenya is signatory in order of ratification:

• Montreal Protocol on Substances that Deplete the Ozone Layer (1987) ratified 9 November 1988

• United Nations Convention to Combat Desertification (1994), ratified 12 June 1994

• United Nations Framework Convention on Climate Change (1992), ratified 30 August 1994

• Convention on Biological Diversity (1992), ratified 11 September 1994

• Bamako Convention (1991), ratified 17 December 2003

• Kyoto Protocol (2004), ratified 25 February 2005

2.4 *Institutional Framework*

At present there are over twenty (20) institutions and departments which deal with environmental issues in Kenya. Some of the key institutions include the National Environmental Council (NEC), National Environmental Management Authority (NEMA), the Forestry Department, Kenya Wildlife Services (KWS) and others. There are also local and international NGOs involved in environmental activities that impact on the environment in one way or the other in the country.

2.4.8 National Environmental Management Authority (NEMA).

The object and purpose for which NEMA is established is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of the government in the implementation of all policies relating to the environment. A Director General appointed by the president heads NEMA. The Authority shall, among others:

- Co-ordinate the various environmental management activities being undertaken by the lead agencies and promote the integration of environmental considerations into development policies, plans, programs and projects with a view to ensuring the proper management and rational utilization of the natural resources environment on a sustainable yield basis for the improvement of the quality of human life in Kenya.
- Take stock of the natural resources in Kenya and their utilization and consultation, with the relevant lead agencies, and develop land use guidelines.
- Examine land use patterns to determine their impact on the quality and quantity of the natural resources among others. Moreover, NEMA mandate is designated to the following committees:

2.4.9 National Environment Action Plan Committee.

This Committee is responsible for the development of a 5-year Environment Action plan among other things. The National Environment Action Plan shall contain:

Analysis of the Natural Resources of Kenya with an indication as to any pattern of change in their distribution and quantity over time, and Analytical profile of the various uses and value of the natural resources incorporating considerations of intergenerational and intra-generational equity among other duties as the EMCA specifies.

2.4.10 National Environmental Tribunal.

This tribunal guides the handling of causes related to environmental offences in the Republic of Kenya. The Tribunal hears appeals against the decisions of the Authority. Any person who feels aggrieved may challenge the tribunal in the High Court.

2.4.11 The Occupational Safety and Health Act, 2007.

This is an act of Parliament to provide for the safety, health and welfare of 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. The Act was published in the Kenya Gazette Supplement No. 111 (Acts No.15). It received presidential assent on 22nd October, 2007 and became operational on 26th October, 2007. The key areas addressed by the Act include:

a. General duties including duties of occupiers, self-employed persons and employees
b. Enforcement of the act including powers of an occupational safety and health officer
c. Registration of workplaces.
d. Health General Provisions including cleanliness, ventilation, lighting and sanitary conveniences

e. Machinery safety including safe handling of transmission machinery, hand held and portable power tools, self-acting machines, hoists and lifts, chains, ropes & lifting tackle, cranes and other lifting machines, steam boilers, air receivers, refrigeration plants and compressed air receiver
f. Safety General Provisions including safe storage of dangerous liquids, fire safety, evacuation procedures, precautions with respect to explosives or inflammable dust or gas
g. Chemical safety including the use of material safety data sheets, control of air pollution, noise and vibration, the handling, transportation and disposal of chemicals and other hazardous substances materials
h. Welfare general provisions including supply of drinking water, washing facilities, and first aid
i. Offences, penalties and legal proceedings.

Under section 6 of this act, every occupier is obliged to ensure safety, health and welfare of all persons working in his workplace. The occupier shall achieve this objective by preparing and as often as may be appropriate, revising a written statement of his general policy with respect to the safety and health at work of his employees and the organization and arrangements for the time being in force for carrying out that policy (Section 7).

He is also required to establish a safety and health committee at the workplace in a situation where the number of employees exceeds twenty (section 9) and to cause a thorough safety and health audit of his workplace to be carried out at least once in every period of twelve months by a registered safety and health Advisor (Section 11). In addition, any accident, dangerous occurrence, or occupational poisoning which has occurred at the workplace needs to be reported to the occupational safety and health officer of the respective area by an employer or self-employed person (section 21). According to section 44, potential occupiers are required to obtain a registration certificate from the Director for all premises intended for use as workplaces. Such places shall be maintained in a clean state during the operation phase (section 47).

To ensure machinery safety, every hoist or lift – section 63 and/or all chains, ropes and lifting tackles – section 64 (1d), shall be thoroughly examined at least once in every period of six months by a person approved by the Director of Occupational Health and Safety Services. Similarly, every steam boiler - section 67 (8) and/or steam receiver - section 68 (4) and all their fittings and/or attachments shall be thoroughly examined by an approved person at least once in every period of twelve months whereas every air receiver shall be thoroughly cleaned and examined at least once in every period of twenty-four months or after any extensive repairs - section 69 (5). According to section 71 (3), every refrigeration plant capable of being entered by an employee also needs to be examined, tested and certified at least once in every period of twelve months by an approved person.

In relation to fire safety, section 78 (3) requires spillage or leaks of any flammable liquid to be contained or immediately drained off to a suitable container or to a safe place, or otherwise treated to make it safe. Furthermore, a clear and bold notice indicating that smoking is prohibited should be conspicuously displayed in

any place in which explosive, highly flammable or highly combustible substances, are manufactured, used, handled or stored-section 78 (5). In addition, necessary precautions for dealing with fire incidents should be implemented including provision of means for extinguishing fire and means for escape, in case of fire, for the persons employed in any workplace or workroom – section 81. As far as disaster preparedness and emergency response program is concerned, section 82 (1) makes it a mandatory requirement for every occupier of a workplace to design evacuation procedures to be used during any emergency situation and to have them tested at regular intervals.

To promote health and safety of employees who are at risk of being exposed to chemical substances, section 84 (3) and 85 (4) requires every employer to maintain at the workplace material safety data sheets and chemical safety data sheets respectively for all chemicals and other hazardous substances in use and ensure that they are easily available to the employees.

The employers' positive contribution towards the welfare of the employees include provision and maintenance of adequate supply of wholesome drinking water - section 91 and a first aid box or cupboard of the prescribed standard – section 95 at suitable point (s) conveniently accessible to all employees.

Other precautionary measures include: issuance of a permit to work to any employee, likely to be exposed to hazardous work processes or hazardous working environment, including such work processes as the maintenance and repair of boilers, dock work, confined spaces, and the maintenance of machinery and equipment, electrical energy installations, indicating the necessary precautions to be taken – section 96 (1); provision and maintenance for the use of employees, adequate, effective and suitable protective clothing including suitable gloves, footwear, goggle and head coverings in any workplace where employees are likely to be exposed to wet, injurious or offensive substance – section 101 (1). The proponent will be required to ensure that the main contractor includes in the contract document, adequate measures to promote safety and health of workers.

2.4.12 Environmental Vibration Pollution (Control) Regulations, 2009

These regulations were published as legal Notice No. 61 being a subsidiary legislation to the Environmental Management and Co-ordination Act, 1999. The regulations provide information on the following:

i. Prohibition of excessive noise and vibration
ii. Provisions relating to noise from certain sources
iii. Provisions relating to licensing procedures for certain activities with a potential of emitting excessive noise and/or vibrations and
iv. Noise and excessive vibrations mapping.

According to regulation 3 (1), no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. Regulation 4 prohibits any person to (a) make or cause to be made excessive vibrations which

annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment; or (b) cause to be made excessive vibrations which exceed 0.5 centimeters per second beyond any source property boundary or 30 metres from any moving source.

Regulation 5 further makes it an offence for any person to 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.

Regulation 12 (1) makes it an offence for any person to operate a motor vehicle which- (a) produces any loud and unusual sound; and (b) exceeds 84 dB(A) when accelerating. According to sub regulation 2 of this regulation, No person shall at any time sound the horn or other warning device of a vehicle except when necessary to prevent an accident or an incident.

Regulation 13 (1) provides that except for the purposes specified in sub-Regulation (2) there under, no person shall operate construction equipment (including but not limited to any pile driver, steam shovel, pneumatic hammer, derrick or steam or electric hoist) or perform any outside construction or repair work so as to emit noise in excess of the permissible levels as set out in the Second Schedule to these Regulations.

Regulation 16 (1) stipulates that where a sound source is planned, installed or intended to be installed or modified by any person in such a manner that such source shall create or is likely to emit noise or excessive vibrations, or otherwise fail to comply with the provisions of these Regulations, such person shall apply for a License to the Authority. According to regulation 18 (6), the license shall be valid for a period not exceeding seven (7) days. Regulation 19 (1) prohibits any person to carry out activities relating to fireworks, demolitions, firing ranges or specific heavy industry without a valid permit issued by the Authority. According to sub regulation 4, such permit shall be valid for a period not exceeding three months. The project proponent will be required to comply with the above-mentioned regulations in order to promote a healthy and safe working environment.

2.4.13 National Construction Authority Act, 2011

The National Construction Authority Act, 2011 provides guidelines for registration of contractors in Part II section 3. This part provides a list of requirements that any firm seeking to be registered as a contractor must satisfy. Section 4 & 5 explains the evaluation process by the National Construction Authority Board and the subsequent issuance of registration certificate.

Section 12 makes a provision for requirements for a foreigner intending to be registered as a foreign contractor to operate in Kenya. This Section states that, Subject to section 18 of the Act, a foreign person or firm shall be eligible for registration as a contractor on application to the Authority and payment of the prescribed fees.

Section 17 (1) states that, All construction works, contracts or projects either in the public or private sector shall be registered with the Authority in accordance with the Act. After registration, the Authority shall review the application and upon certification that the owner has met all requirements, issue a compliance certificate. This is to ensure the Authority regulates all construction works within the country.

According to this Act, all construction works have to be approved and licensed by the National Construction Authority before the developer commences construction activities. The Act further provides that a developer must pay a licensing fee of 0.5% of the project cost to the Authority as part of the requirement before licensing.

