ENVIRONMENTAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED RESIDENTIAL APARTMENTS ON L.R NOs 12715/14037, 12715/14038, 12715/14039, 12715/14040, 12715/14041, ALONG MWANANCHI ROAD, IN SYOKIMAU, MACHAKOS COUNTY

PROPONENT:

NEW RISE HOUSE DEVELOPMENT
LIMITED
P.O BOX 16335-00100,
NAIROBI.

UNDERTAKEN BY:

Environmental Management Consultancy (EMC)
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DECLARATION

NEW RISE HOUSE DEVELOPMENT LIMITED

This Environmental Impact Assessment (EIA) study report is submitted to the National Environment Management Authority (NEMA) pursuant to the Environment Management and Coordination Act, CAP 387 and the Environmental (Impact Assessment and Audit) Regulations, 2003.

The project is based on the proposed Residential Development (Apartments) on LR Nos, 12715/14037, 12715/14038, 12715/14039, 12715/14040, 12715/14041, along Mwananchi road, in Syokimau, Machakos County. The EIA has been conducted to the highest Environmental standards possible.

That the developer will abide by the findings and the recommendations of the study and the EIA license throughout the project implementation cycle

NAME: New Rise House Development Limited
P.O Box 16335-00100,
Nairobi.

SIGNATURE:…… **DATE:**……

EIA CONSULTANTS:

That the Environmental Impact Assessment (EIA) study report submitted is based on the proposed development of apartments on plot L.R. NOs 12715/14037, 14038,14039,14040,14041, in Syokimau, Machakos County

To my knowledge, all information contained in this document is an accurate and truthful representation of all findings as relating to the proposed project as per projects information provided by the proponent and contractor to the EIA consultant:

NAME: Firm of Experts EMC **Reg. No:** 1541
Lead experts name: Vincent O. Oduor **Reg. No:** 0346

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SIGNATURE……. **DATE** ……

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ACRONYMS AND ABREVIATIONS

^{O}C	Degree Celsius
CPP	Consultation and Public Participation
DRDS	Domestic Refuse Disposal Services
EA	Environmental Audit
EAC	East African Community
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Co-ordination Act
EMP	Environmental Management/Monitoring Plan
HWM	Household Waste Management
KEBS	Kenya Bureau of Standards
Km	Kilometres
KPC	Kenya Power Company
KVA	Kilo Volts Amperes
L.R	Land Registration/Reference
NEC	National Environmental Council
NEMA	National Environment Management Authority
OHSO	Occupational Health and Safety Office
PCs	Private Companies
PPE	Personal Protective Equipment
PPM	Parts Per Million
SWM	Solid Waste Management
ToR	Terms of Reference
VOC	Volatile Organic Compounds

0. EXECUTIVE SUMMARY

0.1. Introduction

The New Rise House Development Limited proposes to construct Four hundred and eight (408) units of residential units in Syokimau, Machakos County. The proposed site is currently undeveloped.

The development will comprise of a residential development of A1,A2,B1,B2,B3,C1,C2,D1,D2,D3 typology which entails G+6 floors with studio, 1,2,3&4 bedrooms units (408 No.)

The total project cost will be Nine hundred and ninety two million, three hundred and thirty two thousand, six hundred and ninety shillings and thirty nine cents (992,332,690.39) Kenya shillings out of which a total of Ksh. 992,332 is payable to the authority (NEMA) being the sum of 0.1% as seen in the annexed Bill of Quantities.

The Kenya Government policy on such projects requires that an Environmental Impact Assessment (EIA) be carried out at the planning stages of the proposed undertaking to ensure that significant impacts on the environment are taken into consideration during the design, construction, operation and decommissioning of such projects. Therefore, in compliance with the law and to avoid unnecessary conflicts that retard development, the proponent has undertaken this EIA and incorporated environmental concerns as required.

EIA is a tool for environmental conservation and has been identified as a key component in new project implementation. According to section 58 of the Environmental Management and Coordination Act (EMCA) chapter 387 second schedule 9 (1), and Environmental (Impact Assessment and Audit) regulation, 2003, new projects must undergo EIA process. Consequently, the EMCA 2019 categorizes projects of similar magnitude under ***High Risk Projects***, thus; ***(g) establishment of new housing estate developments exceeding One hundred housing units;*** The Report of the same must be submitted to National Environment Management Authority (NEMA) for approval and issuance of relevant licenses. This was necessary as many forms of developmental activities cause damage to the environment and hence the greatest challenge today is to maintain sustainable development without interfering with the environment.

0.2. Scope

The scope of the assessment covered construction works which included ground preparation, masonry of the proposed development as well as installation of utilities required by the proposed project. The output of this work was a comprehensive EIA Project Report for the purposes of applying for an EIA licence.

