ENVIRONMENTAL IMPACT ASSESSMENT

STUDY REPORT

FOR

THE PROPOSED RESIDENTIAL SERVICED APARTMENTS DEVELOPMENT ON L.R. NO. 330/168 ALONG MBAAZI AVENUE, THOMPSON ESTATE, NAIROBI CITY COUNTY.

This Environmental Impact Assessment (EIA) Study Report is submitted to the National Environment Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination Act, 1999 and the Environmental (Impact Assessment and Audit) Regulations, 2003

Project Proponent:

AHCOF INVESTMENTS (KENYA) COMPANY LIMITED,
P.O BOX 22592-00100,
NAIROBI.

The following expert(s) conducted the assessment and prepared this EIA Study Report

Name of the Expert	Designation	Reg. No.	Signature
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For and on behalf of:

AHCOF INVESTMENTS (KENYA) COMPANY LIMITED,

P.O BOX 22592-00100,

NAIROBI.

Signed: _____ Date: _____

Name…….....

Designation.....

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Table 1: Acronyms and Abbreviations Used in This Report

°C	Degree Celsius
NCC	Nairobi City County
CO_x	Carbon Oxides
CPD	City Planning Department
DPC	Dump Proof Courses
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management Coordination Act
EMP	Environmental Management Plan
ERPs	Emergence Response Plans
Ha	Hectare
IEA	Initial Environmental Audit
IEM	Integrated Ecosystem Management
Φ	Diameter
L.R	Land Reference
NEAPC	National Environment Action Plan Committee
NEC	National Environment Council
NEMA	National Environmental Management Authority
NO_x	Nitrogen Oxides
OHS	Occupational Health and Safety
PCC	Public Complaints Committee
PPE	Personal Protective Equipment
PV	Permanent Vent
RC	Reinforced Concrete
SEM	Sustainable Environmental Management
SERC	Standard and Enforcement Review Committee
TOR	Terms Of Reference
WCC	Waste Collection Centre
WRT	With Respect To

EXECUTIVE SUMMARY

INTRODUCTION

Globalization, urbanization, migration and technological advancements have continued to drive cities forward right from their infant stages, the cyclic processes, growth, through to their renewal and regeneration. More and more people are moving and positioned themselves in cities for business, work, venturing forth and recreation. The demand for Residential space development situation in Kenyan (urban areas) has remained under tremendous pressure. Both the government and private sector have had a role to play with the government servicing the land and leaving it to private entrepreneurs to develop. The provision of housing has not kept pace with the said phenomenon.

However, the Kenyan government has with great concern realized the pressure for residential/ accommodation sites which have great implication on the service industry and on housing (especially on urban shelter) and has introduced a policy aimed at providing over 150,000 house unit per year; but in line with physical planning policies- Policies in the physical planning and housing sectors are aimed at increasing the supply of standard housing units, water supply and sanitation, channelizing the urbanization and assuring proper urban development and management

AHCOF INVESTMENTS (KENYA) COMPANY LIMITED, herein after referred to as proponent have realized the said opportunities in the Kenya's service industry and housing sector. It has proposed to develop a residential serviced building (**160No. apartment units**). The project is proposed on plot **L.R. No. 330/168 located along Mbaazi Avenue opposite the entrance of Heritage Court, Thompson Estate, Nairobi City County.**

For a long time, policy makers directed all efforts in economic development without due regard to the resource base on which the economic development depend on. As a result, there has been unprecedented environmental degradation due to lack of environmental conservation resulting to unsustainable development. More recently, investors and developers, spurred on by regulators world over, have recognized the need for change in order to safeguard the environment.

Reference to this, *environmental concerns* have now been integrated in the planning and implementation processes of any proposed projects in Kenya. The key objective is to mitigate

conflicts with the environment at the vicinity during implementation and operation phases. In addition, it is now mandatory for Environmental Impact Assessments (EIAs) to be undertaken on projects of such magnitude and nature; to enhance *Sustainable Environmental Management* as well as controlling and revitalizing the much-degraded *environment*. The environmental management is regulated by the National Environmental Management Environment (NEMA) in Kenya.

Pursuant to the prevailing legal requirements as envisaged in the Environmental Management and Coordination Act (EMCA), 1999 and to ensure sustainable environmental management, *the proponent* undertook this EIA on the *proposed project's site*; and incorporated substantial environmental aspects as advised by NEMA. This EIA Study report thus provides relevant information and environmental considerations on the project proponent's intention to seek approval from NEMA for the development of the proposed project. Environmental Experts who are registered by the Authority conducted the assessment.

SCOPE, OBJECTIVES AND TERMS OF REFERENCE

The major objective of the EIA study is to evaluate the effects/impacts of proposed development in relation to the environment i.e. physical, biological, and social-economic environments. It aims at influencing the protection and co-existence of the development with the surroundings as well as the compatibility of the proposed development to the area; to ensure and facilitate sustainable environmental management during construction and occupation phases.

The scope of the assessment study covered the physical extent of the project site and its immediate environs, construction works of the proposed development, installation of basic utilities/facilities and services as required by the physical planning. The output of the study was the production of an Environmental Impact Assessment study report for submission to NEMA for the purposes of seeking an EIA license.

PROJECT DESCRIPTION

The development will be in three blocks with Block A, B, C having No 40, 80, 40 residential serviced units respectively. Thus the *total units are 160*. The total plinth area will be 18420 SQM having a plot coverage and plot ratio of 35 per cent and 3.53 respectively.

A brief description of the proposed development is as follows:

a. **The ground floor** will be used for parking having 130 parking bays. It will also have generator and transformer rooms, underground water tank, control room, 5No stores, refuse room, gatehouse and a pump room.
b. **The mezzanine floor** will be used for parking and will comprise of 56No. parking bays and 2No stores.
c. **1st floor** comprises of:
    - 8 typical 2 bedroom units with each unit having a lounge, kitchenette, washrooms and 2No bedrooms.
    - 8 typical 1bedroom units with each unit having a lounge, kitchenette, washrooms and 1 bedroom.
    - Gym, swimming pool, changing rooms and a lounge
d. **2nd to 10th floor levels** will be typical and will comprise of:
    - 8 typical 2 bedroom units with each unit having a lounge, kitchenette, washrooms and 2No bedrooms.
    - 8 typical 1bedroom units with each unit having a lounge, kitchenette, washrooms and 1 bedroom.
e. **Other features** include; 2No lift shafts on each block, staircases, children play area, electrical and mechanical ducts and landscaped gardens/green spaces

SOCIO- ECONOMIC (POSITIVE) IMPACTS OF THE PROJECT

The proposed development has positive impacts to both the proponent and general society. The benefits will be experienced during construction and occupation phases. They include the following:

※ Provision of houses, hence increase in the national/local housing stock and quality. This is in line with the government policy of providing housing and standard housing infrastructure to the society to the tune of 150,000 house units per year

※ The optimal use of land i.e. increased utility of the parcel of land, which is currently vacant.

- ※ Boost local investment; to both government and the proponent. The proponent will benefit through renting of housing spaces and the government through levies and taxes.
- ※ Creation of market for goods and services. Many secondary businesses are also likely to spring up during the construction phase especially those providing foods and beverages to the construction workers.
- ※ Provision of employment during both construction and occupational phases.

ISSUES OF CONCERN ASSOCIATED WITH PROJECT IMPLEMENTATION

Against the background of the above positive impacts, there are a few issues of concern anticipated from the implementation of the subject project. These shall be experienced during implementation/construction phase, operation/occupation phase and decommissioning phase. They include *soil degradation*; *air quality; noise; oil wastes; water resources; solid and liquid waste management; drainage, terrestrial ecology, visual and landscape; traffic; public comfort; occupation, health and safety (OHS); and energy.*

The **impacts** have been elaborated as follows:

- ※ Clearing of the vegetative cover (grass) from the site to pave way for implementation of the project
- ※ Impact to soil (including soil erosion) especially when laying the foundation and other earthworks.
- ※ Increased noise and vibration mostly during construction phase.
- ※ Impact (constraints/pressure) to the existing infrastructure i.e. water, power, surface drains, roads among others.
- ※ Increased waste generation (both solid and liquid) during construction and operational/occupation.
- ※ Increased storm water/ run off resulting from the roof catchments and as a result of decreased recharge areas, after pavement of most areas.

- ※ Air pollution as a result of dust particles emanating from cement, excavation and construction activities. Exhausts from the involved machinery will lead to increased levels of noxious gases.
- ※ The health and safety of workers and immediate residents and neighbours may be compromised in case of occurrence of incidences, pollution and disturbance

Proposed potential mitigation measures

To minimize the occurrence and magnitude of the negative impacts, mitigation measures have been proposed against each of the anticipated impacts. Other measures have been integrated in the project designs with a view to ensuring compliance with applicable environmental laws and guidelines. The measures include the following:

- ※ Careful siting, planning and implementation processes- to ensure that it is sympathetic to its surroundings and is in line with city county's physical planning and construction standards.
- ※ Soil compaction and watering of loose soils on all unpaved access paths/roads, cleared surfaces, construction materials at the site to minimize air pollution (suppress dust) and erosion by the agents of soil erosion i.e. water and wind.
- ※ Erection of warning / informative signs at the site during the implementation phase, and traffic control along the connecting road.
- ※ To avoid strain on water supply, the contractor should employ water conservation measures such as water reuse, water harvesting and use of run-off for construction purposes (where applicable), minimisation or avoidance on misuse of water and provision of rainwater harvesting systems to the entire roof catchments of the proposed project.
- ※ To cater for surface drainage, well-designed drain channels should be installed to harmonize management of the resulting storm water within the site. The drains should be installed to channel the run-off to the drainage system. The drains should be regularly maintained and covered with gratings to avoid accidents and dirt entry. *Storm water/ runoff will be greatly reduced by rainwater harvesting and storage.*

- ※ To reduce noise pollution, portable barriers to shield compressors and other small stationary equipment (where necessary) should be installed; sensitize workers on the need to switch off engines whenever possible; ensure that the machinery are well maintained; install silencers whenever possible and ensure that the work is carried out between specified time i.e. 8a.m. and 5p.m.
- ※ Proper and regular tuning and maintenance of construction machinery/equipment to minimize emission of noxious fumes and noise emanating from friction of the rubbing metal parts. Vehicle/machinery idling should be minimized/controlled. The maintenance should be conducted in appropriate and designated service bays to reduce chances of contamination of environment by resulting oils and greases. Any of such oils should be collected and disposed appropriately.
- ※ Workers should be provided with full protective gear (PPE) to beef up on their health and safety standards and they should be sensitized on health, safety and environmental conservation aspects. The site should be fenced off during construction to keep off animals and the general public.
- ※ To reduce the health and safety risks, effective emergence response plans should be adapted both during implementation and operation phase. There should be a specific area for hazardous material storage, machinery maintenance activities and refuelling and these should be clearly indicated and adhered to.
- ※ The Sewerage system should be properly designed, installed (using approved materials and standards) and regularly maintained to effectively drain effluent into trunk system of NWSCo.
- ※ Provision of sound waste management systems and procedures. During implementation phase, the contractor should put in place effective and efficient waste disposal systems. Waste, including excavated soil and debris should be properly disposed-off by backfilling or dumping in approved grounds by the City County and NEMA. The proponent/contractor should provide acceptable and standard sanitary conveniences to the workers during the construction.