The proponent for this project shall comply with this Act by seeking National Construction Authority approval before kick starting construction works. This will entail compliance with all requirements stipulated in this Act. The proponent shall also engage licensed contractors and ensure all construction workers meet the National Construction Authority requirements for skilled construction workers.

CHAPTER THREE: DESCRIPTION OF THE PROJECT

3.1 Introduction and project objectives

The motivation for establishment of the project is the existing high demand for affordable houses in Woodley area and the larger Nairobi City. The conceived project is designed to be within character of the current development trend of the project area, where a general survey of the site revealed that such residential apartments are common. Thus, such developments are guaranteed of attracting the desired clientele.

The proponent proposes to construct **a residential comprised of seventy-six (76) studio units, seventy-six (76) one-bedroom units, one hundred and fifty-two (152) two-bedroom units and two (2) penthouses making a total of three hundred and six (306) housing units. The development shall also comprise of children's play area, equipment rooms, club house, a fitness area, a residential lobby, one hundred and ten (110) car parking spaces and other associated amenities.** The detailed distribution of the units per floor is as described below:

Basement 1 – comprised twenty-four (24) car parking spaces

Ground floor – comprised of children's play area, equipment rooms, a club house, a fitness area, and a residential lobby

Mezzanine 1 – comprised of twenty-four **(24)** car parking spaces

Mezzanine 2 – comprised of thirty **(30)** car parking spaces

Mezzanine 3 – comprised of thirty-two **(32)** car parking spaces

First floor – comprised of four **(4)** studio units, four **(4)** one-bedroom units, and eight **(8)** two-bedroom units

Typical 2nd-19th floors – comprised of four **(4)** studio units, four **(4)** one-bedroom units, and eight **(8)** two-bedroom units per floor making a total of two hundred and eighty-eight **(288)** housing units in the eighteen floors.

Roof terrace floor – comprised two **(2)** penthouses

Roof floor – comprised of flat roof

Summary of housing units

Type of housing unit	No. of housing units
Studio units	**76**
One-bedroom units	76
Two-bedroom units	152
Penthouses	2
Total	**306**

3.2 Project location

The proposed project is located along Jamhuri Crescent, Woodley area, of Nairobi City County. The site falls within a mixed- use residential area with single-dwelling and several similar multi-dwelling apartments and associated developments including a road network, electricity supply and other infrastructure. The location coordinates are **latitude: -1.300956, and longitude: 36.788655**

Figure 1: Proposed site location
Source: Google Earth

3.3 Site Ownership

The following conditions apply to the land;

- That the proponent provides adequate measures against environmental degradation.
- That the proponent is bound by any other conditions that may be imposed by the county in its by-laws.
- Plus all the special conditions outlined in the copy of attached ownership documents.

The development drawings have been submitted for approval by the relevant departments in the relevant departments with the following conditions in mind:

- That the proponent shall adhere to the drawing specification as they will be approved plus all condition included in the approval letter.

The land ownership documents are registered under **GD BB ONE DEVELOPMENT Limited of P.O. Box 58299– 00200 Nairobi.**

3.4 Existing developments and current land use.

The proposed project site is currently developed with two townhouses designed to host a single family. The site falls within a residential area with several apartments and associated developments including a road network, electricity supply and other infrastructure. It is accessed through a well tarmacked road. The current land use of the plot is residential single-dwelling use but a change of use to residential multi-dwelling use has been approved by the Nairobi City County Government.

Figure 2: Neighbouring similar development

3.5 Infrastructure

The development will have a comprehensive and robust infrastructure including access roads, parking areas, water storage, electricity distribution and waste disposal mechanism.

3.5.1 Electrical system

The area is served by the mains electricity lines and thus the proponent shall connect the property to the same. The necessary guidelines and precautionary measures relating to the use of electricity shall be adhered to.

3.5.2 Water Reticulation system

Water from Nairobi City Water and Sewerage Company (NCWSC) will be used during construction and operation phases. A borehole shall also be drilled to supplement water from Nairobi City Water and Sewerage Company. Moreover, there will be water storage tanks to increase water supply to various components of the houses.

3.5.3 Sewerage

The area is connected to a mains sewer line and waste water will be disposed of through internal drainage that shall then be connected to the NCWSC line serving this area.

3.5.4 Solid Waste

Solid waste management will consist of dustbins stored in cubicles protected from rain and animals. The waste will then be collected by a NEMA licensed private waste management company and be composited, palletized or re-cycled depending on the waste management strategy to be adopted in line with the Environmental Management and Co-ordination (Waste Management) Regulations, 2006.

3.5.5 Security

There will be the main entrance for easy security operations around the compound a boundary wall connected with security alarms, entry control, and quick response systems will be used within the project area.

3.5.6 Fire safety

The development provides for firefighting facilities such as fire extinguishers in the form of hydrants and carbon dioxide gas extinguishers. Fire breaks have also been provided for.

3.5.7 Parking area

There is a drive way and parking area, which will be paved, and will be spacious. The total parking spaces shall be one hundred and ten (110).

3.5.8 Perimeter Fence

A concrete perimeter wall will be erected around the project site.

3.5.9 Landscaping

The site will be landscaped after construction, using plant species available locally. This will include establishment of flower gardens and lush grass lawns to improve the visual quality of the site where pavements will not have taken space.

3.5.10 Buildings Construction

The technology used in the design and construction of the apartments will be based on international standards, which have been customized by various housing units in Kenya. The project will consist of flats with associated facilities, parking and infrastructure as presented in the architectural drawings in the appendix.

The buildings will be constructed as per the respective structural engineer's detail as provided for in the drawings presented in the Appendix. Basically, the building structures will consist of concrete appropriately reinforced with metal (steel and iron). The roof will consist of structural timber and steel members and roofing tiles. The buildings will be provided with a well-designed concrete staircase for every house.

The buildings will be provided with facilities for drainage of storm water from the roof through peripheral drainage systems into the drainage channels provided and out into the natural drainage channel/system. Drainage pipes will be of the PVC type and will be laid under the buildings and the driveway encased in concrete. 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 above ground water tanks and firefighting facilities.

3.6 Description of the Project's Construction Activities

3.6.1 Pre-construction Investigations

The implementation of the project's design and construction phase will start with thorough investigation of the site's biological and physical resources in order to minimize any unforeseen adverse impacts during the project cycle.

3.6.2 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 of the project will be sourced from Nairobi and neighbouring areas such as Athi River and Juja. 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.

3.6.3 Clearance of Vegetation.

The site has some vegetation cover including grass growing in it and several mature trees.

The proponent shall ensure as many indigenous trees as possible are used for revegetation as well as conserving the mature trees

3.6.4 Storage of Materials

Building materials will be stored on site. Bulky 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 proponent 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.*

3.6.5 Excavation and Foundation Works

The soil cover in the proposed area is thick with a thick layer of black cotton soil about 4 meters deep. However, this shall be excavated and disposed of in approved sites (preferably exhausted quarries).

3.6.6 Masonry, Concrete Work and Related Activities

The construction of the building walls, foundations, floors, pavements, drainage systems, perimeter fence and parking area among other components of the project 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 be supplemented by machinery such as concrete mixers.

3.6.7 Structural Steel Works

The building will be reinforced with structural steel for stability. Structural steel works will involve steel cutting, welding and erection.

3.6.8 Roofing Works

Roofing activities will include construction of a non-porous concrete slab that will be gently sloping to facilitate efficient drainage of all rain water that falls on the roof.

3.6.9 Electrical Work

Electrical work during construction of the premises 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.

3.6.10 Plumbing

Installation of pipe-work for water supply and distribution will be carried out within the entire building. In addition, pipe-work will be done to connect sewage from the premises to the NCWSC mains sewer line.

3.6.11 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 lush grass lawns where applicable and will involve replenishment of the topsoil. It is noteworthy that the proponent will use plant species that are available locally preferably indigenous ones for landscaping.

3.7 Description of the Project's Operational Activities

3.7.1 Residence

A number of three hundred and six (306) families will reside within the project site once its construction is complete. Several domestic activities such as cooking, washing, use of vehicles, and leisure and recreational activities will thus accompany residence. In addition, there will be production of domestic and sanitary wastes.

3.7.2 Solid Waste

The proponent will provide facilities for handling solid waste generated within the facility. These will include dust bins/skips for temporarily holding waste within the premises before final disposal at the designated dumping site.

3.7.3 Waste Water and storm water Management

The proponent shall construct an internal drainage system connected to the NCWSC mains sewer line serving the area to facilitate disposal of all waste water and liquid wastes generated from the property during occupation.

3.7.4 Cleaning

The proponent will be responsible for regular washing and cleaning of the pavements and communal areas. Individual tenants will be responsible for washing and cleaning their own premises/ residences. Cleaning operations will involve the use of substantial amounts of water, disinfectants and detergents.

3.7.5 General Repairs and Maintenance

The residential apartments and associated facilities will be repaired and maintained regularly during the operational phase of the project. Such activities will include repair of building walls and floors, repairs and maintenance of electrical gadgets and equipment, repairs of refrigeration equipment, repairs of leaking water pipes, painting, maintenance of flower gardens and grass lawns, and replacement of worn-out materials among others.

3.8 Description of the Project's Decommissioning Activities

Decommissioning is an important phase in the project cycle and comes last to wind up the operational activities of a particular project. It refers to the final disposal of the project and associated materials at the expiry of the project lifespan. If such a stage is reached, the proponent needs to remove all materials resulting from the demolition/ decommissioning from the site. The following should be undertaken to restore the environment.

- Remove all underground facilities from the site
- The site should be well landscaped by flattening the mounds of soil and
- Planting indigenous trees and flowers
- All the equipment should be removed from the site
- Fence and signpost unsafe areas until natural stabilization occurs
- Backfill surface openings if practical

3.8.1 Dismantling of Equipment and Fixtures

All equipment including electrical installations, furniture partitions, pipe-work and sinks among others will be dismantled and removed from the site on decommissioning of the project. Priority will be given to reuse of this equipment in other projects. This will be achieved through resale of the equipment to other building owners or contractors or donation of this equipment to schools, churches and charitable institutions.