0.3. Methodology Outline

Since the proposed site is located within an area with no rich natural resources whose total effect to the surroundings could be adverse and noting that the intended development and use of the facility will be in character with the surrounding (the area is characterised by developments of

similar scale), an environmental study report was required. The general steps followed during the assessment were as follows:

- Formulation of the Terms of Reference (submitted under Ref: NEMA/TOR/5/2/564).
- Environment screening, in which the project was identified as among those requiring environmental impact assessment under schedule 2 of the EMCA Cap 387
- Environmental scoping that provided the key environmental issues
- Desktop studies and public interviews
- Physical inspection of the site and surrounding areas
- EIA Public participation via the use of questionnaires and photography
- Reporting.

0.4. Positive Impacts

The proposed project will come along with numerous positive impacts as exhaustively discussed within the report. They include: Employment opportunities, revenue generation to the County and central governments, optimal use of land, economic benefit to the proponent and increased residential housing units.

0.5. Negative Impacts mitigation Measures

The proposed project is to be developed in an area that is already designated for such developments and hence, no conflict in land use is anticipated. The Table 1 below is a summary of anticipated impacts as well as proposed mitigation measures. The construction activities should not negatively impact on the adjacent developments and if they do, then a remedy should be agreed upon.

Table 1: Impacts and Mitigation Measures

Possible Impacts	**Mitigation measures**
Soil erosion	Control earthworks; Install drainage structures properly; Ensure management of excavation activities
Air pollution	Stockpiles of earth should be sprayed with water or covered during dry seasons; Provide dust masks for the personnel in dust generation areas; Sensitize construction workers on pollution control measurers
Noise pollution	Sensitize workforce including drivers of construction vehicles; Install sound barriers for pile driving activity; Install portable barriers to shield compressors and other small stationary equipment where necessary; Display signs to indicate construction activities; Maintain all equipment; Workers in the vicinity of high level noise to wear safety and protective gear.
Dust generation	Spray stock piles of earth with water; Avoid pouring dust materials from elevated areas to ground; Cover all trucks hauling soil, sand and other loose materials ; Provide dust screen where necessary
Exhaust emissions	Vehicle idling time shall be minimized; Equipment shall be properly tuned and maintained
Water sources	Proper Management of water usage to avoid unnecessary wastage of water; Avail storage tanks.

Site cleanliness and sanitary facilities	Special attention shall be paid to the sanitary facilities on site; Garbage shall be disposed periodically
Public health and occupational safety	Ensure proper solid waste disposal and collection facilities; Ensure dustbin cubicles are protected from animals, rains and are well covered; Provide suitable safety gear for all personnel; Proper treatment of waste water

0.6. Conclusion

Considering the positive socio-economic and environmental benefits to accrue as a result of the development, and the EIA having found no major impacts to arise from the development, it is our recommendation that the project be allowed to proceed on the understanding that the proponent will adhere to the recommended mitigation measures and will further implement the proposed EMP.

0.7. Recommendations

i. The proponent to implement strictly the measures outlined in the EMP as well as adhering to all relevant national and international environmental, health and safety standards, policies and regulations that govern establishment and operation of such projects.
ii. Maximize positive impacts as much as possible as exhaustively outlined within the report. These measures will go a long way in ensuring the best possible environmental compliance and performance standards.
iii. The developer be licensed to implement the project as proposed.

1. INTRODUCTION

1.1. Background and Rationale

The New Rise House Development Limited proposes to construct 408 units of residential apartments in Syokimau estate, Machakos County. The proposed development will comprise of a residential development of A1,A2,B1,B2,B3,C1,C2,D1,D2,D3 typology which entails G+5 floors with studio, 1,2,3&4 bedrooms units.

The proposed site has adequate space to accommodate the proposed project with the proposed service infrastructure such as water, power supply, waste management and effluent disposal. It was recognised that this form of development is likely to impact on the site and the surrounding environment thereby calling for an EIA study to enable impact mitigation.

EIA is a tool for environmental conservation and has been identified as a key component in new project implementation. According to section 58 of the Environmental Management and Coordination Act (EMCA) No.8 chapter 387 second schedule 9 (1), and Environmental (Impact Assessment and Audit) regulation, 2003, new projects must undergo Environmental Impact Assessment. The report of the same must be submitted to National Environment Management Authority (NEMA) for approval and issuance of relevant certificates.

1.2. Scope, Objective and Criteria of the Environmental Impact Assessment (EIA)

1.2.1. Scope

The Kenya Government policy on all new projects, programmes or activities requires that an environmental impact assessment be carried out at the planning stages of the proposed undertaking to ensure that significant impacts on the environment are taken into consideration during the design, construction, operation and decommissioning of the facility. The scope of this Environmental Impact Assessment, therefore, covered:

- The baseline environmental conditions of the area,
- Description of the proposed project,
- Provisions of the relevant environmental laws,
- Identification and discussion of any adverse impacts to the environment anticipated from the proposed project,
- Appropriate mitigation measures,
- Provision of an environmental management plan outline.