- ※ Comprehensive landscaping should follow on completion of the proposed development to prevent soil erosion and upgrade the site to its appropriate environmental standard.
- ※ Adapt the proposed Environmental Management and Monitoring Plans involving all relevant stakeholders during implementation phase and inhabitants, during operation phase.

CONCLUSION AND RECOMMENDATIONS

The analysis of the EIA study indicates that the proposed project has significant benefit to the local and national service industry and housing sector. The analysis reveals that the benefits far outweigh the associated costs and negative impacts. The benefits include increase in quality urban housing facilities, creation of employment opportunities, increase utility of the land, creation of employment opportunities especially during project implementation phase, increase in government revenue and improvement of local standards of living. Nevertheless, the project will come with some negative impacts such as increased pressure on existing infrastructure, pollution (to air, water and soil) mostly during construction phase, increased waste (solid and liquid) generation and effect on ecology (flora)

In relation to the proposed mitigation measures that will be incorporated during implementation and occupation phases; the project's input to the Kenyan housing sector; and cognizance of the fact that the project proponent is environmentally conscious, the subject project is beneficial and important for a developing country (like Kenya). It is our recommendation that the proponent be granted EIA licence to implement the project. Major concerns should nevertheless be geared towards minimizing the occurrence of impacts that would degrade the general environment. This will however be overcome through close following and implementation of the outlined Environmental Management and Monitoring Plans (EMPs); which have been strategically packaged with key environmental sustainability elements, tailored toward enhancing the adoption of *Integrated Ecosystem Management (IEM)*. This will form the (now) widely accepted keystone of the environmental action agenda.

CHAPTER 1

1.0 INTRODUCTION

1.1 GENERAL OVERVIEW

Kenyan key urban areas have, for the last two decades, experienced increased population due to rapid rural-urban migration and natural internal growth. During the same period, there has been a rapid development especially in the Capital City-Nairobi. Both the government and private sector have had a role to play; with the government servicing the land and leaving it to the private entrepreneurs for investment. As a result (of the said urbanization), the demand for residential houses having great implications on standard housing infrastructure and housing has drastically increased. Fortunately, the Government has with great concern realized the situation. It has therefore come up with a strong policy aimed at multiplying housing space being a service industry and urban housing to the tune of approximately 150,000 house units per annum. In addition, it has realized the fundamental effort by the private sector and individuals in bridging this gap.

In line with the above, *AHCOF INVESTMENTS (KENYA) COMPANY LIMITED, herein* after referred to as *proponent* has proposed to *develop 160No. Residential serviced units*. The proposed project will be located on **plot LR No. 330/168 along Mbaazi Avenue opposite Heritage Court, Thompson Estate, Nairobi City County.**

The project will enhance provision of quality housing facilities and contribute to the government's housing policy. The project will optimize land use and its utility; in line with the local physical planning. It will also provide employment especially during construction phase. It will create a market for goods and services (construction inputs) which include raw materials, construction machinery and labour. Many secondary businesses are also likely to spring up during the construction phase; especially those providing foods and beverages to the construction workers.

Environmental concerns have now been integrated in the planning and implementation processes of any proposed projects; to mitigate conflicts with the environment at the vicinity. In addition, it is now mandatory for Environmental Impact Assessments (EIA) to be undertaken on projects of such magnitude and nature to enhance *Sustainable Environmental Management* as well as controlling and revitalizing the much-degraded *environment*.

Pursuant to the prevailing legal requirements as envisaged in the EMCA, 1999 and to ensure sustainable environmental management, *the proponent* undertook this EIA; and incorporated substantial environmental aspects as advised by NEMA. This *EIA study report* thus provides relevant information and environmental considerations on the project proponent's intention to seek approval from NEMA for the implementation of the proposed project. Environmental Experts who are registered by the Authority (NEMA) conducted the assessment.

1.2 OBJECTIVES OF THE EIA

Environmental Impact Assessment (EIA) is a process having the ultimate objective of providing decision makers with an indication of the likely environmental consequences of a proposed activity. The main objectives of this EIA therefore include the following:

i. To identify and evaluate the significant environmental impacts of the project
ii. Evaluate the impacts of the various alternatives on the project
iii. Propose mitigation measures for the significant negative impacts of the project on the environment.
iv. Generate baseline data for monitoring and evaluating impacts, including mitigation measures during the project cycle.
v. Highlights environment issues with a view to guiding policy makers, planners, stake holders and government agencies to make environmentally and economically sustainable decisions
vi. To incorporate environmental management plans and monitoring mechanisms

1.3 TERMS OF REFERENCE (TOR)

This Environmental Impact Assessment considered the following aspects and others that proved of significance during the study.

a. Location of the proposed project
b. A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project.
c. The objectives of the proposed project.

d. The technology, procedures and processes to be used, in the implementation of the project.

e. The materials to be used in the construction and implementation of the project.

f. The products, by-products and waste to be generated by the project.

g. A description of the potentially affected environment.

h. Analysis of alternatives including project site, design and technologies.

i. An environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures.

j. Propose measures to prevent health hazards and to ensure security in the working environment for the employees, residents and for the management in case of emergencies.

1.4 SCOPE OF EIA STUDY

The EIA study includes an assessment of impacts of the construction and operations on the following:

a. Description of the proposed project
b. Baseline information (Biophysical and Socio-Economic environment, land use and zoning approval, etc)
c. Assessment of the potential environmental impacts on the project area
d. A review of the policy, legal and administrative framework
e. Development of the mitigation measures and future monitoring plans.
f. Proposition of alternatives
g. Occupational Health and Safety –OHS

1.5 METHODOLOGY

Following a preliminary visit of the proposed site, the following was undertaken:-

i. Screening of the project, a process that identified the project as being among those requiring EIA under schedule 2 of the EMCA 1999,
ii. A scoping exercise that identified the key issues to be addressed in the assessment.

iii. Documentary review on the nature of the proposed activities, policy and legal framework, environmental setting of the area and other available relevant data/information.

iv. Public participation and discussions with the local community, proponent and architects.

v. Physical investigation of the site and the surrounding areas using a pre-prepared checklist identifying possible environmental and human safety issues that are likely to be affected,

vi. Reviewing the proposed project designs and implementation plan/schedules with a view to suggesting suitable alternatives,

vii. Developing an environmental management plan outline with responsibilities, schedules, monitorable indicators and time frames among other aspects,

viii. A comprehensive report including issues as listed in the Environmental (Impact Assessment) Regulations 2003.

CHAPTER 2

2.0 PROJECT DESCRIPTION, DESIGN AND IMPLEMENTATION

2.1 NATURE OF THE PROJECT

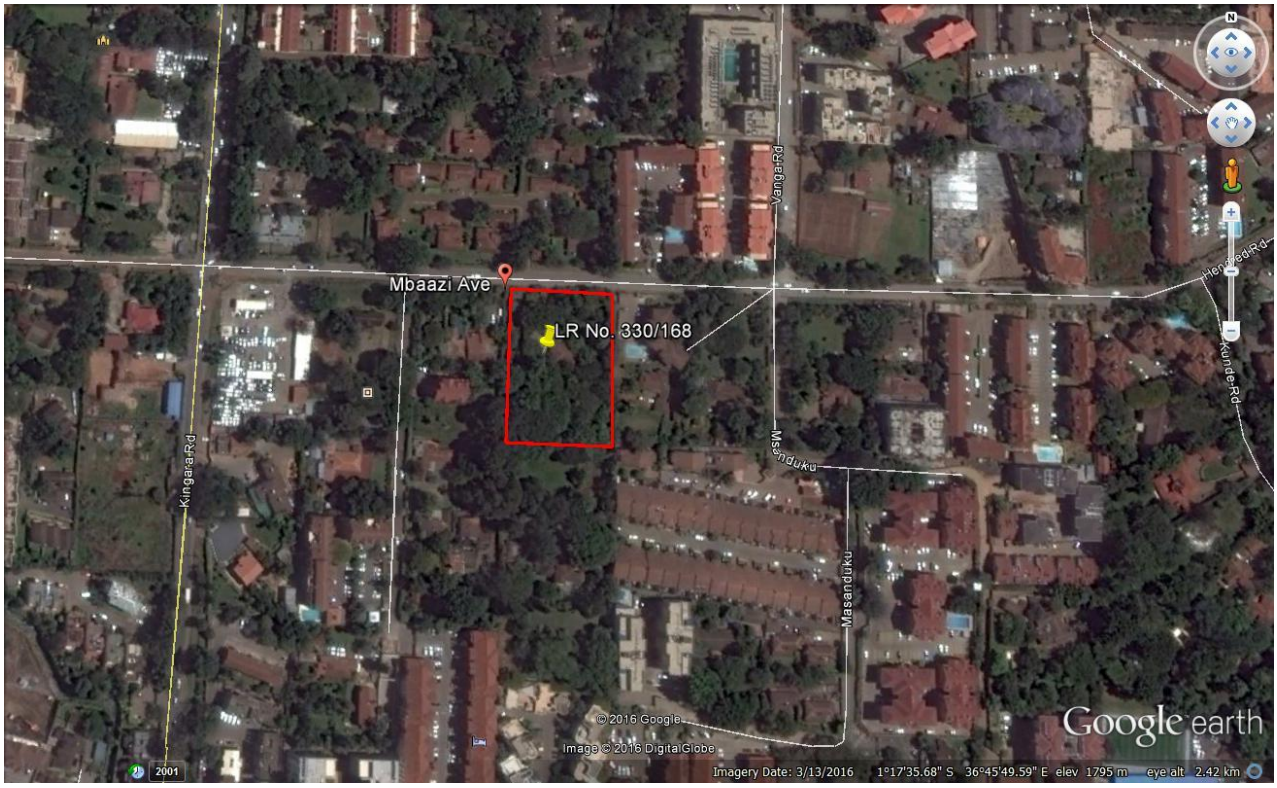
The proposed project is development of residential serviced (apartments). The new development aims at providing more habitable housing infrastructure, to maximize on the utilization of the land i.e. it aims at increasing the utility of the land. There currently exists a residential house on the plot. It is, however, not occupied and will be demolished to give way for redevelopment of proposed development.

The project will provide *one hundred and sixty (160) residential serviced units*. It (project) has standard infrastructure as required by among others, the County Physical Planning Department.

2.2 LOCATION OF THE PROJECT

The proposed project's site is in *Thompson area* of Nairobi City County. The site **L.R. No. 330/168** is located along Mbaazi Avenue opposite Heritage Court. It measures approximately 1.001 Acres. The area is zoned for mixed use development (apartments, offices, institutions etc.)

Plate 1: Site Location



2.3 OWNERSHIP AND ZONING

The parcel of land on which the subject development is proposed is held on freehold interests and registered under the Land Registration Act, 2012 as L.R. No. 330/168. It is registered under the names *AHCOF Investments (Kenya) Company Limited*, the project proponents, who are hereby seeking EIA licence for the proposed project - *see a copy of title in the annex*.

2.4 PROJECT DESCRIPTION

The development will be in three blocks with Block A, B, C having No 40, 80, 40 residential serviced units respectively. Thus the total units are 160. The total plinth area will be 18420 SQM having a plot coverage and plot ratio of 35 per cent and 3.53 respectively.