3.8.2 Site Restoration

Once all the waste resulting from demolition and dismantling works is removed from the site, the site will be restored through replenishment of the topsoil and re-vegetation using indigenous plant species.

3.8.3 Building Materials and Energy Used

Several building materials will be required for construction of the town houses and associated facilities. These will include sand, ballast, hard core, timber, cement, clay tiles, metal sheets, electrical gadgets, and steel, plumbing materials, glass and paints among others. Most of these materials will be obtained locally within Athi River and Nairobi as well as surrounding areas. The main sources of energy that will be required for construction of the project will be solar energy for all the activities of the proposed project.

3.8.4 Solid Waste Generated

Large amounts of solid waste will be generated during construction of the project. These will include metal cuttings, rejected materials, surplus materials, surplus oil, excavated materials, paper bags, empty cartons, empty paint and solvent containers, broken glass among others. The proponent will take steps to minimize the generation of such waste and to ensure proper disposal procedures.

A lot of domestic waste such as waste from foodstuffs, empty plastic containers, cartons, etc will be generated during the operational phase of the project. The proponent will be responsible for waste management within the Housing Project and will put in place measures such as provision of waste handling facilities and ensuring prompt and regular waste disposal. On decommissioning, large quantities of solid waste will be generated from demolition works and equipment dismantling. The proponent will provide measures for recycling, reuse or disposal of such wastes.

3.9 Public participation

Public participation basically involves engaging members of the public to express their views about a certain project. Public participation tries to ensure that due consideration will be given to public values, concerns and preferences when decisions are made. Public participation in this project was facilitated through administration of questionnaires to the neighbors of the proposed development site as well as properly publicized public barazas with the entire neighbourhood. The neighbours reiterated that more emphasis should be put towards ensuring that the proposed project and its infrastructure would not

negatively interfere with the environmental integrity of the surrounding areas. Further public participation shall be conducted in follow up Barazas and the minutes together with proposed mitigation measures of negative environmental and social impacts submitted to NEMA for consideration.

Public involvement is a fundamental principle of the EIA process. Timely, well planned and appropriately implemented public involvement programmes will contribute to EIA studies and to the successful design, implementation, operation and management of proposals. Specifically public involvement is a valuable source of information on key impacts, potential mitigation measures and the identification and selection of alternatives. It also ensures the EIA process is open, transparent and robust, characterized by defensible analysis. Nearly all EIA systems make provision for some type of public involvement. This term includes public consultation (or dialogue) and public participation, which is a more interactive and intensive process of stakeholder engagement. Most EIA processes are undertaken through consultation rather than participation. At a minimum, public involvement must provide an opportunity for those directly affected by a proposal to express their views regarding the proposal and its environmental and social impacts. The purpose of public involvement is to:

- Inform the stakeholders about the proposal and its likely effects;
- Canvass their inputs, views and concerns; and
- Take account of the information and views of the public in the EIA and decision making.

The key objectives of public involvement are to:

- obtain local and traditional knowledge that may be useful for decision-making;
- facilitate consideration of alternatives, mitigation measures and tradeoffs;
- ensure that important impacts are not overlooked and benefits are maximized;
- reduce conflict through the early identification of contentious issues;
- provide an opportunity for the public to influence project design in a positive manner (thereby creating a sense of ownership of the proposal);
- improve transparency and accountability of decision-making; and
- Increase public confidence in the EIA process.

Experience indicates that public involvement in the EIA process can and does meet these aims and objectives. Many benefits are concrete, such as improvements to project design. Other benefits are intangible and incidental and flow from taking part in the process. For example, as participants see their

ideas are helping to improve proposals, they gain confidence and self-esteem by exchanging ideas and information with others who have different values and views.

Public participation exercise for the assessment was carried out. Interviews were carried out in the neighbourhood by the use of questionnaires (sample attached), and a public Baraza to find out all the views from the neighbours towards the housing project. Neighbouring the site are several apartments. Additionally, adverts were placed in two newspapers, the Kenya Gazette, and a Radio station to further inform the public and all interested parties and allow them to give their feedback regarding the proposed project. All people interviewed had no objection to the proposed project save for a few environmental issues such as noise and dust during construction and increased traffic jam along access road which have been addressed below and, in the EMP.

CHAPTER FOUR: BASELINE INFORMATION OF THE STUDY AREA

4.1 Introduction

This chapter has information on the location, bio- physical, socio and economic aspects of the project area. These are elaborately discussed in order to identify areas likely to be affected as a result of project activities. This study therefore considered the physical location, climatic data, geology, drainage, infrastructure, demography and socioeconomic information.

4.2 Climatic Conditions

At 1,795 meters (5,889 ft) above sea level, Nairobi enjoys a moderate climate. Under the Koppen climate classification, Nairobi has a Subtropical highland climate. The altitude makes for some chilly evenings, especially in the June/July season when the temperature can drop to 10 °C (50 °F). There are two rainy seasons but rainfall can be moderate. The cloudiest part of the year is just after the first rainy season, when, until September, conditions are usually overcast with drizzle. Temperature fluctuates between 15°C and 32°C in most areas

4.2.1 Temperatures

The sunniest and warmest part of the year is from December to March, when temperatures average the mid-twenties during the day. The mean maximum temperature for this period is 24 °C (75 °F). The minimum temperature also remains low during cloudy nights, usually hovering around 8 °C and at times reaching 6°C. Clear skies in January and February also bring colder nights. The highest temperature ever registered in Nairobi was 32.8 degrees Celsius and the lowest was 3.9 degrees Celsius. The mean maximum temperature for this period is 24 °C (75 °F).

4.2.2 Rainfall

There are two rainy seasons but rainfall can be moderate. The cloudiest part of the year is just after the first rainy season, when, until September, conditions are usually overcast with drizzle. Mean annual rainfall range is 500-1000mm/year. Relative humidity means values range from 70 to 80%.

Wind Flows

The lower winds throughout the year are of the easterly type. Between October and April, they shift to the northeast while as from May to September they move to the southeast. Prior to the “Long Rain”

season strong winds prevail with an average speed of 22.5 Miles/hour. The rest of the year has wind speed varying from 10 to 15 Miles/hour. However, during night, the winds are usually calm.

4.2.3 Sunshine

Early mornings in Nairobi in general are often cloudy, but the sun peeks through by midmorning. Throughout the year, there is an average of seven hours of sunshine per day. Thirty percent more sunlight reaches the ground during the afternoon than in the morning. Of course, there is more sun shine during the summer months, when the sun is more overhead in the southern hemisphere. Infrequently during the rainy season the sun never show through the clouds. Even in August, the cloudiest month, there is an average of four hours of sunshine.

4.3 Topography and Drainage

Nairobi main drainage follows the regional slope of the volcanic rocks towards the east, while subsidiary internal drainage into the Rift region is confined to the western part. The lava plains east of the line Ruiru-Nairobi-Ngong are underlain by a succession of lava flows alternating with
Lakebeds, streams deposits, tuffs and volcanic ash. These plains, comprising mainly the Athi plains and the northern section of the Kapiti plain, extend westwards, rising from 4900 feet (1493 m) at the Athi River to 6000 feet (1829 m) in the faulted region near Ngong. The lava plains are crisscrossed with steep-walled gullies and canyon-like gorges, such as those along the Mbagathi valley. Further east this valley widens slightly where soft material is being actively eroded (Saggerson, 1991)

4.4 Hydrogeology and Soils

In general groundwater in volcanic rocks is limited to fractures and erosion levels within the volcanic succession. Fresh lavas are usually not water bearing because of their massive and impervious nature. The most significant aquifer system west of the project area is the Upper Athi Series aquifer system. This is the main aquifer for boreholes in Nairobi and Kiambu areas and is composed of tuffs, lakebeds and sediments. Other aquifers in this area are found in the weathered inter-lava layers and in fractured zones.

The rocks in the Nairobi area mainly comprise a succession of lavas and Pyroclastic of the Cainozoic age and overlying the foundation of folded Precambrian schist's and gneisses of the Mozambique belt (Saggerson, 1991). The crystalline rocks are rarely exposed but occasionally fragments are found as agglomerates derived from former Ngong volcano. The soils of the Nairobi area are products of weathering of mainly volcanic rocks. Weathering has produced red soils that reach more than 50 feet

(15m) in thickness (Saggerson, 1991). A number of subdivisions are recognized in the Nairobi area according to drainage, climatic regions and

Slopes and other categories have been introduced for lithosols and regosols.

A geotechnical investigation of the soil within the project site was conducted and the following findings and recommendations were made:

Based on the findings of the investigation, we recommend that the near surface strata examined is not suitable for the proposed new apartment foundations since it is a mixture of Brownish Silty Clay and plant roots. Foundations to the new buildings can be placed on isolated pad foundations designed to exert the pressures as indicated below. The bearing strength figures are based on the shear strength of the soils. It is recommended that a final verification of the same using plate bearing tests is carried out on proposed founding levels at the beginning of the construction stage to check the values against acceptable settlement in order to rule out local weak areas caused by the shelving of foundation materials. The safe bearing capacities and depths are as follows:-

- 150 kN/m2 at 2.0 metres below ground level.
- 200 kN/m2 at 3.0 metres below ground level.
- 225 kN/m2 at 4.0 metres below ground level.

The foundations in the area near the swamp would require protection from potential ingress by ground water. Therefore, adequate provisions with regards to the cover to the Foundation reinforcements are necessary. Finally, it was recommended that the foundation excavations be back-filled above the foundations with well compacted material and the surface at ground level must be paved and sloped away from the foundations to ensure that rain water does not pond above the foundations and permeate below them. Based on the Recommendations of Road Design Manual Part 3, the moderate plastic nature of the Brown Silty Clay mixed with Murram, it is suitable as both foundation and road backfill material.