1.2.2. Terms of Reference (TOR) for the EIA Process

1.2.3. Data Collection Procedures

The TORs for the EIA study was approved by the authority under Ref: *NEMA/TOR/5/2/564*.
Data collection was carried out through questionnaires, use of checklists, observations and photography, site visits and desktop environmental studies in the manner specified in Part V (section 31-41) of the Environmental (Impact Assessment and Audit) Regulations, 2003.

1.2.4. Reporting and Documentation

The EIA Project Report from the findings was compiled in accordance with the guidelines issued by NEMA for such works and was prepared for submission by the proponent for consideration and approval. The Consultant ensured constant briefing of the client during the entire exercise.

1.2.5. Methodology Outline

The general steps followed during the assessment were as follows:

- Environment screening, in which the project was identified as among those requiring environmental impact assessment under schedule 2 of EMCA, chapter 387
- Environmental scoping that provided the key environmental issues
- Desktop studies and interviews
- Physical inspection of the site and surrounding areas
- EIA Public participation by the use of questionnaires
- Reporting.

2. PROPOSED PROJECT DESCRIPTION

2.1. Location

The proposed development is located in Syokimau estate Machakos County on coordinates - **1.360545, 36.925386** as shown by the pin drop in the figure 2 below. The development proponent has obtained a change of use to enable them put up the multi dwelling residential development on the land that was previously utilized for only residential development.

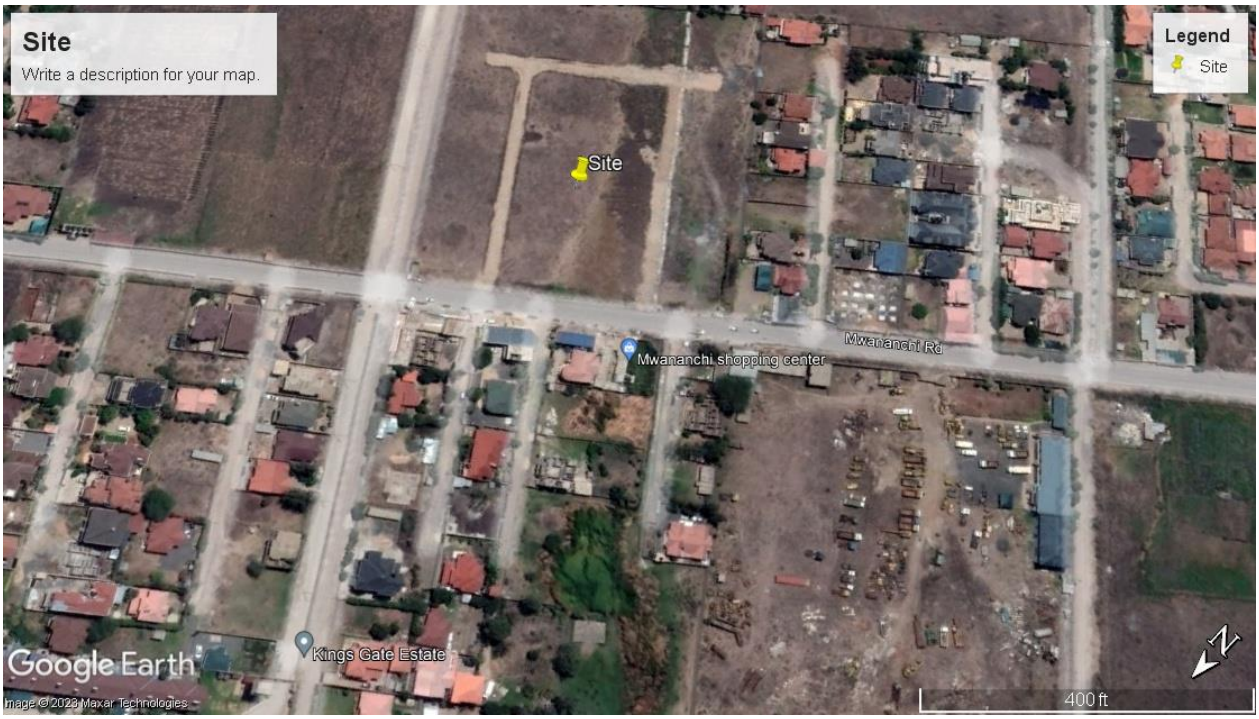

Figure 1: Google site Location

Figure 2. Project site and project neighbour respectively

2.2 Project Cost

The total project cost will be Nine hundred and ninety two million, three hundred and thirty two thousand, six hundred and ninety shillings and thirty nine cents (992,332,690.39) Kenya shillings_out of which a total of Ksh. 992,332 is payable to the authority (NEMA) being the sum of 0.1% as seen in the annexed Bill of Quantities.