A brief description of the proposed development is as follows:

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c. **1st floor** comprises of:
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    - 8 typical 1bedroom units with each unit having a lounge, kitchenette, washrooms and 1 bedroom.
e. **Other features** include; 2No lift shafts on each block, staircases, children play area, electrical and mechanical ducts and landscaped gardens/green spaces

More/fine details of the development, Specifications and features of the proposed project have been given. (*The details are found in the copies of the architectural drawings attached as Annex).*

2.5 PROJECT DESIGN AND IMPLEMENTATION

2.5.1 Overview of the Project

The project will involve architectural, civil/structural, mechanical, and electrical works associated with the site construction. The major components of the project include Design, Construction, Commissioning, Operation and Decommissioning.

It is anticipated that these operation**s** will have adverse impact on the environment .Hence, this EIA study report has been prepared to analyze the project in order to determine the impacts and establish mitigation measures.

2.5.2 Components of the Project

The project has the following five phases with each phase having a set of detailed components.

2.5.2.1 Design phase

This will involve:-

- Preparation of architectural drawings including elements of mechanical/electrical and structural designs.
- Selection of best design and approval of the drawings and designs

Architectural drawings showing the features and specifications to be used in the project have been annexed to this report.

2.5.2.2 Pre-construction phase

Feasibility studies will be carried out to determine soil stability and other site characteristics to guide and inform the construction phase. Temporary structures will be put up to act as site office and the existing residential house will be demolished.

2.5.2.3 Construction phase

The building will be constructed based on applicable building standards of Kenya. Other building standards which will also be incorporated include British Building Standards *BS 8110, BS 5950, BS4449, BS4461 etc.* The development shall also incorporate environmental guidelines, health and safety measures.

Construction Inputs

The project inputs include the following:

※ Construction raw materials i.e. sand, cement, stones, crushed rock (gravel/ ballast), ceramic tiles and other ceramic fittings, steel and wooden fixtures and fittings, glass, steel metals, timber, roofing materials, painting materials among others. All these should be obtained from licensed dealers, especially those that have complied with the environmental management guidelines and policies.

※ Construction machines including machinery such as trucks, concrete mixers, and tools and other relevant construction equipment. These will be used for the transportation of materials, clearing of the site and construction debris. Most of the machinery will use electrical and petroleum products to provide energy.

※ A construction labour force of both skilled and non-skilled workers. These will require services such as energy, water supply and sanitation facilities.

※ Water for construction purposes.

※ Power from the mains grid or provided by generators.

Construction Activities

The construction activities include the following

※ Demolition of the existing house structure and disposal of the debris

※ Procurement of construction materials from approved dealers.

※ Transportation of construction materials and debris using heavy and light machinery

※ Appropriate storage of the construction materials.

※ Site clearing, excavation and filling and laying of foundation

※ Construction works i.e. masonry works/building works including, finishes, fixtures and fittings.

※ Disposal of debris/ materials. All debris and excavated materials will be dumped on sites approved by the Municipal Engineer.

- ※ Electrical, civil, and water engineering and sanitary works. These will be done by qualified and registered expertise.
- ※ Landscaping works and earth works mostly on completion of the proposed development.
- ※ Completion of the development and occupation.

2.5.2.4 Final inspection

The final inspection will be carried out to ensure that the project has been accomplished in conformity with the terms set out in the approvals by all the statutory bodies and contract. It will be undertaken by the statutory bodies, project proponent, the architects, engineers, and the contractor and will involve verification of the architectural, mechanical, civil/structural, and other details of the project. After critically inspecting the project, the team will prepare a list of what requires to be corrected by the contractor. Upon completion of corrections, and if no new defects are noted, the job will declared officially completed.

Finally, a certificate of completion and/or occupancy will be issued by Nairobi City County. At this point; the inspection will factor in the health and safety considerations of intended occupants.

2.5.2.5 Operation

The activities that will take place during the operation phase will strictly comply with the designated and approved use.

2.5.2.6 Products, By Products and Wastes to Be Generated By the Project

It is anticipated that the project will generate a variety of products, by-products and wastes during its construction and operational phases. The characteristics of the products, by-products and wastes are discussed in this section.

a) Products

The final product will be a residential serviced block with 160 housing units.

b) By-Products

The by-products will be disposed-off as follows.

1. Debris: The debris generated during the demolition of the existing house will be re-used where appropriately and/ or disposed at designated dumping sites.
2. Soil: The soil generated during excavation will be reused elsewhere in the project. Unusable soil will be transported for disposal at designated dumping sites.
3. Pieces of timber/wood: Large pieces of timber/wood generated during the construction phase will be transported back to the contractor's yard for reuse in future while the small pieces of timber/wood will be disposed-off for use as fuel for cooking and heating.
4. Empty cans and drums: These will be used to store water during construction. The damaged ones will be disposed-off to registered scrap metal and plastic waste dealers.
5. Excess sand, ballast and stock piles: These can be used for future construction activities e.g. renovations. Upon completion of the project, these will be moved by the contractor to a suitable yard.

2.5.2.7 Decommissioning Phase of the Project

With time, the structures within the scheme will either partly or wholly need to be demolished to reflect changes in land use. This will depend on the planning and developmental changes and priorities prevailing over time. The need to decommission the structures may also arise from the deterioration of the state of the buildings due to age.

Decommissioning strategies to be adopted include;

a) Assess the prevailing planning and development policy in application in the area to determine the appropriate use of the land
b) Assessment of the condition of the buildings to determine appropriate use or disposal of materials
c) Prepare a demolition plan
d) Apply for approvals to the relevant agencies
e) Issue vacation notices to all the affected residents/tenants.
f) Fencing of the site.
g) Disconnection and removal of utilities e.g. water pipes, electricity and telephone cables

h) Remove all the underground facilities like water pipes, sewer drainage pipes, electricity and telephone cables
i) Mechanical demolition of the structures
j) Reuse or sell the salvaged materials.
k) Disposal at designated county government disposal sites.
l) Leveling and planting of grass and flowers.

The completion of the decommissioning should ensure that the site is safely restored to its original natural state as much as possible; this will thus open an opportunity for another development cycle.

2.6 PROJECT BUDGET AND DURATION

The proposed project is estimated to cost f**ive hundred and twenty two million one hundred and forty nine thousand shillings (522,149,000)**

The project implementation works is estimated to take 2 years to complete

NEMA fees= 0.1% equals 522,149/=

CHAPTER 3

3.0 BASELINE CONDITIONS

3.1 PHYSICAL ENVIRONMENT

3.1.1 Climate

Nairobi has no real winter or summer. For the greater part of year the days are sunny and nights cool and pleasant. The long rains occur in March / May while the short rains from the end of October to the mid December.

During the rainy season, it usually warm sunny and showery. Mean precipitation ranges from 156.0 to 1134.0 mm/month. Hottest periods are usually during January, February, September and October with temperatures getting as high as 30^0 C while the coolest periods are between June-July and December with temperatures as low as 10^0 C.

3.1.2 Topography

The proposed project's site gradually slopes towards the southern part of the property. However, the proposed works will have little or no influence to the movement of surface materials (mostly soil) once set loose-during earth works.

3.1.3 Soils

The soils on the site are red volcanic in nature which are well drained and easy to work on during construction.

3.1.4 Water Resources and Wetlands

There is no water resource such as a river or stream bordering the proposed site. Although there is a river located approximately 500 metres from the site, measures will be taken to curb erosion and pollution of any water body.

The project proponent intends **to drill a borehole** to supplement water provided by the NWSCo. However, this will be done after conducting a hydrological survey and seeking licenses from the relevant authorities including WRMA and NEMA. The proponent will also adhere to the relevant provisions of EMCA (Water Quality) Regulations 2006 when abstracting the underground water.

3.2 BIOLOGICAL ENVIRONMENT

The proponent has reserved ample space for tree planting and landscaping to compensate for affected vegetation and further improve the environment. Adequate measures will be taken to conserve and preserve the ecosystem.

3.2.1 Flora:

The site is generally characterized by shrubs and trees. There are 37 mature trees and 29 others which are not mature. The ones along the boundary, 28 mature and 8 which are not mature, will be conserved. Some of the trees will be cut to pave way for the proposed development and measures will be taken to replant observing the necessary relevant policies. The developer will seek tree cutting permit from relevant authorities before carrying out the activity.

Plate 2: Trees within the plot

Source: field study, 2016

3.2.2 Fauna:

There are different species of birds and animals such as eagles, monkeys' e.tc. The deliberate preservation of the trees will not interfere with the ecosystem.

3.3 SOCIO-ECONOMIC ENVIRONMENT

3.3.1 Land Use

The neighborhood is generally characterized by a mix of different uses. Mostly, Thompson is a residential area with a mixture of middle and high density housing. The housing typology consists of mainly bungalows, flats and townhouses. Although most of the developments have been maintained at low levels, the trend appears to be changing with developers constructing multiple story buildings (residential and commercial).

3.3.2 Educational

The area also has seen an increasing number of other developments, such as educational institutions, churches and the general commerce sector. This is due to the increased demand arising from the incoming population.

The different education facilities found in the area include; Nursery Schools (such as Little Paws Montessori House and Lavington Kindergarten); Primary Schools (Makini Primary School and Riara Group of Schools School); International Schools (Nairobi International School and Braeside School); Secondary Schools (St. Deborah Girls' High School, Lavington Secondary School and Makini Secondary School); and Colleges (Eden Tuition and Study Center, Strathmore).

3.3.3 Public purpose (Church)

Religious institutions in the neighborhood include Emmanuel Baptist Church-Lavington and Seventh Day Adventist Church.

3.3.4 Commercial Activities

These activities are concentrated along the main Gitanga Road and include shopping malls such as Valley Arcade and The Junction Mall which has shops, mpesa shops and banks. Other commercial activities in the area include banks and light industry (petrol station). Banks in the shopping centre include Family Bank, Equity Bank and Jamii Bora Bank.

3.3.5 Security

Security in the area is provided by the nearby Muthangari Police Station and Kilimani Police Station which are located approximately 3km from the site. However, the proponent will beef securing by employing guards 24 hours and installation of CCTV cameras at strategic points within the premises.

3.3.6 Health

The major health institutions in the neighborhood are Nairobi Women's Hospital, The Karen Hospital and Melchizedek Hospital.

3.4 INFRASTRUCTURE

3.4.1 Roads and accessibility

The proposed project's site is located in an area served with good road network; and is well connected to the main roads networks-i.e. ***Mbaazi Avenue, Kingara road and Gitanga road***. The accessibility of the site will be instrumental during project implementation process and occupation phase. A traffic impact assessment was conducted by Apex consultants and it reveals that the development will not have detrimental influence on the community. The entrance and exit have designed to avoid any unnecessary gridlock along Mbaazi avenue.

Plate 3: Mbaazi Avenue Accessing the Plot

Source: field survey 2016

3.4.2 Water supply

The general area is served with water supplied by Nairobi Water and Sewerage Company. The developer intends to connect to the main water supplier. However, due to the noted inconsistencies in the delivery of the commodity from the supply company, the developer intends to:

- Make arrangements with registered water vendors to supply the commodity (water) to the site in case of short-fall in the normal supply.
- Install standard roof water collection systems for the roof catchments of the proposed building blocks. These include gutters, down pipes and suitable water storage tanks for the harvested rainwater. It will greatly help in minimizing pressure on the existing water supply.
- Drill a borehole to supplement the supply

Plate 4: Water meter and water tank

Source: field survey 2016

3.4.3 Sewer System

The general area is served with public sewerage system of NWSCo. The proponent therefore intends to connect to the trunk sewer for sewerage disposal. The internal sewer system of the proposed project will be suitably designed to collect all effluent / waste water from the development. All sanitary works will be done to the entire satisfaction of local authority and Ministry of Health, Public Health Office.