4.5 Biological Environment

This section describes key biological elements, including the identification and distribution of dominant, rare and unique flora and faunal species within the region of concern (proposed project site and other potentially affected areas).

4.5.1 Flora

Natural vegetation in Nairobi has been cleared to pave way for the establishment of both residential and commercial developments. The natural vegetation in the area has thus been greatly modified. The remnants of the natural vegetation of the site and its environs are few scattered trees and shrubs as well as grass. The site has exotic plants and the proponent is encouraged to do a lot of landscaping to provide greenery and maintain a healthy environment.

4.5.2 Fauna

This will look at the aquatic and wetland faunal species as well as terrestrial species. The site is situated within a commercial/ residential zone where human activities have altered the natural habitat for animals over the years. The principal source of water for this region is surface water from the Athi drainage basin

The project's effect may seem insignificant to such lives but it is of great concern to the environment at large. It is expected that the area will be populated by small mammals such as mice, rats, moles and other members of the Rodent Family. Bird species were also observed at the site. None of the faunal species observed are rare or endangered.

4.6 Socio-economic Environment

Kenya's real gross domestic product (GDP) grew by 5 .8per cent in 2005 against a revised growth of 4 .9 percent in 2004 (CBS 2006). The major growth sectors were agriculture and forestry; transport and communications; manufacturing; and wholesale and retail trade. Economic growth is expected to be sustained in 2006. Nairobi is a major contributor to Kenya's economy: it generates over 45 per cent of GDP; employs 25 per cent of Kenyans and 43 per cent of the country's urban workers (UN-Habitat 2006). The paradox is that the financial capacity of the Nairobi City County is extremely limited, largely because of poor resource management and a weak revenue collection system. As a result, there is a 200 per cent shortfall between the revenue collected per capita ($7 on average) and per capita expenditure ($21) (UN Habitat 2006)

4.6.1 Land use:

Urban land use refers to spatial distribution of social and economic activities. Accordingly, an up-to-date land use inventory is frequently required to facilitate urban planning and growth patterns as well as monitoring of urban expansion. A study by the Department of Resource Surveys and Remote Sensing (DRSRS 1994) identified eight major land-use classes in Nairobi. These include Residential Use

Industrial, commercial and service centres, Infrastructure land use, Recreational areas, urban agriculture as well as Water bodies and riverine areas.

4.6.2 Economic Activity:

The economy and the environment are closely linked, as natural resources are the basis of production, manufacturing and waste disposal. Environmental resources such as forests, water and land have a vital role to play in boosting economic growth and reducing poverty. While it may be argued that economic growth brings many benefits to people, the attendant pollution loading and resource depletion poses great risks to human health and the environment. If not

Managed properly this may even jeopardize the viability of the economic activities being supported. Nairobi is a major contributor to Kenya's economy: it generates over 45 per cent of GDP; employs 25 per cent of Kenyans and 43 per cent of the country's urban workers (UN-Habitat 2006). The paradox is that the financial capacity of the Nairobi City County is extremely limited, largely because of poor resource management and a weak revenue collection system. As a result, there is a 200 per cent shortfall between the revenue collected per capita ($7 on average) and per capita expenditure ($21) (UN Habitat 2006).

4.6.3 Population

Population is a major driver of environmental change in Nairobi and as such is a determinant of other parameters such as solid-waste-generation rates, land-use patterns and settlement, and water consumption. The population of Nairobi grew from 8,000 in 1901 to 118,579 in 1948 (Rakodi 1997). By 1962, the city had a population of 343,500 people, although some of this could be attributed to extension of the city's boundaries. Between the 1948 and 1962 censuses, the population grew at an average rate of 5 .9 per cent per annum, compared with 7 .6 per cent in the previous 12-year period. The population of Nairobi city according to 2019 census was 4,397,073. Taking the 2019 census figures as a baseline, it is projected that the city's population by the next census in 2029 will be about 5.9 million.

4.6.4 Employment Trend

As Nairobi's population increases, so does the demand for jobs. Currently, 63 per cent of women and 71.8 per cent of men aged between 15 and 50 are economically active. Currently, the formal and informal sector employment percentages in Kenya stand at 16.2% and 83.8% respectively. It is

estimated that about 1 people join the labour force annually. Recent labour survey in Kenya indicates that Roughly 87.2% to 90% of all new jobs created are in the informal sector, highlighting a continuous struggle to generate formal, white-collar positions.

4.6.5 Socio-economic Importance of the proposed project

The proposed project is in line with the governments' housing policy that aims to facilitate the attainment of adequate shelter and healthy living environment to all socioeconomic groups in Kenya. The project will therefore help to increase settlement in the region by investing in the construction industry; the proponent will also contribute towards the economic growth of our nation through revenue collection. In particular, the proposed project will generate the following positive socio-economic impacts:

1. The proponent will rent the residential cum commercial development to the public. The proposed project will therefore serve as a source of income to the proponent thereby improving their living standards
2. During the operation phase of the project, the proponent will be required to pay tax to the government hence contributing to the economic growth of our nation
3. The proposed project will indirectly contribute towards enhancement of security in the neighbourhood of the area
4. The proposed project will generate revenue to the County through payment of connection and service fee.

Apart from the direct employment of construction workers, the proposed project will also benefit the following categories of individuals:

- Transporters. Investors on lorry and trailer transport will benefit greatly from the project. This benefit will extend to vehicle dealers and manufacturers, lorry drivers and turn boys.
- Cement Manufacturers. The local cement manufacturers and their employees and shareholders are direct beneficiaries of the development.
- The government will also get some impressive increase in V.A.T. and other taxes levied on cement.
- Manufacturers and dealers of other building materials. Most of the building materials to be used are locally manufactured. Relevant companies, their workers and shareholders will be direct beneficiaries of the development.

- Sand Harvesters. Locals involved in sand harvesting in sand harvesting are to be major beneficiaries of the project. The benefit will extend to the local authority entitled to levy taxes on sand transporters.
- Ballast Quarries. There will be massive use of ballast. These will ensure that the Quarry owners and workers benefits greatly.

4.7 Water Resources

Although Nairobi relies mainly on surface water supplies, the sources of these supplies lie outside the city. The surface streams, though numerous, are heavily contaminated by domestic and industrial effluents and solid wastes. Naturally rivers are expected to cleanse themselves as they move downwards, but this is not the case with the Nairobi River and its tributaries, because there are many sources of organic pollution along the river.

Even when water is available, it is often unsuitable for human consumption, and boiling it is expensive. Poor water quality and its high cost may contribute to malnutrition, child mortality and exposure to water-borne diseases and also impede efforts to reduce hunger and poverty. The natural groundwater quality is generally good and reaches the drinking water standards for most constituents, except for fluoride, which often exceeds 1 mg/l

4.8 Waste Management.

Waste management is a growing problem in Nairobi. Increasing urbanization, rural-urban migration, rising standards of living and rapid development associated with population growth have resulted in increased solid waste generation by industrial, domestic and other activities. The increase in solid waste generation has not been accompanied by an equivalent increase in the capacity of the relevant urban authorities to deal with this problem. Only about 40 per cent of the waste generated in Nairobi is collected by the City Council of Nairobi, the private sector collects about 20 per cent and the balance is left uncollected, or is disposed of through other means, including by burning, dumping in pits and other unauthorised places, or is collected by the numerous nongovernmental organizations, community-based groups and other ad hoc or voluntary groups (Ikiara 2006). It is estimated that there are at least 60 private companies engaged in solid waste collection services in the city (JICA 1998 in UNEP/NEMA 2005). The existing waste management practices in the neighbourhood of the proposed project site and within the Nairobi City County in general include:

NEMA, in line with the Environmental Management and Coordination (Waste Management) Regulations, 2006 requires all solid waste (unless the generator opts to recycle) to be dumped at approved sites.

The neighborhood of the proposed site relies on private garbage collectors to dispose of solid waste. The Proponent will be required to contract a licensed solid waste transporter to collect and transport solid waste from the site for dumping at approved sites.

CHAPTER FIVE: IMPACT ASSESSMENT METHODOLOGY & ANALYSIS OF ALTERNATIVES

5.1 Introduction

This chapter will describe the impact assessment methodology to be used for this project. The methodology has been developed by the consultant and aims to provide a relatively objective approach for the assessment of potential impacts.

5.2 Methodology

To ensure a direct comparison between various impacts, standard rating scales have been defined for assessing and quantifying the identified impacts. This is necessary since impacts have a number of parameters that need to be assessed. Five factors need to be considered when assessing the significance of impacts, namely:

1. Relationship of the impact to **temporal** scales – the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.

2. Relationship of the impact to **spatial** scales – the spatial scale defines the physical extent of the impact.

3. The severity of the impact – the **severity/beneficial** scale is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party. The severity of impacts can be evaluated with and without mitigation in order to demonstrate how serious the impact is when nothing is done about it. The word 'mitigation' means not just 'compensation', but also the ideas of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable.

4. The **likelihood** of the impact occurring – the likelihood of impacts taking place as a result of project actions differs between potential impacts. There is no doubt that some impacts would occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.

Each criterion is ranked with scores assigned to determine the overall **significance** of an activity. The criterion is then considered in two categories, viz.

- Effect of the activity and the likelihood of the impact.

The total scores recorded for the effect and likelihood are then read off the matrix presented to determine the overall significance of the impact.

- The overall significance is either negative or positive.

5.3 Analysis of Alternatives

5.3.1 The No Action Alternative

The No Action Alternative in respect to the proposed project implies that the status quo is maintained i.e. no construction/development activity to take place. This option is most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. However, the need for such development is high and the anticipated insignificance environmental impacts resulting from construction have already been experienced. This option will however, involve several losses both to the project proponent/land owner and the Kenya society and Government. The property will remain under-utilized or neglected. The No Project Option is the least preferred from the socio-economic and partly environmental perspective since if the project is not done: -

- The economic benefits especially during constriction i.e. provision of jobs for skilled and non-skilled workers will not be realized.
- There will be no generation of income by the developer and the Government.
- The social-economic status of Kenyans and local people would remain unchanged.
- The local skills would remain under utilized
- No employment opportunities will be created for Kenyans who will work in the project area.
- Discouragement for investors to produce this level of standard and affordable development.