2.3 Design of the project

New Rise House Development Limited intends to construct and establish residential development in Syokimau area, Machakos County. The housing development will consist of the following;

A1; 3bedroom units18 * 6= 108
A2; 2bedroom units 6* 6= 36
B1; 2bedroom units 18 *6= 108
B2; 1bedroom units 6 *6= 36
B3; Studio units 6* 6= 36
C1; 4bedroom units + dsq 2 *6= 12
C2; 3bedroom units + dsq 2* 6= 12
D1; 3bedroom units 4 *6= 24
D2; 3bedroom units 4 *6= 24
D3; 3bedroom units 2* 6= 12

A total of 408 residential units are proposed

Construction will be guided by national and international standards for both engineering and environmental compliance.

The development will have the following environmentally sound characteristics:-

1. Power conservation e.g. by use of occupation sensors for lighting and enhancing natural lighting during the day.
2. Reduced need for air conditioning by enhanced natural cross ventilation and reduction of solar glare/heat gain through having the mid-section open to the sky.
3. Use of water conservation techniques to ensure sustainability.

2.3.2. Electrical system

The building will be connected to the electricity main line of the Kenya Power Company, which will be used in all phases of the project. The various components of the electrical system shall comprise single and twin socket outlet, lockable meter board with glass view panel, gate lights and security alarm panel outlet and CCTV connection system. The necessary guidelines and precautionary measures relating to the use of electricity shall be adhered to.

2.3.3. Water reticulation system

Water from private vendors will be used during the construction phase. At the operation phase of the project, water will be sourced from the local municipal supply and other locally available private boreholes who serve the area. There will be water storage tanks to increase water capacity at the project site to the required amount.

2.3.4 Waste/Sewerage & Storm water run-off

Grey water and effluent drainage from the project site will be connected to an elaborate sewer management system to prevent ground resources degradation. Solid waste management will

consist of collections by dustbins in the apartments and along the corridors at designated points. The collected waste will later be transported to a waste treatment site a by NEMA licensed waste collector. All storm water drainage will be channelled into open storm water drain systems.

2.4. Description of the project's construction activities

2.4.1 Excavation and foundation works

Excavation will be carried out to prepare the site for construction of foundations, pavements and drainage systems. This will involve a combination of earthmoving machinery such as excavators, wheel loaders and trucks as well as manual labour.

2.4.2. Storage of materials

Building materials will be stored on site. Bulky materials such as rough stones, ballast, sand and steel will be carefully piled on site. To avoid piling large quantities of materials on site, the proponent will order bulky materials such as sand, gravel and stones in quotas. Materials such as cement, paint and glasses among others will be stored in temporary storage structures built for this purpose.

2.4.3. Masonry, concrete work and related activities

The construction of the building walls, foundations, floors, pavements, drainage systems, swimming pool among other components of the project involves a lot of masonry work and. General masonry include stone shaping, concrete mixing, plastering, slab construction, construction of foundations, and erection of building walls and curing of fresh concrete surfaces. These activities are known to be labour intensive and are supplemented by machinery such as concrete mixers.

2.4.4. Structural steel works

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

2.4.5. Plumbing

Installation of pipe-work will be done to connect sewage from the ablution blocks to a sewer system. Plumbing will also be done for drainage of storm water from the rooftop into the peripheral storm water harvesting tanks. Plumbing activities will include metal and plastic pipe cuttings, the use of adhesives, metal grinding and wall drilling among others.

2.5. Description of the project's occupational activities

2.5.1. Solid waste and waste water management

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

2.5.2. Cleaning

The proponent will be responsible for ensuring regular washing and cleaning of the pavements, the car park area, staircases etc. Cleaning operations will involve the use of substantial amounts of water, disinfectants and detergents.

2.5.3. General repairs and maintenance

The apartments and associated facilities will be repaired and maintained regularly during the operational phase of the project. Such activities will include repair of building walls and floors, repair and maintenance of electrical gadgets, painting and replacement of worn out materials among others.

2.6. Description of the project's decommissioning activities

2.6.1. Demolition works

Upon the requirement for decommissioning, the project components including buildings, pavements, drainage systems and associated facilities will be demolished. This will produce a lot of solid waste, which will be re-used for other construction works or if not re-usable, disposed of appropriately by a licensed waste disposal company.

2.6.2. Dismantling of equipment and fixtures

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

2.6.3. Site restoration

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

3. BASELINE INFORMATION OF THE STUDY AREA

3.1. Physical environment

The development will be established in Syokimau estate on undeveloped parcels of land. Most neighbouring plots to the development have been developed into residential apartments and commercial buildings. The surrounding project area is highly developed with supermarkets, malls, offices, residential apartments among others. The proposed development is in line with the land use pattern of the area.