3.4.5 Surface Drainage

The surface water/run-off will mainly be absorbed within the site i.e. open areas. However, increased surface run-off is anticipated from roof catchments of building structure; drive way and parking, which are partially impervious. Therefore as rain falls much water/run-off is anticipated due to slight decrease in recharge areas. In connection to this, the volume of water reaching the *drain system* will be large and as such it greatly influences the design of effective surface drainage system of the proposed project.

In line with the above, surface drainage systems will effectively be designed and installed to manage the storm water such as may be derived from the parking, driveways and roof of the building blocks. Open (concrete drainage-inverted concrete drains) channels will be used to drain the excess surface water/storm into the public drainage system along the access road.

Plate 5: NWSCo manhole and Open Drains along the road

Source: field survey 2016

3.4.6 Solid Waste Management

Increased solid waste generation (from the project) is anticipated mainly arising from the construction activities (wooden, glass, plastics, and sanitary litter etc.). The sources include the following:-

i. Debris resulting from the existing house structure to be demolished.

ii. Debris resulting from earth works and minimal vegetative materials to be cleared to pave way for the proposed project.

iii. All *stony,* wooden and glass materials resulting from related activities, during implementation of the proposed project.

iv. Plastic materials resulting from such works as sewerage, drainage and water systems, electricity works etc.

v. Sanitary litter as generated during implementation and occupation of the project.

vi. Kitchen materials and other refuse especially on the occupation of the proposed project

All debris generated during project implementation process will be disposed suitably into the approved dumpsite or as directed by the Engineer, Ministry of Works.

Handling of wastes during occupation phase shall be fundamentally considered and especially through inclusion of Waste Collection Centre (WCC) at the entrance to the site. This shall enhance *storage, collection, transportation and disposal* of all solid waste of the entire project, on occupation.

3.4.7 Energy

Construction machineries will require fuels (petroleum) during construction phase. Electrical power will come in handy; in driving the selected construction machinery. Energy will also be needed during occupation phase (on completion of the project). The general area and the proposed site in specific is supplied with electricity from the national grid *(see plate 5 below)*. The proposed development will be connected (KPLC) on completion of the proposed project upon obtaining requisite permits.

In addition to the above, the need for energy conservation will be emphasized during construction and occupation phases. During occupation phase, the use of energy conserving appliances (i.e. LED bulbs) and renewable energy sources such as solar energy will be encouraged. The roof top of the development is designed to accommodate for solar harnessing.

Plate 6: Powerlines

Source: field survey 2016

3.4.8 Communication

The area is well covered by communication facilities such a Telkom, Safaricom, Airtel, YU among others. All these will facilitate communication during the project cycle.

3.4.9 Security

There will be a single gate to the proposed project, which will be fully manned 24 hours. The entire site will also be banded with a perimeter fence.

CHAPTER 4

4.0 PERTINENT ENVIRONMENTAL LEGISLATIVE AND REGULATORY FRAMEWORK

4.1 INTRODUCTION

The law has made provisions for the establishment of the National Environmental Management Authority (NEMA), which has the statutory mandate to supervise and co-ordinate all environmental activities. The Environmental Management and Co-ordination Act (EMCA) 1999, and the Environmental Impact Assessment and Audit Regulations, 2003, are the legislation that governs Environmental Impact Assessment (EIA) studies.

Policies and legislation highlighting the legal and administrative requirements pertinent to this study are presented below.

4.2 NATIONAL ENVIRONMENTAL ACTION PLAN (NEAP)

According to the Kenya National Environmental Action Plan (NEAP, 1994) the Government recognized the negative impacts on ecosystems emanating from development programmes that disregarded environmental sustainability. Established in 1990, the plan's effort was to integrate environmental considerations into the country's economic and social development.

Under the NEAP process EIA was introduced and is nowadays a requirement for any proposed project.

4.3 THE ENVIRONMENT MANAGEMENT AND COORDINATION ACT, 1999

The Act entitles every person in Kenya to a clean and healthy environment and aims to safeguard and enhance the environment.

This Environmental Impact Assessment (EIA) Study Report is submitted to the National Environment Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination Act, 1999 and the Environmental (Impact Assessment and Audit) Regulations, 2003.

EMCA, 1999 provides for the establishment of an appropriate legal and institutional framework for the management of the environment and related matters. It is a framework environmental legislation that establishes appropriate legal and institutional mechanisms for the management of

the environment. It provides for improved legal and administrative co-ordination of the diverse sectorial initiatives in order to improve the national capacity for the management of the environment. This is in view of the fact that the environment constitutes the foundation of national economic, social, cultural and spiritual advancement.

According to section 58, sub-section 1of the Act and the environmental (Impact Assessment and audit) Regulation, 2003, all new enterprise and projects must undergo Environmental Impact Assessment (EIA). The EIA study report is submitted to the National Environment Management Authority (NEMA) in the prescribed form, and accompanied by the prescribed fee.

This EIA study report thus provides relevant information and environmental considerations on how the project proponent's intends to safeguard and enhance the environment at the site and in the immediate neighbourhoods during project implementation and occupation phases.

4.4 WASTE MANAGEMENT REGULATIONS 2006

Part II of the Act says "(1) No person shall dispose 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 off 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".

The contactor/proponent shall ensure that all solid waste generated on/from the site is suitably disposed into the approved waste disposal sites.

4.5 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 the promotion of the country's socio-economic progress, it also recognizes the by-products of these processes as wastewater. It, therefore, calls for the development of appropriate sanitation systems to protect people's health and water resources from pollution.

The project's internal wastewater system will be connected to a trunk sewer. This will ensure safe wastewater disposal.

4.6 OCCUPATION HEALTH AND SAFETY ACT (OSHA), 2007

The Act makes provision for the health, safety and welfare of persons on work places. The provision requires that all practicable measures be taken to protect persons in work places from potential Hazards. The provisions of the Act are also relevant to the management of hazardous and non-hazardous wastes, which may arise from/in workplaces.

For developments such as construction projects , the Act is important as it requires project proponents to have adequate management procedures of occupational safety and health at the work places. For safe construction works, the contractor and project managers should ensure the following:

- *Provision of personal protective equipment (PPE), fire safety, electrical safety, and other precautions essential for safe construction work.*
- *Provision of physical barriers and solid separators (dust barriers, hazard barriers, temporary walkways, among others, as explained in the extract of the Act.)*
- *Inspection of construction equipment to ensure that they are in good working condition before beginning a job. In addition, the contractor/proponent will ensure that regular inspections and maintenance of the equipment are conducted accordingly.*

4.7 THE PHYSICAL PLANNING ACT, CHAPTER 286

The act was promulgated in 1996 and under (section 36) it is concerned with land use and development control matters, to ensure orderly and sustainable development. The statute stipulates the procedure for preparation of local short and long term physical development plans. It also provides procedures for urban renewal or re-development plans. It aims at guiding the development in the whole country irrespective of the land tenure limitations. It helps to reinforce the EMCA in the sense that it is a requirement according to section 36 for any project proposals submitted to any local authority for development permission to have an EIA report undertaken, if the local authority considers the activity of the project to have injurious impact on the environment.

Section 30 (1) of the Act stipulates that no person shall carry out development within the area of a local authority without a development permission granted by the local authority under section 33.

Section 29 of this Act provides for development control. It empowers the local authority to prohibit or control the use and development of land and buildings in the interests of proper and orderly development of its area.

The council is further empowered by the Act to reserve and maintain all the land planned for open spaces, parks, urban forests and greenbelts in accordance with the approved physical development plan.

The Act further states that, No licensing Authority shall grant, under any written law a license for commercial or industrial or occupation of any building or in respect to any premises or land, for which no development permission has been granted by the respective local authority.

The site proposed for the residential serviced apartments is in an area already developed into mixed use.

The proposed project has to be approved the department of the city Planning in Nairobi before commencement of the implementation works

4.8 PUBLIC HEALTH ACT- (REVISED 1986)

The public health Act regulates activities detrimental to human health. The owner(s) of the premises is responsible for environmental nuisances such as noise and emissions, at levels that can affect human. Section 115 of this Act state 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 be injurious or dangerous to health. Such nuisance or conditions are defined under section 118 as waste pipes, sewers, drains or refuse pits in such state, situated or constructed as in the opinion of the medical officer of health to be offensive or injurious to health.

Part 9 of the Act deals with sanitation and housing, and it's of most significance for the control of polluting discharges.

It is accordance with this Act that we have developed an Environmental Management Plan (EMP) to ensure safety of workers, Neighbors and passersby

a) Health

Under health, there should be provision of suitable protective clothing and appliances including where necessary, suitable gloves, footwear, goggles, gas masks, and head covering, and maintained for the use of workers in any process involving expose to wet or to any injurious or offensive substances

b) Safety

Special precaution against gassing is laid down for work in confined spaces where persons are liable to be overcome by dangerous fumes. Air receivers and fittings must be of sound construction and properly maintained.

c) Welfare

Section 55 provides for the development and maintenance of an effective programme of collection, compilation and analysis of occupational safety. This will ensure that health statistics, which shall cover injuries and illnesses including disabling during working hours, are adhered.

To achieve this, systems on the management of both solid and liquid waste (effluent) will be adopted as proposed in the report. In addition, the development has been approved by the public heath office in Nairobi.

4.9 WATER QUALITY REGULATIONS, 2006 (LEGAL NOTICE NO. 121)

Water Quality Regulations apply to water used for domestic, industrial, agricultural, and recreational purposes; water used for fisheries and wildlife purposes, and water used for any other purposes. Different standards apply to different modes of usage. These regulations provide for the protection of lakes, rivers, streams, springs, wells and other water sources. The regulation says that "all sources of water from domestic uses shall comply with standards set in the First Schedule of these Regulations". *For the proposed project, the proponent shall connect the entire internal wastewater system to a NWSCo sewer trunk (proposed by the proponent) to ensure safe wastewater disposal.*

4.10 SOLID WASTE MANAGEMENT LEGAL NOTICE NO. 121

The Environmental Management and Coordination Legal Notice No 121 on (waste management) provides for the responsibility of waste generator, cleaner production methods, segregation of waste by generator, waste transportation license, responsibility of a waste transporters, transportation of waste by licensed transporters, license for disposal facility, waste treatment by operators of disposal sites, requirement for environmental audit and re-use and recycling plants. The legal notice further provides mitigation measures to industrial wastes and their treatment. The hazardous and toxic wastes have been specified by the legal notice that also provides for various requirements of EIA. Details on how hazardous and toxic wastes have to be handled, stored, treated, transported and even provision of permits. This has to apply to pesticides and toxic substances, biomedical wastes and radioactive wastes whereby collection, transportation, storage, treatment and disposal of them have been specified. The legal notice further specifies of offences, penalties and operation that have to be followed when dealing with any waste.

The proponent shall use the services of a private registered solid waste collection company to collect and dump all the solid waste generated from the proposed site. Temporal solid waste handling containers shall be provided on site and protected from rain and animals where residents will collect their solid waste before it is dumped to the council's designated dumpsite.

CHAPTER 5

5.0 DESCRIPTION OF THE EXISTING AND ANTICIPATED IMPACTS

5.1 EXISTING IMPACTS

There is no any notable negative environmental impact on the proposed site at the moment.