5.3.2 The relocation Alternative

Relocation option to a different site is an option available for the project implementation. At the moment, there are no alternative sites for the proposed development (i.e. the project proponent doesn't have an alternative site). This means that the proponent has to look for the land if relocation is proposed. Looking for the land to accommodate the scale and size of the project and completing official transaction on it may take a long period. In addition, it is not a guarantee that such land would be

available. It's also worth noting that the said project is already underway in terms of seeking development approvals in various government departments.

The project proponent would spend another long period of time on design and approvals of the plans by the relevant government departments. The project design and planning before the stage of implementation would call for costs; already incurred in the proposed development i.e. whatever has been done and paid to date would be counted as a loss to the proponent. In consideration of the above concerns and assessment of the current proposed site, relocation is not a viable option. From the analysis above, it becomes apparent that the No Project Alternative is not the appropriate alternative to the local people, Kenyans, and the Government of Kenya.

5.3.3 Alternative Land Use Activities

The area is in a residential zone i.e. used for residence. Alternative land use activities such as farming, grazing land and car repairs will conflict with surrounding land use activities. For uniformity purposes, the proponent is interested in construction of residential houses similar both in form and character to what is exist in the neighborhood (residential houses).

5.3.4 Alternative to Construction Materials and Technology.

There is a wide range of construction and furnishing materials which can be sourced locally and internationally. In this construction, certified raw materials/equipment and modern technology will be used. Also, electrical appliances that save energy will be given first priority. The concrete pillars and walls will be made using locally sourced stones, cement, sand (washed and clean), metal bars and fittings that meet the Kenya Bureau of Standards requirements.

5.3.5 Solid Waste Management Alternatives.

Throughout construction, the project will produce wastes such as soil, wood chips, metal scraps and paper wrappings among other. Wastes to be generated during operation phase are mainly domestic in nature. The Proponent is expected to observe EMCA (Waste Management Regulations, 2006). Priority will be given to reduction of wastes, recycling, and reuse. This will minimize environmental pollution.

5.3.6 Project Design

This Environmental Impact Assessment Project Report is based on information and consultations with the project proponent, the Architect and details contained in the architectural plans and drawings of the project. (***Please see attached copies of Architectural Plans***). The project will entail construction of residential apartments.

CHAPTER SIX: POTENTIAL ENVIRONMENTAL IMPACTS

6.1 Introduction

This chapter outlines the potential negative and positive impacts that will be associated with the proposed project. The impacts will be related to activities to be carried out during construction of the project. The operational phase impacts of the project will be associated with the activities carried out by the residents/tenants, which will be both commercial and domestic. In addition, closure and decommissioning phase impacts of the project are also highlighted.

The impacts of the mixed development project during its life cycle stages (construction, operation and decommissioning) can be categorized into: impacts on the biophysical environment; health and safety impacts; and socio-economic impacts. Construction of the proposed residential apartment's development is likely to present several environmental impacts. These can be either positive or negative.

6.2 Anticipated Environmental Impacts

During the field survey, key impacts both positive and negative relating to the proposed residential and commercial development was identified. They were obtained by making physical observations at the project site as well as existing land use in the neighbourhood.

6.3 Positive Environmental Impacts of Construction Activities

6.3.1 Creation of Employment Opportunities

Several employment opportunities will be created for construction workers during the construction phase of the project. This will be a significant impact since unemployment is currently quite high in the country at large.

6.3.2 Provision of Market for Supply of Building Materials

The project will require supply of large quantities of building materials most, of which will be sourced locally. This provides ready market for building material suppliers such as quarrying companies, hardware shops and individuals with such materials.

6.3.3 Increased Business Opportunities

The large number of project staff required will provide ready market for various goods and services, leading to several business opportunities for small-scale traders such as food vendors around the construction site.

6.3.4 Individual Investment

Economically, the project will be an investment to the proponent. The proposed project once complete can also be used as a collateral asset.

6.3.5 Optimal Use of Land

The development project leads to optimal use of land. Considering the scarcity of serviced land in the larger Nairobi Metropolitan area, the project enhances the returns on the limited land space in the region.

6.3.6 Revenue to Government.

Value Added Tax (VAT) on construction materials/ tools to be purchased and NEMA fees among others will be sources of revenue for the government and its institutions.

6.3.7 Enhanced Security.

During the operation of the project, security will be enhanced in the premise and the houses through distribution of suitable security lights and presence of a security guard. This will lead to improvement in the general security in the surrounding area.

6.3.8 Improved Infrastructure.

Project activities will lead to improvement of transport, sewerage, water supply and telecommunication networks. Such services are a prerequisite to development in any region.

6.4 Negative Environmental Impacts of Construction Activities

6.4.1 Decommissioning of the existing single-dwelling house

Description of the Decommissioning Activities

Decommissioning is an important phase in the project cycle and comes last to wind up the operational activities of a particular project. It refers to the final disposal of the project and associated materials at the expiry of the project lifespan. If such a stage is reached, the proponent needs to remove all materials resulting from the demolition/ decommissioning from the site. For the proposed project to be

implemented, the existing single-dwelling house shall have to be safely decommissioned. The following should be undertaken to restore the environment.

- Remove all underground facilities from the site
- The site should be well landscaped by flattening the mounds of soil and
- Planting indigenous trees and flowers
- All the equipment should be removed from the site
- Fence and signpost unsafe areas until natural stabilization occurs
- Backfill surface openings if practical

6.4.2 Negative Environmental Impacts of Decommissioning Activities

Solid Waste

Demolition of the project small buildings and related infrastructure will result in large quantities of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. In addition, even the generally non-toxic chemicals such as chloride, sodium, sulphate and ammonia, which may be released as a result of leaching of demolition waste, are known to lead to degradation of groundwater quality.

Noise and Vibration

The demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas.

6.4.3 Extraction and Use of Building Materials

Building materials such as hard core, ballast, cement, rough stone and sand required for construction of the housing project 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 of the buildings, 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.

6.4.2 Dust Emissions

During construction, the project will generate substantial quantities of dust at the construction site and its surrounding. The sources of dust emissions will include site preparation and levelling works, and to a small extent, transport vehicles delivering building materials. 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.

6.4.3 Exhaust Emissions.

The trucks used to transport various building materials from their sources to the project site contribute to increases in emissions of CO_2, NO_2 and fine particulate along the way as a result of diesel combustion. Such emissions can lead to several environmental impacts including global warming and health impacts. Because large quantities of building materials are required, some of which are sourced outside Nairobi, such emissions can be enormous and may affect a wider geographical area. The impacts of such emissions can be greater in areas where the materials are sourced and at the construction site as a result of frequent gunning of vehicle engines, frequent vehicle turning and slow vehicle movement in the loading and offloading areas.

6.4.4 Traffic flow during construction

There is a likelihood of increase in traffic on road adjacent to the site during construction (the Nairobi-Mombasa Highway). The trucks used to transport various building materials from their sources to the project site will contribute to increases in emissions of CO_2, NO_x and fine particulate along the way as a result of diesel combustion. Such emissions can lead to several environmental impacts including global warming and health impacts. Because large quantities of building materials are required, some of which are sourced outside Nairobi, such emissions can be enormous and may affect a wider geographical area. The impacts of such emissions can be greater in areas where the materials are sourced and at the construction site as a result of frequent running of vehicle engines, frequent vehicle turning and slow vehicle movement in the loading and offloading areas such trucks may slow down traffic flow.

6.4.5 Noise and Vibration

The construction works, delivery of building materials by heavy trucks and the use of machinery/equipment including bulldozers, generators, metal grinders and concrete mixers will contribute high levels of noise and vibration within the construction site and the surrounding area. Elevated noise levels within the site can affect project workers and the residents, passers-by and other persons in within the vicinity of the project site.

6.4.6 Risks of Accidents and Injuries to Workers

Because of the intensive engineering and construction activities including erection and fastening of roofing materials, metal grinding and cutting, concrete work, steel erection and welding among others, construction workers will be exposed to risks of accidents and injuries. Such injuries can result from accidental falls from high elevations, injuries from hand tools and construction equipment cuts from sharp edges of metal sheets and collapse of building sections among others.

6.4.7 Solid Waste Generation

Large quantities of solid waste (soil) will be generated as a result of excavation of the site. In addition, additional solid waste will be generated at the site during construction of the building and related infrastructure. Such waste will consist of metal cuttings, rejected materials, surplus materials, surplus oil, excavated materials, paper bags, empty cartons, empty paint and solvent containers, broken glass among others. Such solid waste materials can be injurious to the environment through blockage of drainage systems, choking of water bodies 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.

6.4.8 Energy Consumption

The project will consume fossil fuels (mainly diesel) to run transport vehicles and construction machinery. 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 supplied by Kenya Power & Lighting Company (KPLC) Ltd. 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.

6.4.9 Water Use

The construction activities will require large quantities of water. Water will mainly be used for concrete mixing, curing, sanitary and washing purposes. Excessive water use may negatively impact on the water source and its sustainability.

6.5 Positive Environmental Impacts of Operational Activities

6.5.2 Provision of Housing and Commercial Facilities

The project will provide modern Houses with new and state of the art infrastructure to the Nairobi City residents. In addition, modern and affordable commercial spaces and office suits shall be availed. This impact will be significant since the larger Nairobi metropolitan area is currently experiencing a shortage of Housing and commercial facilities for its residents.

6.5.3 Employment Opportunities

Some people will be employed by the project as management agents, caretakers, cleaners, security personnel and technicians.

6.5.4 Revenue to National and Local Governments

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

6.5.5 Improved Security

Security will be ensured around the Houses through distribution of suitable security lights and presence of 24-hour security guards. This will lead to improvement in the general security in the surrounding area.