3.2 Geographical Environment

3.2.1 Climatic Condition

The general climate of Machakos County is semi-arid with an altitude range of 1000 – 1600 meters above sea level. There are two rainy seasons but rainfall can be moderate. The cloudiest part of the year is just after the first rainy season, when, until September, conditions are usually overcast with drizzle. The area is characterized by sunny daylights and chilly night. The proposed project site is to the northwest of the Mlolongo town and it experiences relatively dry conditions just like the entire region.

3.2.2 Temperatures

The sunniest and warmest part of the year is from December to March, when temperatures average the mid-twenties during the day. The mean maximum temperature for this period is 27 °C (75 °F).The minimum temperature also remains low during cloudy nights, usually hovering around 11 °C and at times reaching 8°C. Clear skies in January and February also bring colder nights. Temperatures range from a minimum of 9.1oC to a maximum of 26.7oC

3.2.3 Rainfall

There are two rainy seasons but rainfall can be moderate. The cloudiest part of the year is just after the first rainy season, when, until September, conditions are usually overcast with drizzle. Rainfall ranges from 500 mm to 900 mm per annum.

3.2.4 Sunshine

Early mornings in Machakos in general are often blue sky, but the sun peeks through by midmorning. Throughout the year, there is an average of ten hours of sunshine per day. Thirty percent more sunlight reaches the ground during the afternoon than in the morning. Of course, there is more sun shine during the summer months, when the sun is more 24 overhead in the southern hemisphere. Infrequently during the rainy season the sun never show through the clouds. Even in August, the cloudiest month, there is an average of four hours of sunshine.

3.2.5 Topography and Drainage

Upper Machakos and Nairobi's main drainage follows the regional slope of the volcanic rocks towards the east, while subsidiary internal drainage into the Rift region is confined to the

western part. Major plains which comprising mainly the Athi plains and the northern section of the Kapiti plain, extend westwards, rising from 4900 feet (1493 m) at the Athi River to 6000 feet (1829 m) in the faulted region near Ngong. The Kirichwa Valley Tuffs lying to the east of the highway function like a sponge and the contact between them and the underlying impermeable phonolite thus forms a perfect aquifer so much so that a number of channels containing water occur beneath Athi River region. The site of the project is flat and therefore with heavy rains flooding might result. The proponent is advised to construct a strong floor slab that is well raised to avoid any water surges to the project development.

3.2.6 Hydrogeology and Soils

In general groundwater in volcanic rocks is limited to fractures and erosion levels within the volcanic succession. Fresh lavas are usually not water bearing because of their massive and impervious nature. The most significant aquifer system west of the project area is the Upper Athi Series aquifer system. This is the main aquifer for boreholes in Upper Machakos, Nairobi and Kiambu areas and is composed of tuffs, lakebeds and sediments The rocks in the Upper Machakos regions such as Mavoko, Syokimau and Mlolongo area mainly comprise a succession of lavas and Pyroclastics of the Cainozoic age and overlying the foundation of folded Precambrian schist's and gneisses of the Mozambique basement rock which traverses the entire lower eastern region upto Kilimambogo area .The crystalline rocks are rarely exposed but occasionally fragments are found as agglomerates derived from former Ngong volcano. The soils of this area are products of weathering of mainly volcanic rocks. Weathering has produced black cotton soils that reach more than 50 feet (15m) in thickness. 25 Metamorphism process is witnessed in the region that has resulted to major deposits of limestone rich mines.

3.3 Biological Environment

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

3.3.1 Flora

Natural vegetation in Upper Machakos region (Syokimau, Mlolongo and Athi River) has been cleared to pave way for the establishment of both residential and commercial developments. The natural vegetation in the area has thus been greatly modified. The remnants of the natural vegetation of the site and its environs are a few scattered grasses. The site has no great vegetation cover and it is predominantly dry savannah, open grass plains with scattered acacia bushes. The region also has seasonal stream which supplies water to a nearby wetland. The proponent is encouraged to do a lot of landscaping to provide greenery and maintain a healthy environment.

3.3.2 Fauna

This will look at the aquatic and wetland faunal species as well as terrestrial species. The site is situated within a residential zone where human activities have altered the natural habitat for

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

3.4 Land use

Urban land use refers to spatial distribution of social and economic activities. Accordingly, an up-to-date land use inventory is frequently required to facilitate urban planning and growth patterns as well as monitoring of urban expansion. A study by the Department of 26 Resource Surveys and Remote Sensing (DRSRS 1994) identified eight major land-use classes in major urban centres in Kenya. These include Residential use Industrial, commercial and service centers, Infrastructure land use, Recreational areas, urban agriculture as well as Water bodies and riverine areas.

3.5 Infrastructure and Services

3.5.1 Roads and Accessibility

The project site can be accessed from Nairobi CBD using Mombasa road/ Nairobi Expressway. The roads and drainage infrastructure on site has been improved over time by the County government and different private developers to enhance development.

3.5.2 Energy

The area is well served by electricity from the national power grid where the project proponent will be able to tap electricity from and adequate electrical power supply is available in the area. There are no issues concerning the power supply especially in regards to overload or power surges.