5.2 ANTICIPATED IMPACTS

Impacts can be positive or negative, direct or indirect. The magnitude of each impact is described in terms of being significant, minor or negligible, temporary or permanent, long-term or short-term, specific (localized) or widespread, reversible or irreversible. Some impact mitigation has already been addressed in the proactive design and other mitigations can only be guaranteed through active, responsible management, helped by following the guidelines in the project environmental management plan.

These qualities are indicated in the assessment tables as follows:

Key	Type of Impact	Key	Type of Impact
++	Major positive impact	+	Minor positive impact
--	Major negative impact	-	Minor negative impact
0	negligible/ zero impact	NC	no change
Sp	specific/ localized	w	Widespread
R	Reversible	ir	Irreversible
Sh	short term	L	long term
T	Temporary	p	Permanent

On the basis of information gathered during the field study, potential environmental impacts of the project are tabulated below.

Table 2: ANTICIPATED ENVIRONMENTAL IMPACTS

Impacts on or due to	Construction phase	Occupation phase	Remarks
Changes in land use- extent	0	0	There will be no significant change in land use. The area is zoned for mixed use. A change of use has been obtained from single dwelling to multiple dwelling (Flats).
Changes in hydrology	-	0	No effect to the orientation of the hydrology of the general area. However, the proponent wants to drill a borehole to supplement the water supplied by NWSCo.
Pollution: **Air/ dust** **Noise** **Oil waste**	 - , t - , t - , t	 0 - -	During construction: dust and exhaust emissions from involved machinery may affect air quality; construction activities, hooting of the involved vehicles and workers may generate noise and (vibration) which may have some effect to the neighbourhoods Petroleum oils and grease as used in vehicles and construction machinery may spill or leak on/into the ground; hence into the soil or water system(s).
Site drainage	-/0	+/0	Run -off will result from the increased impervious surfaces (roof catchments) of the proposed building blocks, paved areas such as parking and drive ways. Due consideration should be applied to the surface drainage systems of the entire site and roof catchments. The use of *rainwater harvesting systems* and suitable storage facilities will help in reducing run-off volumes within the land and in the public drain system.
Soil erosion	- L, sp	0	Earthworks (during construction) will have some impact on soil erosion. Incorporating appropriate soil conservation measures and proper drainage facilities during construction would mitigate the impacts. During occupation phase, soil erosion will not be a

			problem since the site will be fully and suitably landscaped
Water resources	- sh	+	NWSCo will be the main supply of water commodity during construction phase. This may create some changes in the flow mostly during slabs lying/formation; which demand a lot of water. The occupational phase of the proposed project will bring in additional population within the area and hence additional water users. Some pressure to the water supply is thus expected. The use of rainwater from the roof catchments can however ease the anticipated pressure. The proponent should provide suitable rainwater harvesting systems (gutters, down pipes, storage facilities) to each house unit.
Vegetation/ Flora	- sh sp	0	Although there is no vegetation of conservation value on site, the mature trees located on the plot boundaries will be conserved. Landscaping will be done within the site to improve site appearance.
Fauna	- t	0	There will be minor / temporary disturbance to small animals/bird life due to noise from construction activities.
Public Health	- t ir	NC	During construction, increased dust, noise and air pollution levels could impact on public health, particularly in the direct impact zone. During the occupation phase, there will be no change compared to present conditions with regard to pollution.
Sites of cultural Value	0	0	There are no sites of cultural, historic or traditional significance.
Visual intrusion	- t/p	+/- p	During construction, visual intrusion is attributed to construction works including construction traffic. Impacts can be mitigated through controlling the operating hours of construction traffic, clearing debris after construction and landscaping.
Construction materials	-	0	Building stone will be required for the construction of the project. Other materials will include steel, plumbing materials etc. All

			these should be sourced from legalised/registered commercial suppliers who are environmentally sensitive. Undesirable, hazardous or unauthorized materials should not be used.
Construction waste	- sh sp	0	Construction waste will be minimal. Proper disposal of generated waste is necessary; the waste should be disposed into the approved dumpsites.
Clean on completion	- sp	0	The contractor should ensure that when works are completed, the site is left clean and tidy.
Positive impacts	+ +, t	++ p	Increased quality housing facilities Creation of jobs for skilled and non-skilled workers- employment opportunities will be provided during the period. Increased government revenue Direct and indirect boost on local business during construction phase.

5.3 ISSUES OF (ENVIRONMENTAL) CONCERN POTENTIAL MITIGATION MEASURES

The construction of housing projects involves a series of distinct yet interdependent physical operations. These include site clearing, excavation works, building works etc. All are potentially significant sources of particular impacts.

This part includes impacts during implementation/construction phase, occupational phase and decommissioning phase on the following issues: *soil degradation*; *air quality; noise; oil wastes; water resources; solid and liquid waste management; drainage, terrestrial ecology, visual and landscape; traffic; public comfort; occupation, health and safety (OHS); and energy.* Most of these key issues were identified during the scoping exercise and are clearly elaborated as follow:

5.3.1 Soil Erosion

This is the loss of the top-most soil material (on the earth surface) down slope (by run-off) or transportation by the use of machinery or other equipment including animals.

In this particular project soil erosion will not be a major environmental issue of concern since there will be no major excavation or leveling to be done. However, it is important to note that the project will involve digging of trenches and hence soil disturbance; exposing and setting it loose to the agents of soil erosion.

Potential Mitigation Measures

- ※ Provide soil erosion control measures i.e. suppressing open surfaces with water or use of soil erosion control structures on soil-erosion prone areas within the site. Loose soil should be protected from erosion agents such as run-off (water), human, animal and wind.
- ※ Avoid unnecessary excavations and other soil disturbances that can predispose it to the agents of erosion.
- ※ Avoid unnecessary movement of soil materials from the site.
- ※ Control over construction activities especially during rainy / wet conditions
- ※ Re-surface open areas on completion of the project and introduce appropriate vegetation.

5.3.2 Noise and Vibration

Noise is unwanted/undesirable sound that can affect job performance, safety, and health. Psychological effects of noise include annoyance and disruption of concentration. Physical effects include loss of hearing, pain, nausea, and interference with communications when the exposure is severe.

Construction activities of this nature are agents of noise pollution, affecting the immediate environment. Such noise emanate from construction machinery and equipment i.e. concrete mixers, excavators, workers, trucks and other vehicles accessing the site. It also affects small animals and bird life.

Potential Mitigation Measures

- ※ Use of noise suppressors or silencers on noisy equipment or noise shields i.e. corrugated iron sheet structures.
- ※ Construction works should be carried out only during the specified time i.e. from say 0800 hrs to 1700 hrs.

- ※ Machineries should be maintained regularly to reduce noise resulting from friction.
- ※ Workers should be provided with suitable Personal Protective Equipment (PPE) such as earmuffs when operating noisy machinery and when in noisy environment.
- ※ There should not be unnecessary horning of the involved machinery.
- ※ Provision of a bill board at the construction site/gate notifying of the construction activity and timings.

5.3.3 Increased water demand

Water is nowadays a major issue of concern. The proposed project may cause some strain to the existing water supply since construction activities are known to be heavy water consumers. Both workers and the construction works will create additional demand to the supply in some ways. On occupation, the subject project will also bring in additional population, hence some impact to the water supply.

The proponent however wants to drill a borehole to supplement water supplied by NWSCo.

Potential Mitigation Measures

- ※ The contractor should use water bowsers and tankers to bring in water for construction activities i.e. during periods of high water demand (i.e. during slab formation). Water fetching should however be subject to authorization by the local water authority.
- ※ Install water conserving taps that turn-off automatically when water is not in use.
- ※ Encourage water reuse/recycling during construction and occupation phases.
- ※ Roof catchments of building blocks should be provided with rainwater harvesting systems (gutters, down pipes and water storage facilities) to enhance collection and storage of the resulting run-off. Such water can be used in watering flower gardens, general cleaning etc
- ※ Provide notices and information signs to sensitize on means and needs to conserve water resource i.e. '*Keep/Leave the Tap Closed'*, etc. This will awaken the civic consciousness of the workers and residents with regard to water usage and management

- ※ On a policy level, the government should make the rainwater harvesting facilities affordable through tax incentives such as Zero ratings or scrapping of VAT on such facilities.

5.3.4 Increased Energy Demand

There will be increased use of energy due to increased energy users during construction and occupation phases. Energy conservation is thus fundamental.

Energy conservation involves optimum use of petroleum products (diesel and gasoline), electrical appliances (equipment), lighting systems and other electric machinery as used for different purposes. It also includes use of renewable energy sources.

Potential Mitigation Measures

Electrical appliances

- ※ Switch electrical appliances when not in use.
- ※ Optimize operations of electrical equipment to enhance energy conservation.

Lighting

- ※ Put off all lights immediately when not in use or are not needed. At end of functions take necessary measures to switch off lights immediately.
- ※ Use energy conserving electric lamps for general lighting.
- ※ Make use of alternative source of energy such as solar power, which is renewable. The proponent should include solar power systems to the block.

5.3.5 Sewage and effluent

Effluent/sewage resulting from areas such as sanitary facilities and kitchen is of significant concern with respect to the environment. It should never come into contact with the surrounding i.e. water, soil, air etc. It should always drain effectively into the sewerage systems; via well designed (closed) and laid pipe networks. For this particular project, the resultant effluent will be drained public sewer system.

Potential Mitigation Measures

- ※ The design of the internal sewerage system should consider the estimate discharges from individual sources and the cumulative discharge of the entire project i.e. it should have the capacity to consistently handle the loads even during peak volumes.
- ※ All drain pipes passing under building, driveway or parking should be of heavy duty PVC pipe tube encased in concrete surround. All manholes on drive ways and parking areas should have heavy-duty covers set and double sealed airtight; as approved by specialists.
- ※ Sanitary facilities should be kept clean always, through regular washing/cleaning.

5.3.6 Surface Drainage

The drainage of the general site comes in handy to enhance effective flow of the much anticipated surface run-off emanating from the roof catchments and other impermeable areas within the site. The drainage of the storm water will be greatly compromised especially if it rains, since storm water drain channels will not be present during construction phase.

Potential Mitigation Measures

- ※ During construction, the designs should ensure that surface flow is drained suitably into storm water drains to control flooding within the site. It is therefore wise to provide temporary surface water drainage systems during this period. This will in addition help in minimizing chances of water stagnation and spreading into neighbourhoods.
- ※ During occupation phase, surface run-off will significantly be reduced by inclusion of rain water harvesting and storage facilities of the run-off generated on the roof catchments of the building blocks.
- ※ Drainage channels should be covered; say with gratings, to avoid occurrence of accidents and entry of dirt.
- ※ These channels should ensure the safe final disposal of run-off /surface water and should be self-cleaning.

5.3.7 Air Quality

The proposed construction activities will result to increased dust and gas emissions. Some Construction machinery and trucks (including small vehicles) generate hazardous exhaust fumes such as Carbon Oxides (CO_x), Sulphur Oxides (SO_x) and Nitrogen Oxides (NO_x). Dust (particles) as caused by vibrations of machines and vehicle movement suspends in the air mostly during dry spells. Such dust and gases have direct negative impact to the quality of air hence animal/human health.