6.6 Negative Environmental Impacts of Operational Activities

6.6.2 Solid Waste Generation

The project is expected to generate enormous amounts of solid waste during its operation phase. The bulk of the solid waste generated during the operation of the project will consist of paper, plastic, glass, metal, textile, domestic, and organic wastes. Such wastes can be injurious to the environment through

blockage of drainage systems, choking of water bodies and negative impacts on animal health. Some of these waste materials especially the plastic/polythene are not biodegradable may cause long-term injurious effects to the environment. Even the biodegradable ones such as organic wastes may be injurious to the environment because as they decompose, they produce methane gas, a powerful greenhouse gas known to contribute to global warming.

6.6.3 Energy Consumption

During operation, the family units will use a lot of electrical energy mainly for domestic purposes including lighting, cooking, running of air conditioning equipment, running of refrigeration systems, pumping water into reservoirs. Since electricity generation involves utilization of natural resources, excessive electricity consumption will strain the resources and negatively impact on their sustainability.

6.6.4 Water Use

The domestic activities during the operation phase of the project will involve the use of large quantities of water.

6.7 Negative Environmental Impacts of Decommissioning Activities

6.7.2 Solid Waste

Demolition of the project small buildings and related infrastructure will result in large quantities of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. In addition, even the generally non-toxic chemicals such as chloride, sodium, sulphate and ammonia, which may be released as a result of leaching of demolition waste, are known to lead to degradation of groundwater quality.

6.7.3 Noise and Vibration

The demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas.

6.8 Positive Environmental Impacts of Decommissioning Activities

6.8.2 Rehabilitation

Upon decommissioning the project, rehabilitation of the project site will be carried out to restore the site to acceptable status. This will include replacement of topsoil and re-vegetation that will lead to improved visual quality of the area.

6.8.3 Employment Opportunities

Several employment opportunities will be created for demolition and construction staff.

CHAPTER SEVEN: IMPACTS MITIGATION MEASURES

7.1 Introduction

This chapter highlights the necessary mitigation measures that will be adopted to prevent or minimize significant negative environmental, health and safety impacts associated with the activities of the project during its construction, operation and decommissioning phases. Allocation of responsibilities, time frame and estimated costs for implementation of these measures are presented in the environmental management plan (EMP) in Chapter 8.

7.2 Mitigation of Construction Phase Impacts

7.2.1. Efficient sourcing and Use of Raw Materials

The proponent will source building materials such as sand, ballast and hard core from registered quarry and sand mining firms, whose projects have undergone satisfactory environmental impact assessment/audit and received NEMA approval. Since such firms are expected to apply acceptable environmental performance standards, the negative impacts of their activities at the extraction sites are considerably well mitigated.

To reduce the negative impacts on availability and sustainability of the materials, the proponent will only order for what will be required through accurate budgeting and estimation of actual construction requirements. This will ensure that materials are not extracted or purchased in excessive quantities. Moreover, the proponent will ensure that wastage, damage or loss (through run-off, wind, etc) of materials at the construction site is kept minimal, as these would lead to additional demand for and extraction or purchase materials.

In addition to the above measures, the proponent shall consider reuse of building materials and use of recycled building materials. This will lead to reduction in the amount of raw materials extracted from natural resources as well as reducing impacts at the extraction sites.

7.2.2. Minimization of Run-off

The proponent will put in place some measures aimed at minimizing soil erosion and associated sediment release from the project site. These measures will include terracing and levelling the project site to reduce run-off velocity and increase infiltration of rainwater into the soil. In addition, construction vehicles will be restricted to designated areas to avoid soil compaction within the project site, while any compacted areas will be ripped to reduce run-off.

7.2.3. Minimization of Construction Waste

It is recommended that demolition and construction waste be recycled or reused to ensure that materials that would otherwise be disposed of as waste are diverted for productive uses. In this regard, the proponent is committed to ensuring that construction materials left over at the end of construction will be used in other projects rather than being disposed of. In addition, damaged or wasted construction materials including cabinets, doors, plumbing and lighting fixtures, marbles and glass will be recovered for refurbishing and use in other projects. Such measures will involve the sale or donation of such recyclable/reusable materials to construction companies, local community groups, institutions and individual residents or homeowners. The proponent shall put in place measures to ensure that construction materials requirements are carefully budgeted and to ensure that the amount of construction materials left on site after construction is kept minimal.

It is further recommended that the proponent should consider the use of recycled or refurbished construction materials. Purchasing and using once-used or recovered construction materials will lead to financial savings and reduction of the amount of construction debris disposed of as waste. Additional recommendations for minimization of solid waste during construction of the project include:-

i. Use of durable, long- lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time
ii. Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements
iii. Purchase of perishable construction materials such as paints incrementally to ensure reduced spoilage of unused materials
iv. Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste
v. Use of construction materials containing recycled content when possible and in accordance with accepted standards.

7.2.4. Reduction of Dust Generation and Emission

Dust emission during construction will be minimized through strict enforcement of onsite speed controls as well as limiting unnecessary traffic within the project site. In addition, it is recommended that excavation works be carried out in wet weather; and traffic routes on site be sprinkled with water regularly to reduce amount of dust generated by the construction trucks.

7.2.5. Minimization of impacts on traffic flow

The proponent will put in place measures to address such concerns by ensuring that construction vehicles preferably deliver materials during off-peak hours when traffic volume is low. There will also

be provision for caution signs on the access road to alert users on construction activities in progress in order to prevent occurrence of accidents. This will be achieved through proper planning of transportation of materials to ensure that vehicle fills are increased in order to reduce the number of trips done or the number of vehicles on the road. In addition, truck drivers will be sensitized to avoid unnecessary racing of vehicle engines at loading/offloading areas, and to switch off or keep vehicle engines at these points.

7.2.6. Minimization of Noise and Vibration

Noise and vibration will be minimized in the project site and surrounding areas through sensitization of construction truck drivers to switch off vehicle engines while offloading materials. In addition, they will be instructed to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as churches, schools and hospitals. In addition, construction machinery shall be kept in good condition to reduce noise generation. It is recommended that all generators and heavy-duty equipment be insulated or placed in enclosures to minimize ambient noise levels.

7.2.7. Health and safety of Workers on site

The proponent is committed to adherence to the occupational health and safety rules and regulations stipulated in Occupational Health and Safety Act (Cap 514). In this regard, the proponent is committed to provision of appropriate personal protective equipment such as gloves; helmets, overall as well as ensuring a safe and healthy environment for construction workers by providing sanitary facilities (toilets) and portable water while food will be bought by workers from the nearby hotels.

7.2.8. Reduction of Energy Consumption

The proponent shall ensure responsible electricity use at the construction site through sensitization of staff to conserve electricity by switching off electrical equipment or appliances when they are not being used.

In addition, proper planning of transportation of materials will ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts. Complementary to these measures, the proponent shall monitor energy use during construction and set targets for reduction of energy use.

7.2.9. Minimization of Water Use

The proponent shall ensure that water is used efficiently at the site by sensitizing construction staff to avoid irresponsible water usage.

7.3 Mitigation of Operation Phase Impacts

7.3.1 Ensuring Efficient Solid Waste Management

The proponent will be responsible for efficient management of solid waste generated by the project during its operation. In this regard, the proponent will provide waste handling facilities such as waste bins and skips for temporarily holding waste generated at the site. In addition, the proponent will ensure that such disposed of regularly and appropriately. It is recommended that the proponent put in place measures to ensure that the occupants of the Houses manage their waste efficiently through recycling, reuse and proper disposal procedures.

7.3.2 Minimization of Sewage Release

The proponent will ensure that there are adequate means for handling the large quantities of sewage generated by the tenants by directing it to the NCWSC mains sewer line serving the area, and ensuring regular maintenance of the internal drainage system.

7.3.3 Ensure Efficient Energy Consumption

The proponent plans to install an energy-efficient lighting system for the project. This will contribute immensely to energy saving during the operational phase of the project. In addition, occupants of the apartments will be sensitized to ensure energy efficiency in their domestic operations. To complement these measures, it will be important to monitor energy use during the occupation of the houses and set targets for efficient energy use.

7.3.4 Ensure Efficient Water Use

The proponent will install water-conserving automatic taps and toilets. Moreover, any water leaks through damaged pipes and faulty taps will be fixed promptly by qualified staff. In addition, the occupants of the apartments will be sensitized to use water efficiently.

7.4 Mitigation of Decommissioning Phase Impacts

7.4.1 Efficient Solid Waste Management

Solid waste resulting from demolition or dismantling works will be managed as previously described.

7.4.2 Reduction of Dust Concentration

High levels of dust concentration resulting from demolition or dismantling works will be minimized as described in Section 7.2.4.

7.4.3 Minimization of Noise and Vibration

Significant impacts on the acoustic environment will be mitigated as described above.

CHAPTER EIGHT: ENVIRONMENTAL MANAGEMENT PLAN

8.1 Introduction

Integrating environmental issues in business management, such as those related to real estate development is that it increases efficiency while enhancing the project proponent financial and environmental management. These issues, which are normally of financial concern, are: costs, product quality, investments, level of productivity and planning.

Environmental planning and management as a concept seek to improve and protect environmental quality for both the project site and the neighbourhood through segregation of activities that are environmentally incompatible. Environmental planning and management integrate land use structure, social systems, regulatory law, environmental awareness and ethics.

Environmental management plan (EMP) for development projects such as the proposed residential apartment complex development is aimed at providing a logical framework within which identified negative environmental impacts can be mitigated and monitored. In addition, EMP assigns responsibilities for action to various actors, and provides time frame within which mitigation measures can be done.

EMP is a vital output for an environmental impact assessment as it provides a checklist for project monitoring and evaluation. A number of mitigation measures are already incorporated into the project design.

The EMP outlined in Table 8-1 has addressed the identified potential negative impacts and mitigation measures for the proposed residential cum commercial development.