3.5.3 Communication

The area is served with vast communication and internet networks. All networks are accessible in the area including Safaricom, Airtel, Orange and Zuku among many others.

4. LEGISLATIVE AND REGULATORY FRAMEWORK

4.1. Constitutional and Legal Framework

4.1.1. Constitution of Kenya (2010)

Article 42-Environment; Indicates that every person has the right to a clean and healthy environment, which includes the right to –

- Have the environment protected for the benefits of present, future generations through legislative and other measures, particularly those contemplated in Article 69, and
- Have obligations relating to the environment fulfilled under Article 70 [1].

Article 43-Economic and social Rights

Indicate that every person has the right to accessible and adequate housing and to reasonable standards of sanitation.

4.1.2. The Environmental Management and Coordination Act chapter 387

The Environmental Management and Coordination Act (EMCA) chapter 387, and its Attendant Environmental (Impact Assessment and Audit) Regulations of 2003 Provides for the establishment of an appropriate legal and institutional framework for the management of environment in Kenya. The Act introduces two important aspects of urban environmental management, which are directly related to the proposed project: environmental impact assessment (EIA) and environmental audit (EA).

Section 58 (1) has underscored that any person being a proponent of a project Shall before financing, commencing or proceeding with submit an EIA report to the National Environmental Management Authority (NEMA) of Kenya[2].

Section 68 (1) gives NEMA the mandate for carrying out all environmental audits of all activities that are likely to have significant impacts on the environment. It authorizes environmental inspectors, as appointed by NEMA to enter in any premise and determine how far the activities carried out conform to statements in EIA study.

Compliance with EMCA

- The proponent has undertaken an EIA as per the requirements of Section 58 (1) of EMCA chapter 387 awaiting approval prior to the commencement of the project.
- The proponent will implement the proposed EMP and adhere to the conditions set in the license of the proposed project.
- The proponent will adhere to subsequent EMCA legislations such as the noise and waste regulations throughout the cycle of the project.
- The proponent shall undertake annual Environmental audits for the project and submit the reports to NEMA as per the EIA/EA guidelines

[1] LAWS OF KENYA, *The Constitution of Kenya, 2010* (Attorney General Nairobi, 2010), http://www.wipo.int/edocs/lexdocs/laws/en/ke/ke019en.pdf.

[2] George M. Wamukoya and Francis DP Situma, *Environmental Management in Kenya: A Guide to the Environmental Management and Coordination Act* (Centre for Research and Education on Environmental Law, 2000).

4.1.3. Physical land use & planning act (2019)

The Physical Planning Act (Cap. 286) aims at developing a sound spatial framework[3]. The plan proposals enhance and promote intergraded spatial/physical development. The Physical planning Act (Cap. 286) makes specific provisions in respect to the mandate of local authorities.

Section 24 (1): the Director may prepare with reference to any Government land, trust land or private land within the area of authority of a city, municipal, town or urban council or with reference to any trading or marketing center, a local physical development plan.

Section 24(3): the Director may prepare a local physical development plan for the general purpose of guiding and co-coordinating development of infrastructure facilities and services for an area referred to in subsection (1), and for the specific control of the use and development of land or for the provision of any land in such area for public purpose.

Section 25 (b): a local physical development plan shall consist of such maps and description as may be necessary to indicate the manner in which the land in the area may be used.

Section 29 (a): confers upon local authorities the powers to prohibit or control the use and development of land and buildings in the interests of proper and orderly development of its area.

Section 36: This section compels that if in connection with a development application, a local authority is of the opinion that proposals for industrial location, or any other development activities (such as building developments) will have injurious impact on environment, the applicant will be required to submit together with application an environmental impact assessment report.

Compliance with this legislation

- The architectural drawings (plans) of the proposed project have been submitted to the county government of Machakos for approval
- The proponent will ensure that the land is utilized in an ecofriendly manner and is restored to its original condition once the project is decommissioned.
- Ensure the development does not in away have injurious impact on the environment and that a developmental footprint of less than 75% is maintained.

4.1.4. Physical Planning (Building and Development Control) Regulations

Under the provisions of the Physical Planning (Building and Development control) Regulations; The Director of Physical Planning shall refuse to recommend any new building or proposed development, or alteration or addition to any existing building if:

i. The proposal is not in conformity with approved development plan.
ii. Such plans disclose a contravention of the physical Planning (Building and Development) rules.
iii. The plans are not correctly drawn or omit to show information required.
iv. On such being required, separate application accompanied by sets of plans has not been lodged in respect of building on separate plots or subplots etc.

Compliance

- Change of use from single dwelling to multi dwelling residential has been approved by the county government
- The proponent shall adhere to the recommendations given in the building order by the county physical planner

[3] The Republic of Kenya, "The Physical Land Use & Planning Act, 2019" (Kenya law reports).