Potential Mitigation Measures

- ※ Provide protective equipment and materials and clothing such as nose masks, goggles etc. to the workers
- ※ Regular and prompt maintenance of construction machinery and equipment. This minimizes generation of hazardous gases and other suspended particulate matter.
- ※ Control over areas generating dust particles. Such areas should be regularly sprinkled with water to reduce/suppress dust. Such areas (and excavated soil) can be enclosed to mitigate effects of wind on them.

5.3.8 Oil Leaks and Spills

It is important to note that oil spills are prevalent in construction sites. Though this may not be common for the subject project, it is wise to control and observe leakages/spillages that may occur especially during maintenance of the involved machinery.

Potential Mitigation Measures

- ※ All machinery should be keenly observed not to leak oils on the ground. This can be ensured through regular maintenance.
- ※ Maintenance should be operated/ carried out in a well-designed and protected area and where oils/grease is completely restrained from reaching the ground. Such areas should be covered to avoid storm from carrying away spilled oils into the soil/water systems. Waste water/ wash water from these areas should be properly disposed or treated by inclusion of oil-interceptor chambers along drainage channels.

- ※ All oils/grease and materials should be stored in a site's store, in the contractor's yard.
- ※ Proper disposal of oil handling materials such as drums, oily clothes/papers/materials and cans.

5.3.9 Solid Waste

Construction activities result in increased solid wastes on construction sites. Such waste materials include stones, wood, broken glasses, containers, rods of metal, pieces of iron sheets, sharp objects (nails), non-biodegradable materials and other assorted materials.

On completion and occupation, the project will be generating waste products from various operations and activities; mostly *house refuse.* Therefore removal and disposal of the refuse and other related wastes comes in handy. If it is not removed promptly, away from the generation points (house compounds), it accumulates into large heaps harboring rats, flies etc, which disseminate germs or diseases.

Potential Mitigation Measures

- ※ To manage waste in line with the Environmental management and coordination (Waste Management) Regulations, 2006
- ※ Use of an integrated solid waste management system; through a hierarchy of options: source reduction, recycling, composting and reuse, will facilitate waste handling during occupation phase.
- ※ Provision for dustbin cubicles. This is a significant step towards solid waste management and handling. There should be a bin- preferably two bins maintained by every source, one for organic matter and the other for mineral matter. The contents of the bin of organic matter can be fed to dogs, hogs/pigs etc.

5.3.10 Ecological Impacts: Flora and Fauna

De-vegetation usually result to generation of environmental impacts such as soil erosion, hydrological imbalance, decreases air purifiers etc.

There will be some major temporary and permanent disturbances to small animals / bird life especially those that inhabit the vegetation to be cleared.

Potential Mitigation Measures

- ※ Proper siting of project away from sensitive or protected areas to avoid unnecessary clearing of vegetation.
- ※ Propose restoration programmes early e.g. landscaping and rehabilitation proposals and their role in mitigating impacts for the affected areas.
- ※ Manage the introduced vegetation on completion of the development to restore or improve the site.
- ※ Landscaping as proposed in the designs should be done by specialists.

5.3.11 Construction materials

They include stones, sand, cement, ballast, reinforcing steel rods etc. They should be of the appropriate quality.

Potential Mitigation Measures

- ※ Should be sourced from licensed dealers and suppliers and those that are environmentally conscious/sensitive.
- ※ Quality construction materials used should be thoroughly monitored through regular tests;
- ※ Use materials approved by quality control agencies i.e. Kenya Bureau of Standards (KBS) and ministry of public works

5.3.12 Visual impacts

Visual impacts are likely to occur during earthworks for the foundation of the project. The project will not be out of proportion with the environment.

Potential Mitigation Measures

- ※ Careful siting, planning and design of the development to ensure that it is sympathetic to its surroundings.
- ※ Compensation for the loss of landscape resources e.g. vegetation by replacing with an equivalent resource e.g. planting new trees.

- ※ On completing the earthworks, the excavated or disturbed areas should be restored immediately; especially through backfilling, levelling and planting of suitable vegetation.
- ※ All solid waste from construction site should be cleared on completion and disposed suitably into the approved dumpsites.

5.3.13 Occupational Health and Safety (OHS)

During construction, there will be increased dust, air and noise pollution. These are considered as negative impacts. The residents and workforce involved will be more subjected to these environmental hazards. Food for the construction workforce is usually provided by mobile individuals most of which operates without licenses. This can compromise health of the workers especially if such foodstuffs are prepared in unhygienic conditions.

Potential Mitigation Measures

- ※ Depending on the occupational safety and health hazards anticipated while performing assigned job tasks, workers will require using properly fitting personal protective equipment (PPE) to avoid injuries and illness. These include working boots, overalls, helmets, goggles, earmuffs, masks, gloves etc
- ※ A First Aid Kit should be provided within the site and during construction phase. This should be fully equipped at all times and should be managed by qualified persons.
- ※ Adapt a suitable emergence response plans to manage occurrence of anticipated hazards during construction phase.
- ※ Safety awareness may be gained through regular safety meetings, safety training or personal interest in safety and health.
- ※ The contractor should have workmen's compensation cover. It should comply with workmen's compensation Act, as well as other ordinances, Regulations and union Agreements.
- ※ Sanitary facilities should be provided; and maintain Standard cleanliness of the facilities.
- ※ Local individuals preparing food for the workers at the site should be controlled, monitored and evaluated to ensure that food is hygienically prepared.

- ※ Workers should always be sensitized on social issues such as drugs, alcohol, diseases etc.
- ※ Ensure provision of safe drinking water for the workers on site.

5.3.14 Public disturbance

Construction disturbances result from noise and lighting especially if construction activities are extended to the nights. There may be such disturbances during the project installation/ implementation phase.

Potential Mitigation Measures

- ※ Construction activities should be done only during daytime i.e. weekdays from 8am to 5pm and Saturdays from 8am to noon.
- ※ Billboards should be suitably elected on the start of the project. The signs should indicate and inform the public when works start and when will be completed.

5.3.15 Security

Security is a prerequisite to/for any development as it ensures materials/project. It also controls movement within the site especially for the intruders who might be injured by the materials and other hazardous features available within the site.

Potential Mitigation Measures

- ※ The project site should be enclosed using suitable walls to beef-up security and to control movement within the site.
- ※ There should be guard houses at the gate. Security guards should always monitor the gate of the facility to keep away the intruders and to control movement within the site.
- ※ Contractor should provide adequate security during the construction period when there are no works on the site.
- ※ The guards stationed at the gates should document movements in and out of the site/ property.

5.3.16 Fire preparedness

Fire outbreaks are common in Kenya and they usually subject detrimental effects to the environment. Fire causes both economic and social drawbacks. There are operations that are prone to such outbreaks at construction sites. It is therefore important to consider the issue of fire.

Potential Mitigation Measures

- ※ Recommended Fire fighting equipment:
- ※ Install fire alarm system for entire project
- ※ Installation of fire fighting facilities following Council's Fire Masters requirements approval.

In addition to the above, the structure management should consider the following:-

- ※ Conduct regular fire fighting drills within the site.
- ※ Develop and adapt an (fire) emergency response plan for the project (during construction and occupation stages).
- ※ Ensure that all fire fighting equipment are regularly maintained and serviced.
- ※ Provide fire hazard signs such as 'No Smoking' sign, Direction to exit in case of any fire incidence and emergency numbers.

5.3.17 Traffic density

The proposed project will come along with increased (vehicle) traffic along the connecting routes especially during construction phase. The effect may not be severe during occupation phase.

Potential Mitigation Measures

- ※ Notify the motorists about the proposed development once implementation is started. It is important that warning/ informative signs (bill boards) be erected at the site. The signs should be positioned in a way to be easily viewed by the public and mostly motorists.
- ※ The traffic along the connecting roads should be controlled especially during construction phase and mostly when trucks are turning into the site, say when delivering of materials.

5.4 CONSTRUCTION SAFETY

5.4.1 Introduction

The following sections provide general guidelines and procedures for construction safety during project implementation process.

5.4.2 General Construction Guidelines

Construction work can be particularly hazardous. Proper application of construction standards (following municipal council's regulations), use of approved construction materials, Personal protective equipment, fire safety, electrical safety, and other precautions are essential for safe construction work.

Follow these guidelines when visiting or working at construction sites:

- ※ Do not walk, stand, or work under suspended loads. If you raise a load, be sure to crib, block, or otherwise secure the load as soon as possible.
- ※ Avoid placing unusual strain on equipment or materials.
- ※ Be prepared for unexpected hazards. BE ALERT ALWAYS! - DEVELOP and ADAPT an EMERGENCY RESPONSE PLAN for the proposed project.

5.4.3 Barriers and Guards

Contractors and project managers should use barriers and guards as necessary to protect employees, and visitors from physical hazards. If you suspect a hazard is not sufficiently protected, notify the attending workers or the *Environmental Health & Safety Office on site* immediately.

NOTE: Barriers, guards, and warning signs are required to ensure safety against existing hazards.

5.4.4 Types of Barriers and Guards

- ◈ Physical barriers and solid separators (dust barriers, hazard barriers, temporary walkways, etc.)

NOTE:

- ◈ Signs that state DANGER, WARNING, or CAUTION are also important when barriers or guards are necessary.

- Remember to make signs legible, visible, and brief.

5.4.5 Areas that Need Barriers or Guards

Any area that poses a physical threat to workers and/or pedestrians requires barriers or guards. Areas that typically require permanent or temporary protection include the following:

Stairways, Open Manholes, Elevated platforms, Areas with moving machinery, Excavation sites, Construction sites, Temporary wall or floor openings, Doors opening into construction.

5.5 PROJECT COMPLETION

On completing the construction works on the site, everything should be left in order. To achieve this, the following should be accomplished.

- Comprehensive Landscaping of the site should be done.
- All waste materials should be cleared and removed from the site. There should be no such materials as wood, glass, stones, scrap metals etc. However, these should be disposed appropriately and to the approved dump sites.
- General rehabilitation of any excavated areas; flowers and vegetation should be introduced to add aesthetic value to the site. This should be regularly watered.
- The structures should be cleared, cleaned and rubbed of any dust particles before occupation.
- The workers should be pre-warned of the end of the project (work). They should be suitably compensated and recommended to assist in applying for similar opportunities. If possible/applicable, they should be referred to other projects.

5.6 DECOMISSIONING PHASE

With time, the structures within the scheme will either partly or wholly need to be demolished to reflect changes in land use. This will depend on the planning and developmental changes and priorities prevailing over time. The need to decommission the structures may also arise from the deterioration of the state of the buildings due to age.

Decommissioning strategies to be adopted include;

- ※ Assess the prevailing planning and development policy in application in the area to determine the appropriate use of the land
- ※ Assessment of the condition of the buildings to determine appropriate use or disposal of materials
- ※ Prepare a demolition plan
- ※ Apply for approvals to the relevant agencies
- ※ Issue vacation notices to all the affected residents.
- ※ Fencing of the site.
- ※ Disconnection and removal of utilities e.g. water pipes, electricity and telephone cables
- ※ Remove all the underground facilities like water pipes, sewer drainage pipes, electricity and telephone cables
- ※ Mechanical demolition of the structures
- ※ Reuse or sell the salvaged materials.
- ※ Disposal at designated city council disposal sites.
- ※ Levelling and planting of grass and flowers.

The completion of the decommissioning should ensure that the site is restored to its original natural state as much as possible; this will thus open an opportunity for another development cycle.