8.2 Environmental Monitoring and Evaluation

Environmental monitoring and evaluation are essential in the project lifespan as they are conducted to establish if the project implementation has complied with the set environmental management standards as articulated in the Environmental Management and Coordination (Amendment) Act (EMCA) 2015, and its attendant Environmental (Impact Assessment and Audit) Regulations, 2003.

In the context of the proposed project, design has made provisions for an elaborate operational monitoring framework for the following among others:

- Disruption of natural environment and modification of microclimate
- Air and noise pollution

- Proliferation of kiosks
- Workers' accidents and health infections during construction process

TABLE 8.1: ENVIRONMENTAL MANAGEMENT PLAN (IMPLIMENTATION PHASE)

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	MONITORING MEASURES
Commissioning of the Construction Works	- Site hand-over and Ground breaking	Project team (Lead Consultant/Architect, contractor /proponent)	Part of/Covered in the Project Cost	Presence of the project Team
Securing the Construction Site	- Construction of Perimeter Wall and Hoarding	Contractor	Part of/Covered in the Project Cost	Presence of Perimeter Fence
Housing for Construction/ Site staff	Construction of Labour Camp	Contractor	500,000	Presence of Labour Camp
Security for Construction Material	- Construction of Site Stores - Construction materials to be delivered in small quantities to minimize storage problems	Contractor	400,000	Presence of Site store
Extraction and Use of Building Materials	- Availability and sustainability of the extraction sites as they are non-renewable in the short term - Landscape changes e.g. displacement of animals and vegetation, poor visual quality and opening of depressions on the surface	Contractor/Proponent/project team	Part of/Covered in the Project Cost	Material site rehabilitation
Collapse of Building during Construction	- Ensuring Building Strength and stability - Use of appropriate construction materials and reinforcements as per specifications	Contractor/project team	Part of/Covered in the Project Cost	Presence of the project Team

	- Ensuring building components are as per designs - Proper supervision - Ensure proper timelines are followed e.g. curing time			
Disturbance of Traffic flow during construction	- Proper signage - Awareness creation - Education to truck drivers	Contractor/Project team and general public	350,000	- Presence of site Notice Board /Hoarding - Presence of Security guards to control traffic - Presence of warning signs and education materials
CONSTRUCTION PHASE				
ENVIRONMENTAL IMPACT	**MITIGATION MEASURES**	**RESPONSIBILITY**	**COST (KES)**	**MONITORING MEASURES**
Scraps material and other debris	Use of an integrated solid waste management system i.e. through a hierarchy of options. Wastes generated as a result of facility decommissioning activities will be characterized in compliance with standard waste management procedures.	Project Manager & Contractor	900,000	Absence of all solid waste

	The contractor will select disposal locations and the local council based on the properties of the particular waste generated.			
Soil Excavation leading to site disturbance	- Excavate only areas to be affected by buildings - Dumping of excess excavated materials to sites designated by NEMA and Council - Restoration of sites Excavated	Contractor	800,000	Landscaping after completion of construction
Soil Erosion	- Create and Maintain soil traps and embankments. - Landscaping after completion of construction	Contractor/Proponent Architect/Site engineer Landscape Architect	600,000	Lack/Absence of Soil Erosion
Noise Pollution and Vibration	- Ensure use of serviced and greased equipment - Switch off engines not in use - Construction work to be confined to between 8am to 5pm - Ensure use of earmuffs by machine operators	Proponent and Contractor	Part of Routine operation procedure	Lack of complaints
Air Quality	- Water sprinkling of driveways or the use of biodegradable hydrant e.g., Terrasorb polymer will reduce dust emission during construction - Ensure servicing of vehicles regularly	Proponent and Contractor	Part of Routine operation procedure	- Lack of complaints - Workers wearing protective clothing and earmuffs
Risks of Accidents and Injuries to Workers	- Education and awareness to all construction workers	Proponent Contractor	Part of Routine operation procedure	- Presence of well-equipped First Aid kit

	- Ensure use of appropriate personal protective clothing - Provide First Aid Kits on site - Ensuring Building Strength and stability - Proper supervision			- Presence of Security Guards on site - Presence of a register on the site
Health and Safety	- Provide First Aid Kits on site - Proper signage and warning to public of heavy vehicle turning - Ensuring Building Strength and stability - Provide clean water and food to the workers - The contractor to abide by all construction conditions especially clause B12 which stipulates health safety and workforce welfare	Proponent Contractor	Part of Routine operation procedure	- Presence of well-equipped First Aid kit - Presence of Security Guards on site - Presence of a register on the site
Solid Waste Generation	- Ensure waste materials are disposed of on Council and NEMA approved sites - Ensure re-use of materials that can be re-used - Use of the 3rs – Reduce, Re-use, Re-cycle	Proponent Contractor	800,000	- Absence of Solid waste on the site
Energy Consumption	- Use electricity sparingly since high consumption of electricity negatively impacts on these natural resources and their sustainability - Use of Standby Generators	Proponent Contractor	500,000	- Presence of KPLC power lines - Presence of Generators

Excessive Water Use	- Excessive water use may negatively impact on the water source and its sustainability	Proponent Contractor	500,000	- Presence of a an internal drainage system - Metering of water
OCCUPATION PHASE				
Architectural incompatibility leading to distortion of neighbourhood aesthetic image	- Harmonize building scale with existing developments in neighbourhood. - Harmonize detail, material and finishes for roofs and walls with existing development in the neighbourhood.	Architect Proponent Contractor	Part of/Covered in the Project Cost	- Compatibility with the neighbourhood
Solid Waste Generation and Management	- Regular inspection and maintenance of the waste disposal systems during operation phase - Establish a collective waste disposal and management system - Provide waste disposal bins to each house well protected from adverse weather and animals - Ensure waste materials are disposed of on Council and NEMA approved sites - Use of the 3rs – Reduce, Re-use, Re-cycle	Proponent Estate Managers	300,000	- Presence of NEMA registered waste management companies - Presence of waste handling bins - Absence of wastes

Liquid Waste Generation and Management	- Regular inspection and maintenance of the waste water disposal systems during the operation phase - Connection to the mains sewer line serving the Woodley area. - Efficient maintenance of the internal drainage system.	Proponent Estate Managers	600,000	- Presence of a of a waste water treatment plant - Absence of liquid waste
Storm water and surface runoff	- Have paved local access road and walkway system - Encourage rainwater harvesting - Provision of increased water storage capacity - Provide adequate storm water drainage system	Contractor Proponent Estate Managers	300,000	- Absence of run-off - Presence of good roads - Pavements and drainage channels
Traffic	- Provide adequate parking facilities within the project site	Contractor/Proponent Residents	Routine operation procedure	- Presence of amble parking in the premises
Increased social conflict	- Increased Housing stock in the area and Kenya - Increased economic activities –employment generation, income earnings and housing capital stock formation - Encourage formation of community policing and formation of neighbourhood associations	Contractor Proponent Neighbourhood associations Estate Managers		
Storm Water impacts	- Provide roof gutters to collect and direct roof water to drains - Construct drains to standard specifications	Proponent Contractor	800,000	Absence of Flooding and dampness in the building

	- Develop a storm water drainage system and linkage to natural drains			
Disruption of existing natural environment and modification of micro-climate – - Increased development density - Increased glare/solar reflection - Reduced natural ground cover/surface run-off - Obstruction of ventilating winds	- Development restricted to follow zoning policy/approved density – building line, plot coverage and plot ratio. - Careful layout and orientation of buildings to respect wind and sun direction. - Adequate provision of green and open space planted with grass, shrub and tree cover. - Minimum use of reflective building material and finishes for roof, wall and pavement.	Project team (Contractor Proponent, Architect or Lead Consultant, etc)	600,000	Proper orientation Planted trees/Landscaping
Insecurity	- Ensure secure perimeter wall where applicable - Have a single entry point that is manned 24 hours	Contractor, Proponent Neighbourhood associations Estate Managers	800,000	Presence of perimeter wall Presence of day and night security guards
DECOMMISSIONING PHASE				

Building Safety	Assess the condition of buildings to ascertain usefulness	Engineer/Proponent	300,000	Engineer and Tests on the building
Land and Building use	Ascertain the Planning development policy	Local Authority Physical Planner	450,000	Consultants present
Accidents/Injuries	Securing the Site by fencing off	Contractor/Proponent	300,000	Presence of perimeter fence
Un-disconnected Services e.g. Power, Water, telephone, sewer etc	Ensure disconnection of all services Remove all surface and underground cables and wiring	Contractor	800,000	Absence of cabling
Solid Waste Generation (demolition waste)	- Ensure waste materials are disposed of on Council and NEMA approved sites - Ensure re-use of materials that can be re-used -Use of the 3rs – Reduce, Re-use, Re-cycle	Proponent/Contractor	500,000	Absence of Debris
Noise and Vibration	- Ensure use of serviced equipment - Switch off engines not in use - Demolition work to be confined to between 8am to 5pm - Ensure use of earmuffs by workers	Proponent/Contractor	800,000	Lack of complaints from the neighbours

CHAPTER NINE: ENVIRONMENTAL HEALTH AND SAFETY (EHS)

9.1 EHS Management and Administration

The EHS is a broader and holistic aspect of protecting the worker, the workplace, the tools / equipment and the biotic environment. It is an essential tool in determining the EIA study. The objective of the EHS on the proposed project is to develop rules that will regulate environmentally instigated diseases and occupational safety measures during construction and the operation phases of the proposed project by:

- Avoidance of injuries
- Provision of safe and healthy working environment for workers comfort so as to enhance maximum output.
- Control of losses and damages to plants, machines, equipment and other products.
- Enhance environmental sustainability through developing sound conservation measures.

9.2 Policy, Administrative and Legislative Framework

It is the primary responsibility of the contractor to promote a safe and healthy environment at the workplace and within the neighborhood in which the proposed project will be constructed by implementing effective systems to prevent occupational diseases and ill-health, and to prevent damage to property. The EHS Management Plan when completed will be used as a tool and a checklist by the contracted engineers in planning and development of the construction of this project.