- The proponent shall ensure that the building plans are available on site for inspection by county officials during construction and at any other time.

4.1.5. The public Health Act (Cap 242)

Section 15 (1x) –Nuisance
Any noxious matter or wastewater discharged from any premise, such as a building constitutes nuisance. Any premise not kept in a clean and free from offensive smell such as gases which are injurious to health such as those from commercial establishments shall therefore generate nuisance. The Act therefore stresses that no person shall cause a nuisance to exist on any land or premise occupied by him.
The Act acknowledge that it shall be the duty of all local authorities to take all lawful measures for maintaining its district at all times in a clean and sanitary condition for remedy of any nuisance or condition liable to be injurious to heath. To safeguard against this, part X of the public Health Act states that where in the opinion of the Medical Officer of Health that food stuffs within a warehouse, or a building are insufficiently protected, the owner shall be compelled to observe the require regulations, else he shall be guilty of an offense[4].

Compliance
- The proponent will ensure solid waste shall be handled by a professional NEMA Approved garbage collector on regular basis and disposed appropriately as per the waste regulations.
- Sanitary facilities shall be in conformity with MOH standards and installation of standard fittings. Liquid wastes shall be contained in a waste treatment plant.

4.1.6. The County Government Act, 2012

It affirms that every municipal council has the power to establish and maintain sanitary services for the removal and disinfection, or otherwise dealing with or kinds of refuse and effluent, such as spent oil, and where any such services is established, to compel the use of such services by persons to whom the services is available
Section 166 – empowers the local authority to be responsible for local planning and development control in the city.

Compliance with this legislation
- The proponent is obligated to comply with EIA study report proposed potential mitigation measures in the EMP.
- Adhere to all directives from the County Government of Machakos as they may arise during the full cycle of the project

4.1.7. The OSHA, 2007

The Act aims at making provision for the health, safety and welfare of persons employed in factories and other places of work.
Section 13 – states that every factory shall be kept in a clean state and free from effluvia, arising from any drain, sanitary convenience or nuisance. Effective and suitable provisions is also proposed for securing, maintaining by circulation of fresh air in each workroom, the adequate ventilation of the room.

[4] The Republic of Kenya, "The Public Health Act Chapter 242" (Kenya law reports, 2012).

Section 36 –Provides for precautions with respect to explosive inflammable dust or gas. The section is specific that where in any building, if dust that could escape to work man's room and explode by ignition, steps must be taken to prevent such an explosion.
Section 41 – Compels that in every factory, there shall be maintained fire extinguishers, which shall be adequate and suitable in case of fire out breaks. Similarly, it mandates every factory to provide adequate means of escape in case of fire outbreak for the employees. The Act further requires that if a factory worker is employed in any process involving exposure to wet or to any Injurious or offensive substance, suitable protective clothing must be provided by the employer[5].

Compliance

- The proponent will appoint a reputable contractor who will be responsible for enforcing the requirements during construction and subsequent repairs and maintenance after project completion.
- They will make provision for the health, safety and welfare of persons employed in factories and other places of work. Ensure that every work place shall be kept in a clean state and free from effluvia, arising from any drain, sanitary convenience or nuisance.
- Avail fire extinguishers, which shall be adequate and suitable in case of fire out breaks. Provide adequate means of escape in case of fire outbreak for the employees.
- Ensure factory workers are in any process involving exposure to wet or to any injurious or offensive substance, suitable protective clothing must be provided.
- The proponent shall ensure that the factories and other places of work abstract is displayed at a strategic place within the factory premises

4.1.8. Planning & Building Regulations 2009

These are regulations that set standards for the design and construction of buildings to ensure the safety and health for people in or about those buildings. The regulations are as follows;
Any developer, who intends to erect a building such as a residential block, must;

a) Sought for all approvals before commencement of the work and regular monitoring will follow to ensure compliance with set standards and conditions

b) All plans must be drawn by registered architect/ structural designer

c) Give the concerned local authority a notice of inspection, before the erection of the structure. After erecting the building, a notice of completion shall be issued to the local authority to facilitate final inspection/approval.

d) No person shall occupy a building whose certificate of completion has not been issued by the local authority. As a precaution against fire breakout, the by-law states that the walls of any premise shall be non-combustible throughout, similarly, in every building, other than a small house, which comprises more than one storey, shall have fire resistance.

Compliance

- All approvals will be sought before commencement of the work and regular monitoring will follow to ensure compliance with set standards and conditions.
- The proponent will obtain Certificate of Completion on decommissioning. They shall further provide fire-fighting equipment that may include one or more of the following: hydrants, hose reels and fire appliances, external conations, portable fire appliances,

water storage tanks, dry risers, sprinkler, drencher and water spray spring protector system.