5.6 PUBLIC PARTICIPATION-SOCIAL IMPACT ASSESSMENT

The Constitution of Kenya, 2010 highlights public participation as a basic requirement in any undertaking. The EMCA 1999 also requires that the public be notified of any intention to develop land so as to give their views about the proposed development. It is in this accord that the proposed development ensured public participation of all interested persons.

The participation employed household survey, discussions and consultations with the residents of Thompson area for data collection. A questionnaire (annexed) was developed to collect information on: environmental concerns; issues that the client needed to highlight; advantages and disadvantages of the project; mitigation measures; and details of the respondent.

The EIA study entailed consultation with the identified neighbors whose recommendations were taken into consideration during the preparation of the EIA study report. The negative and positive impacts of the proposed project were discussed with residents and there representatives in the neighborhood of the site. The approach used comprised interviews and administration of structured questionnaires.

Summary of the responses

The public consultation process revealed the following negative impacts:

i. Optimal use of the land
ii. Creation of employment opportunities during the construction period
iii. There will be increased habitable housing units which will result to increased residents in the area
iv. Adverse water shortage in the area
v. Increase in traffic during construction and operation phase at the road junctions
vi. Increased dust and noise pollution especially during construction phase
vii. Movement of trucks during the construction period and the effect of the same on the roads in the area
viii. Management of storm water particularly from the increased concrete surface areas that the project will, upon completion, present
ix. Destruction of the physical environment including vegetation clearance
x. Potential to exert pressure on the existing local infrastructure including electricity supply and liquid & solid waste management

Proposed mitigation measures on the negative impacts

The stakeholders proposed the following mitigation measures:

i. The proponent will drill a borehole, incorporate rainwater harvesting techniques and buy water from registered water vendors to supplement the water supplied by the NWSCo.

ii. Conduct a study on the traffic flow before and after construction

iii. Improvement of the existing access road, i.e. Mbaazi avenue, will be done

iv. Comply with EMCA (Noise and excessive vibration pollution control) Regulations 2009

v. Provide solutions for storm water management

vi. Provide employees with appropriate personal protective equipment (PPE) such as safety goggles, sanitary facilities as well as adequate training

vii. Plant trees at the site especially in the designated green zones

viii. Implement energy conservation measures

The above mitigating measures have been taken into account in the environmental management plan contained in this report.

The completed copies of questionnaires that provided a guide to the consultative public consultation are appended in this report.

5.7 ALTERNATIVES AND PROPOSED ACTION

5.7.1 The proposed Development Alternative

The EIA study report will be presented to the National Environmental Management Authority (NEMA). This will help in evaluating and examining the effects of proposed project on the environment. After the evaluation and under the proposed development alternative, an Environmental Impact Assessment (EIA) License would be issued. This way, NEMA would have approved the project and the proponent would go ahead and implement the plan (project). However, the development has to ensure that all environmental concerns raised are complied with during the implementation period and during occupation/operation phase.

The alternative is composed of the proponent's final proposal, with the inclusion of the NEMA guidelines and regulations and procedures. This is as stipulated in the Environmental Management and Co-ordination Act (EMCA) of 1999, which aims at reducing environmental impacts to the maximum extent practicable.

5.7.2 The No Action Alternative

There is no alternative site for the proposed project. Therefore, if the proposal fails to receive the anticipated approval from NEMA, the project may not be implemented. This implies that there will be no flats on site and the benefits resulting from the site activities will not be realized. Such benefits include the socio-economic Impacts (benefits) anticipated especially during construction- Provision of jobs for skilled and non-skilled workers will not be realized and there will be no generation of opportunistic businesses. The current pressure on existing housing infrastructure will persist. On the other hand, the expected negative environmental Impacts emanating from implementation activities and operations (when the project is occupied after completion) would not occur.

5.7.3 The comparison of Alternatives

Under the proposed Development Alternative, the project would create more housing infrastructure and will subscribe to the Government policy on improvement and multiplication of urban housing infrastructure. It would provide jobs for casual workers during construction. Under the No Action Alternative, there would be no development at all. There would be no benefits from the site; neither would there be the negative environmental Impacts.

If Environmental Impact mitigation measures are implemented as well as adaptation of sound construction management practices, negative effects to environment will be minimal. Therefore, commitments related to this Proposed Development Alternative would ensure that potential negative impacts are minimized to levels of insignificance.

5.7.3.4 Mitigation for the proposed Action

Mitigation measures include sustainable environmental management. The application or adaptation of standard construction management practices is fundamental. The measures would be appropriately designed and implemented to protect the environment and especially water, soil,

drainage, flora and fauna of the area/site. The statutory certificate that would be issued and the project's mitigation aspects included in the report would help to control damage to the environment. This is in relation to the Environmental Management and Co-ordination Act (EMCA), 1999.

CHAPTER 6

6.0 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN-EMP

(Environmental monitoring involves measurement of relevant parameters, at a level of details accurate enough, to distinguish the anticipated changes. Monitoring aims at determining the effectiveness of actions to improve environmental quality. The EMPs outlined in tables 3 and 4 addresses the identified issues of concern (potential negative impacts) and mitigation measures as well as roles, costs and monitorable indicators that can help to determine the effectiveness of actions to upgrade the quality of environment; as regards the proposed project. The EMPs have considered for all phases).

6.1 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN-EMP

Table 3: Environmental management and monitoring plan during construction phase

Environmental/ Social Impact	Proposed Mitigation Measures	Responsibility for mitigation	Monitoring means	Recommended frequency of monitoring	Estimated Cost (Kshs)
Demolition of existing structures	• Apply for demolition permit from relevant authorities such as NCC and NEMA before commencing the demolition • Engage a registered private contractor to carry out the demolition • Provide workers with personal protective equipment (PPE) • The demolition exercise will be limited at day time only • All personnel working on the project will be trained prior to commencing the demolition • Comply with EMCA (Noise and excessive vibration pollution control) Regulations 2009	-Project proponent -Contractor -NEMA inspectors	Inspection	Daily during the demolition process	**50,000**
	Noise and Air pollution • All active demolition areas will be watered at least twice a day to reduce dust. • Careful screening to contain and arrest demolition related	- Project proponent - Contractor - NEMA inspectors	Periodic checks	Daily during the demolition process	**15,000 pm**

Demolition of existing structures	dust will be adopted • Use of equipment designed with noise control elements will be adopted where necessary. • Trucks used during demolition exercise on site shall be routed away from noise sensitive areas in the neighborhood, where feasible. • Idling time for pick-up trucks and other small equipment will be minimized to limited time. • Use of very noisy equipment will be limited to daytime only.				
	Debris and related wastes • A registered private contractor will be engaged to collect demolition debris/wastes to avoid illegal final dumping at unauthorized sites will collect demolition debris. • All debris/wastes to be collected regularly to control air pollution and injury etc • All persons involved in refuse collection shall be in full protective attire. • All trucks hauling demolition debris/wastes shall be covered. • Exposed demolition debris of e.g. dust and sand, will be enclosed, covered, and watered daily before transported to disposal site.	- Project proponent - Contractor - NEMA inspectors	Periodic checks	Daily during the demolition process	**22,000**
	Health and safety of workers • All workers will be sensitized before the exercise begins, on how to control accidents related to the demolition exercise • A comprehensive contingency plan will be prepared before	- Project proponent - Contractor - NEMA inspectors	Periodic checks	Daily during the demolition process	**50,000**

	demolition begins, on accident response. • Adherence to safety procedures will be enforced at all stages of the exercise • All workers, pursuant to labor laws, shall be accordingly insured against accidents. • All workers will be provided and instructed to wear protective attire during demolition, including helmets.				
De-vegetation resulting from site clearance and excavation	• Ensure proper demarcation and delineation of the project area to be affected by construction works. • Apply for tree cutting permit from relevant authorities before cutting of any tree • Preserve all trees located at the boundary of the plot	- Proponent - Contractor - Engineer - Architect	Periodic checks Routine maintenance	Weekly	**25,000**
Soil erosion	• Ensure management of excavation activities • Observe Efficiency of erosion control measures • Control activities especially during rainy seasons • Provide soil erosion control and conservation structures where necessary. • Compact loose soils to minimise wind erosion • Control earthworks	- Proponent - Contractor - Workers - NEMA inspectors - -	Inspection Routine maintenance	Daily; Once a month during project lifetime	**22,000**
Air pollution	• Dust suppression with water-sprays during the construction phase on dusty areas • All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality	- Proponent - Contractor	Inspection/ observation	Daily	**50,000**

	impacts during construction. • Drivers of construction including bulldozers, earth-movers etc will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon and minimize idling of engines. • Careful screening of construction site to contain and arrest construction-related dust. • Exposed stockpiles of e.g. sand, will be enclosed, covered, and watered daily. • Ensure construction machinery and equipment are well maintained to reduce exhaust gas emission • Control speed and operation of construction vehicles	- County Public Health - Officer - Workers - NEMA inspectors			
Noise pollution	• Use of Suppressors on noisy equipment or noise shields for instance corrugated iron sheet structures • Sensitize drivers of construction machinery on effects of noise • Trucks used at construction site shall be routed away from noise sensitive areas where feasible. • Maintain plant equipment to suppress frictional noise • Construction activities to be restricted to daytime i.e. 8am to 5pm • Workers in the vicinity or involved in high-level noise to wear respective safety & protective gear. • Comply with EMCA (Noise and excessive vibration	- Proponent - Contractor - County Public Health - Officer - Ministry of Labour - Workers - NEMA inspectors	Inspection/ observation	Random	**25,000**

	pollution control) Regulations 2009				
Traffic and Road safety	• Enforce speed limits for construction vehicles especially along the roads leading to the site • Provide bill boards at the site/entrance to notify motorists and general public about the development • Ensure that the vehicles comply with axle load limits • Ferry building materials during of off-peak hours • Employ traffic marshals to control traffic in and out of site • Employ well trained and experienced drivers	- Proponents - Contractor - Ministry of Transport - NEMA inspectors - Workers	Observation	Daily	**50,000**
Oil pollution	• Proper storage, handling and disposal of new oil and used oil and related wastes • Maintain construction plant and equipment to avoid leaks • Maintenance of construction vehicles to be carried out in the contractors yard (off the site) • Provide oil interceptors along the drains leading from car wash and service bays	- Contractor - Workers	-Inspection -Observation	Daily	**10,000**
Storm water drainage	• Proper installation of drainage structures/facility • Install cascades to break the impact of water flowing in the drains • Ensure efficiency of drainage structures through proper	- Contractor - -	-Inspection -Routine maintenance	During construction and on completion of each structure	**150,000**

	design and maintenance • Provide gratings to the drainage channels	- -			
Health and safety of workers	• All workers will be sensitized before construction begins, on how to control accidents related to construction. • A comprehensive contingency plan will be prepared before construction begins, on accident response. • Keep record of the public emergency service telephone numbers including: Police, Fire brigade, Ambulance • Accordingly, adherence to safety procedures will be enforced. • Provide first aid kits at strategic places in the site • All workers to wear protective gear during construction e.g. helmets. • Provide clean water and food to the workers. • Construction work will be limited to daytime only • All workers will be adequately insured against accidents. • Sensitize workers on the importance of NHIF and NSSF • Ensure that the workers are registered with NHIF and NSSF and remits appropriate fee	- Contractor - Ministry of Labour - County public health officer - Workers - Proponent - NEMA inspectors - NCC inspectors - NHIF and NSSF officials	-Routine activities checks	Daily Monthly for remittance of appropriate fee	**110,000**
Fire outbreak	• Install fire fighting equipment as provided elsewhere in the report • Sensitize the residents on fire risks i.e. conduct regular fire drills	- Contractor	-Observation	Random	**220,000**