9.3 Organization and implementation of the EHS Management Plan

The contactor shall use the EHS plan at the proposed project site both during construction and operation. The engineer will use it during construction phase with the assistance of an EHS consultant who shall enforce its provision throughout the life of the project.

9.4 The Guiding Principles to be adopted by the contractor

The company will be guided by the following principle: -

- It will be a conscious organization committed to the promotion and maintenance of high standards of health and safety for its employees, the neighboring population and the public at large.

- Ensuring that EHS activities are implemented to protect the environment and prevent pollution.
- Management shall demonstrate commitment and exercise constant vigilance in order to provide employees, neighbors of the project and the environment, with the greatest safeguards relating to EHS.
- Employees will be expected to take personal responsibility for their safety, safety of colleagues and of the general public as it relates to the EHS management plan.

9.5 EHS management strategy to be adopted by the contractor

The following strategies will be adopted to achieve the above objectives:

- Create an Environment Health and Safety Management committee and incorporate EHS as an effective structure at various levels and units to manage and oversee EHS programs in all construction and operation phases of the project
- Maintain an effective reporting procedure for all accidents.
- Provide appropriate tools and protective devices for the success of the project.
- Encourage, motivate, reward and support employees to take personal initiatives and commitment on EHS.

9.6 Safety Agenda for both the proponent and contractor

There will be a permanent EHS agenda during construction.

(a) Contractors

The EHS management plan code of practice shall be applicable to the contractors working in the premises, and shall be read and signed. It shall be incorporated into the contract to perform work. This should also remind the contractor of his/her;

- Legal requirements.
- Statutory obligations.
- Obligation to lay-down a system for reporting accidents
- Responsibility to ensure that his/her employees are supplied with personal protective equipment and where applicable as per the EHS management plan for the whole project.
- Responsibilities as it relates to contracting an EHS consultant in liaison with the proponent
- Obligation to ensure that he obtains detail of jobs and areas where permit-to-work must be issued

(b) All residents' and workers' responsibility

- Know the location of all safety equipment, and learn to use them efficiently

9.7 Safety requirement at the project site during construction and operation Period

(a) The contractor

The contractor will ensure that:

- Safe means of entry and exit at the proposed project site.
- Ensure adequate briefing of job at hand on the safe system of work before commencement of work.
- The EHS coordinator must be in attendance at all times throughout the duration of the project.
- The EHS consultant must maintain constant assessment of the risk involved as the work progresses
- A safety harness must be worn before entry into all confined spaces
- An EHS consultant must be posted at the entrance at the project site to monitor progress and safety of the persons working at the construction site.

(b) The Traffic / Drivers

Within the construction premises, the following traffic rules will be observed: -

- Observe speed limits and all other signs and obey traffic rules.
- Use the vehicle for the purpose to which it is intended only.

c) Fire hazard at the construction site,

Workers at the site shall ensure that: -

- Oxy-acetylene cylinders are not contaminated with grease or oil.
- Oxy-acetylene cylinders are not subjected to direct sunlight or heat.
- Oxy-acetylene cylinders are not to be used or stored standing in a vertical position.
- When in use, ensure the inclination should never be over 30° from the vertical.

9.8 Welding at the construction site

It is the responsibility of the contractor during construction to: -

- Ensure that welding clamp is fixed such that no current passes through any moving parts of any machine.
- Ensure that all welding clamps are in good operating condition and conduct current without arcing at the point of contact.
- Ensure that welding clamps are free from any contact with explosive vapors i.e. Oil spillage, Fuel tanks, Coal dusts and miscellaneous combustible material (e.g. Cotton rags filter bags, rubber belting, and wood shavings).
- Ensure that any slag or molten metal arising from welding activities does not start up fires by:
    - ✓ Clearing combustible material to a distance of at least 3 meters away from the working area or covering area with metal or asbestos sheet.
    - ✓ Appropriate fire extinguisher is to be kept available for immediate use at all times

9.9 Emergency procedure during construction and operation

An emergency situation means:

- Unforeseen happening resulting in serious or fatal injury to employed persons or the neighbouring communities.
- Fire or explosion.
- Natural catastrophe.

In the event of such an emergency during construction, the workers shall:

- Alert other persons exposed to danger.
- Inform the EHS coordinator.
- Do a quick assessment on the nature of emergency.
- Call for ambulance on standby.
- When emergency is over the EHS coordinator shall notify the workers by putting a message: "ALL CLEAR"

Risks of Accidents and Injuries to Workers

Because of the intensive engineering and construction activities including erection and fastening of roofing materials, metal grinding and cutting, concrete work, steel erection and welding among

others, construction workers will be exposed to risks of accidents and injuries. Such injuries can result from accidental falls from high elevations, injuries from hand tools and construction equipment cuts from sharp edges of metal sheets and collapse of building sections among others. The action plan for risk of accidents and injuries to workers is as provided below:

Impact	**Mitigation measures**	**Responsibility**	**Cost**	**Monitoring measures**
Risks of Accidents and Injuries to Workers	- Education and awareness to all construction workers - Ensure use of appropriate personal protective clothing - Ensure provision of personal protective equipment (PPEs) for all construction workers - Provide First Aid Kits on site - Ensuring Building Strength and stability - Proper supervision	Proponent Contractor	Part of Routine operation procedure	- Presence of well-equipped First Aid kit - Presence of Security Guards on site - Presence of a register on the site
Health and Safety	- Provide First Aid Kits on site - Proper signage and warning to public of heavy vehicle turning - Ensuring Building Strength and stability - Provide clean water and food to the workers - The contractor to abide by all construction conditions especially clause B12 which stipulates health safety and workforce welfare	Proponent Contractor	Part of Routine operation procedure	- Presence of well-equipped First Aid kit - Presence of Security Guards on site - Presence of a register on the site

CHAPTER TEN: DECOMMISSIONING

10.1 Introduction

Decommissioning is an important phase in the project cycle and comes last to wind up the operational activities of a particular project. It refers to the final disposal of the project and associated materials at the expiry of the project lifespan. If such a stage is reached, the proponent needs to remove all materials resulting from the demolition/ decommissioning from the site. The following should be undertaken to restore the environment.

- Remove all underground facilities from the site
- The site should be well landscaped by flattening the mounds of soil and planting indigenous trees and flowers
- All the equipment should be removed from the site
- Fence and signpost unsafe areas until natural stabilization occurs
- Backfill surface openings if practical

The table below shows the proposed decommissioning plan:

Table 10.1 EMP for Decommissioning

Expected Negative Impacts	Recommended Measures	Responsible Party	Time Frame	Cost (KShs)
1. Construction Machinery/Structure & Wastes				
Scraps material and other debris	Use of an integrated solid waste management system i.e. through a hierarchy of options. Wastes generated as a result of facility decommissioning activities will be characterized in compliance with standard waste management procedures. The contractor will select disposal locations and the local council based on the properties of the particular waste generated.	Project Manager & Contractor	During decommissioning	900,000
	All buildings, machinery, equipment, structures and	Project Manager & Contractor	During decommissioning	-

	partitions that will not be used for other purposes should be removed and reused or rather sold/given to scrap material dealers.			
	Where recycling/reuse of the machinery, equipment, structures and other waste materials is not possible the materials should be taken to approved dumpsites.	Project Manager & Contractor	During decommissioning	-
Rehabilitation of project site				
Vegetation disturbance Land deformation: soil erosion, drainage problems	-Implement an appropriate re-vegetation programme to restore the site to its original status. -During the vegetation period, appropriate surface water runoff controls will be taken to prevent surface erosion; -Monitoring and inspection of the area for indications of erosion will be conducted and appropriate measures taken to correct any occurrences; -Fencing and signs restricting access will be posted to minimize disturbance to newly-vegetated areas;	Project Manager & Contractor	During decommissioning	800,000
Social- Economic impacts				

-Loss of income -Loss of housing facilities	The safety of the workers should surpass all other objectives in the decommissioning project. -Adapt a project – completion policy; identifying key issues to be considered. -Compensate and suitably recommend the workers to help in seeking opportunities elsewhere. -offer alternative housing facilities	Project Manager & Contractor	During decommissioning	400,000

CHAPTER ELEVEN: PROJECT COST

The proposed project shall cost **Ksh. 1,250,099,660**

CHAPTER TWELVE: CONCLUSION AND RECOMMENDATIONS

12.1 Overview

From the foregoing analysis, the social and economic rating for this project is highly positive. Evaluation of alternatives has already shown that options are limited and costly. Already the proponent has sunk a substantial amount of money in the project up to design stage. Further delay of the project is denying all stakeholders the anticipated benefits of the investment. On the other hand, redesigning or relocation will lead to loss of time and money that is already tied in the preliminary costs of the project. The project does not pose any serious and negative environmental impacts. Adequate mitigation measures have been proposed to address any of the negative impacts arising from the project. The project will create employment and improve income earnings. The project will boost the diminishing housing supply in the country and more in urban areas.

During the preparation of this report for the proposed residential cum commercial development it is observed and established that most of the negative impacts on the environment are rated low and short term with no significant effect. The positive impacts are highly rated and will benefit all stakeholders and the Nairobi City residents at large. The project proponents have proposed to adhere to prudent implementation of the environmental management plan. They are obtaining all necessary permits and licenses from the relevant authorities and have qualified and adequate personnel to do the project as proposed. They have proposed adequate safety and health mitigation measures as part of the relevant statutory requirements

12.2 Conclusion

This study is recommendable and should be approved by NEMA for issuance of an EIA license subject to annual environmental audits after it has been completed and occupied. This will be in compliance with the Environmental Management and Coordination (Amendment) Act of 2015 and the Environmental Impact Assessment and Audit regulations, 2003. Above all the proponent should carry out Environmental Audit 12 months after the project is completed.

The proponent should therefore be licensed to implement this project subject to adherence to the environmental management plan proposed in this report and the statutory requirements.

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