	• Adapt effective emergency response plan • Maintain fire fighting machinery regularly • Provide emergency numbers at strategic points				
Solid and liquid waste	• Ensure proper solid waste disposal and collection facilities • Ensure effective wastewater management • Design of sewerage system should be as provided in the approved plans • Wastes to be collected regularly to control air pollution and vermin/insects etc. • Receptacles will be provided for waste storage prior to collection. • Sensitize workers on the 5 R's of waste management i.e. reduction, recycling, reuse, repurpose and refuse • Refuse collection vehicles will be covered to prevent scatter of wastes by wind. • Wastes will be collected by a licensed operator to avoid illegal final dumping at unauthorized sites. • All persons involved in refuse collection shall be in full protective attire. • As provided for by the Building Code, a temporary latrine will be provided on site to be used by construction workers	- Contractor - Proponent - County Public Health Officer - NEMA inspectors - Registered waste management company	-Routine Activities checks	Daily	**50,000**
Increased water demand	• Management of water usage. Avoid unnecessary wastage • Recycling or reuse of water where possible	- Contractor - Proponent	-Inspection -Observation	Random	**6,000,000**

	• Make use of rain harvesting techniques such as roof catchments to provide water • Employ services of waters vendors to supplement the council's water supply • Drill a borehole	- WRMA - Ministry of water - NEMA inspectors - Workers			
Vegetation	• Design and implement an appropriate landscaping and tree planting program to help in re-vegetation of part of the project area after construction. • Introduction and maintenance of vegetation (trees, shrubs and grass) on open spaces and around the site • Planting and grassing should be done just before the rains or irrigated on dry spells.	- Contractor - Proponent	-Inspection -Observation	Random	**120,000**
Record Keeping	• Collection, analysis and document of relevant environmental data of the site	- Proponent/contractor	-Inspection	Weekly	**20,000**
Internal Audits	• Monitoring will involve measurements, observations, evaluations, assessment of changes in water quality, Emergency plans, waste management, Noise levels, contractor safety etc.	- Proponent/contractor	Inspection	Monthly	**10,000**
Security	• Provide security guards and facilities during construction period • The gate should always be controlled by the security men • Construct a gate house	- Contractor - Proponent	Observation	Daily	**50,000**
Increase in STI infections	• Sensitization of local communities and staff working on the project on dangers of free lifestyle	- Proponent & Ministry of Health	Voluntary screening Secondary data	Annual	-

6.2 EMP FOR OPERATION PHASE

TABLE 4: ENVIRONMENTAL MANAGEMENT PLAN DURING OPERATION PHASE

Possible Impacts	Proposed Mitigation Measures	Responsibility for Mitigation	Monitoring means	Frequency for Monitoring	Estimated Cost (Kshs)
Sewage/waste water spillage	• Direct waste water to the city's sewer • Regular inspection and maintenance of the waste disposal systems	- Proponent - Occupants - County public health officer	Periodic checks	Periodic checks	**50,000**
Solid waste generation	• Ensure that wastes generated are efficiently managed through recycling, reuse and proper disposal procedures • Use of an integrated solid waste management system i.e. 5 R's of waste management • A private solid waste handler to be contracted to handle solid waste	- Proponent - Occupants - County public health officer	Periodic Checks	Periodic and surprise checks	**60,000**
Air pollution	• Cabro-paving on exposed areas • Proper landscaping and maintenance • Watering of uncovered areas • Periodic maintenance of generator, waterpumps and transformers	- Proponent - Ministry of Health - County public health officer - NEMA inspectors	Periodic Activities	Periodic and surprise checks	**25,000**
Traffic	• Provide warning lights and other signs to reduce risk of accidents • Provision of adequate on-site parking bays	- Proponent	Periodic and surprise checks		**15,000**

	• Maintenance of the parking bays				
Health and safety	• Keep record of the public emergency service telephone numbers including: Police, Fire brigade, Ambulance • Document an emergency response procedure • Train residents on emergency response e.g through fire drills and first aid training • Engage a caretaker to ensure maintenance of a clean environment	- Proponent - County Public Health Officer - Ministry of Labour - NEMA inspectors	Routine Activities	Periodic checks and Accident audits	**22,000**
Noise and vibration Pollution	• Installation of silencers on the generators and transformer rooms • Provision of personal protective equipment for workers • Do annual noise measurements. • Do employee medical examination • Comply with L.N. 25:Noise prevention and control rules, 2005 and L.N. 61: Noise and vibration pollution regulation, 2009 • Sensitize residents on minimal permissible noise levels	- Proponent - County Public Health Officer - Ministry of Labour - Workers - NEMA inspectors	Periodic	Periodic checks	**5,000**

Security	• Engage services of security guards • Install CCTV cameras • Incorporate the community policing initiative • Place hotline numbers on strategic places	- Proponent - Occupants	Routine	Periodic checks	**50,000**
Storm water drainage	• Proper maintenance of drainage structures/facility • Provide gratings to the drainage channels	- Proponent	Inspection Routine maintenance	Once a month	**100,000**
In-house operation procedures and regulations	• Ensure good maintenance of the drainage network. • Institute appropriate monitoring procedures and guidelines on environmental performance, • Establish environmental audit and protocol and schedule as per the EIA/audit regulations, encourage workers participation in environmental conservation aspects.	- Proponent	Routine operation procedure	Periodic	-
Increased water demand	• Harvest rain-water • Install water conserving taps that turn off automatically when not in use • Sink a borehole • Provision of roof/ underground tanks for water storage	- Proponent - Occupants	Routine maintenance Inspection	Daily	-

Energy	• Switch off electrical appliances when not in use. • Switch off all lights immediately when not in use or are not needed. At end of functions take necessary measures to switch off lights immediately. • Use energy conserving bulbs e.g. LED bulbs for general lighting. • Make use of alternative source of energy such as solar power, which is renewable. The proponent should include solar power systems to the block.	- Proponent - Occupant	Routine maintenance Inspection	Daily	**500,000**

6.3 EMP FOR THE DECOMMISSIONING PHASE

TABLE 5: ENVIRONMENTAL MANAGEMENT/MONITORING PLAN (EMP) FOR THE DECOMMISSIONING PHASE

Note: A due diligence environmental audit will be undertaken and submitted to NEMA at least three months prior to decommissioning and in line with the Environmental Management and Coordination Act No. 8 of 1999.

Expected Negative Impacts	Recommended Mitigation Measures	Responsibility Party	Time Frame	Cost (ksh)
1. Construction Equipment/ machinery/structures & wastes				
Scraps and other debris on site	- Use of an integrated solid waste management system i.e. through a hierarchy of options: - Waste materials generated as a result of project decommissioning activities will be characterized in compliance with standard waste management procedures/regulations. Disposal locations will be selected by the contractor/project engineer based on the properties of the particular waste stream.	Contractor & Project Proponent	One-off	50,000
	- All buildings, machinery, equipment, structures and partitions that will not be used for other purposes should be removed and recycled/ reused say in other projects	Contractor & Project Proponent	One-off	-
	- Where recycling/reuse of the machinery, equipment, implements, structures, partitions and other demolition waste is not possible, the materials should be taken to approved dumpsites.	Contractor & Project Proponent	One-off	-
2. 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 run off 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;	Contractor & Project Proponent	One-off	25,000
	- Comprehensive Landscaping	Contractor & Project Proponent	One-off	50,000
3. Safety of the project				
Occupational hazards	- Ensure that safety measures have been effectively integrated and positioned in respective areas of the project to control and manage hazards such as fire - Staircases and other hazardous areas should be suitably protected say using strong rails to avoid occurrence of accidents	Contractor & Project Proponent	One- off	-
4. Safety and Social-Economic impacts				

• Loss of income • Reduced ability to support dependants • Loss of quality of life • Loss of benefits i.e. medical, insurance cover etc	- The safety of the workers should surpass as a priority of all other objectives in the decommissioning project - Adapt a project completion policy: identifying key issues to be considered. - Assist with re-employment and job-seeking of the involved workforce. - Compensate and suitably recommend the workers to help in seeking opportunities elsewhere. - Offer advice and counseling on issues such as financial matters.	Contractor	……..	-

CHAPTER 7

CONCLUSION AND RECOMMENDATIONS

Due to higher growth of Kenyan population, the gap between needs and actual availability of housing demand continues to widen. However the government has with great concern realized the above phenomenon and has come up with a policy that aims at providing residential places by providing over 150,000 new house units per year. It has in addition recognised input of individuals and private developers in providing well planned house infrastructure to bridge the gap in the housing sector.

It is nowadays a legal requirement for project proponents to undertake Environmental Impact Assessments (EIAs) on proposed projects to evaluate the impacts they (projects) would have on environment. This helps in mitigating identified conflicts with the environment during project implementation and operation or occupation phases. And it is on this ground that the EIA (on subject project) was undertaken.

The analysis of the EIA study has evidenced that the implementation and occupation/operation of the proposed project will have positive impacts to the Kenya's service industry and housing sector. The impacts will include increase in the national/local housing stock and quality, increased utility of the land, increase in Government revenue, and provision of job opportunities during project implementation phase. However, despite the outlined positive impacts, the proposed development will bring-in some negative impacts such as increased pressure on existing infrastructure (i.e. water, electricity), pollution (to Air, Water, soil) mostly during construction phase.

The proposed project's design has integrated mitigation measures with a view to ensuring compliance with all the applicable laws and procedures as well as the legislation and regulatory framework that govern environmental management. To this effect, the proposed project shall be developed to the required planning/architectural/structural standards of the municipal council, ministries of land and settlement. During project implementation and occupation, *sustainable environmental management (SEM)* shall be ensured; avoiding inadequate/improper use of natural resources, conserving nature sensitively to guarantee respectful and fair treatment of all people working on the project, general public at the vicinity as well as the inhabitants of the project.

In relation to the proposed mitigation measures that will be incorporated during implementation and occupation phases; the development's input to the national housing sub-sector; and cognation that *the project proponent* is environmentally conscious; the proposed project is beneficial to a developing country-Kenya. It is our (EIA study team) considerable opinion that the proposed development is a timely venture that will significantly subscribe to the government housing policy. It is thus our recommendation that the proponent be allowed to go ahead with the implementation of the project provided the outlined mitigation measures are adhered to. Major concerns should be focused towards minimizing the occurrence of impacts that would degrade the general environment. This will however be overcome through close following and implementation of the recommended Environmental Management and Monitoring Plans (EMPs).

Finally, (and on approval by NEMA) the project proponent shall work closely with the Environmental Experts and NEMA, residents and local municipal council to enhance the facilitation of the issues of concern such as water, ecology, soil, surface drainage and waste generated. This will ensure that environmental concerns are integrated into the project at every stage of successive implementation phases and the co-existence of the proposed project with the environment during occupation phase.

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ANNEXES

- Copy of ownership documents
- Copy of Change of Use(PPA2)
- Sample Questionnaires
- Copy of minutes of the Public Consultation Meeting held on 10th December, 2016
- Copy of the attendance sheet for the public meeting held on 10th December, 2016
- Public meeting Pictures
- Approved Architectural plans
- Location map