4.1.9. Penal code (Cap. 63)

The chapter on "Offences against Health and Conveniences" strictly prohibits the release of foul air into the environment, which affects the health of other persons. Any person who voluntarily violates the atmosphere at any place, to make it noxious to health of persons in general dwelling or carrying out business in the neighborhood or passing along public ways is guilty of misdemeanor, i.e. imprisonment not exceeding two years with no option of fine . Under this Act, any person who for the purpose of trade or otherwise makes loud noise or offensive awful smell in such places and circumstances as to annoy any considerable number of persons in the exercise of their rights, commits an offences, and is liable to be punished for a common nuisance, i.e. imprisonment not exceeding one year with no option of fine.

Compliance

- The proponent will ensure using appropriate technology, foul air which affects the health of other persons will not be released into the environment, Further they will for the purpose of trade or otherwise, using any appropriate systems and technology, ensure there is no loud noise or offensive awful smell in such places and circumstances that may annoy any considerable number of persons in the exercise of their rights.

4.1.10. Water Quality Regulations, 2006

The law is based upon the principle that everybody is entitled to a healthy and clean environment. Section 42, is pertinent to the implementation of this project. These Regulations shall apply to drinking water, water used for industrial purposes, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife, and water used for any other purposes[6].

Compliance with this legislation

- The proponent shall strictly adhere to the provisions and requirements of these regulations. He must ensure all applicable water standards are observed to ensure clean, safe water for all purposes.
- The proponent shall carry out an initial environmental audit after the first year of operation. The report shall include analysis of effluent as stipulated in the second schedule of this legislation.

4.1.11. Noise and Excessive Vibrations Pollution (Control) Regulations

Part II of the rregulations[7] regulations; section 3 states:

1. Except as otherwise provided in these Regulations, no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

[6] The Republic of Kenya, "The Environmental Management and Coordination, (Water Quality) Regulations 2006." 2006, www.nema.go.ke.

[7] The Republic of Kenya, "The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009." 2009, www.nema.go.ke.

Compliance: The proponent shall take into concern the provisions of the local authority act to ensure that the development complies with the provisions of the Act.

4.1.12. Waste Management Regulations (2006)

This legislation gives guidelines for handling different kinds of waste. Some of the relevant sections to the proposed project are as follows:
Part II Section 1: No person shall dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle
Part II Section 6: Any person who owns or controls a facility or premises which generates waste shall minimize the waste generated by adopting the following cleaner production principles:

a) **improvement** of production process through:
   i. Conserving raw materials and energy
   ii. eliminating the use of toxic raw materials within such time as may be prescribed by the Authority
   iii. reducing toxic emissions and wastes
b) **Monitoring** the product cycle from beginning to end by:
   i. Identifying and eliminating potential negative impacts of the product.
   ii. Enabling the recovery and re-use of the product where possible.
   iii. Reclamation and recycling.
c) **Incorporating** environmental concerns in the design, process and disposal of a product[8].

Compliance

- The proponent will ensure that all waste are segregated before being transported to a designated waste treatment facility by a contracted NEMA licensed waste transporter
- The proponent has put in place plans to use reuse their main waste product, that is potato peelings, as feedstock for generation of biogas.

4.1.13 Urban Areas and Cities Act No. 13 Of 2011

PART V – on Integrated Development Planning, section 36 sets the objectives of integrated urban areas and city development planning (1) Every city and municipality established under this Act shall operate within the framework of integrated development planning which shall— (a) give effect to the development of urban areas and cities as required by this Act and any other written law; (d) be the basis for— (i) the preparation of environmental management plans; (v) disaster preparedness and response; (vi) overall delivery of service including provision of water, electricity, health, telecommunications and solid waste management; (2) In addition to the objectives set out in subsection (1), an integrated urban or city development plan shall bind, guide and inform all planning development and decisions and ensure comprehensive inclusion of all functions.
Compliance; the proponent has given into consideration all the requirements of the act by getting the planning proposal in line with the planning requirements of the county integrated development planning.

4.1.14 NCA regulations 2014

This is an Act of Parliament that with a mandate to oversee the construction industry and coordinate its development.

[8] The Republic of Kenya, "The Environmental Management and Co-Ordination (Waste Management) Regulations, 2006.," n.d., www.nema.go.ke.

Section 17 states that;

All construction works, contracts or projects either in the public or private sector shall be registered with the Authority in accordance with the Act. An owner shall make an application for registration of a project to the Authority in writing within thirty days from the dare on which a tender for construction works, contract or project is awarded to a contractor registered under this Act. Also, an owner shall ensure that the tender for construction works, contract or projects is awarded to a person, firm or contractor registered under this Act.

The proponent will adhere to this regulation and award a reputable contractor.

4.1.15 National Construction Authority Act No. 41 Of 2011

Section 15 calls for the Requirement for registration
(1) A person shall not carry on the business of a contractor unless the person is registered by the Board under this Act.

Compliance; The proponent, once obtained all the requisite permits and licenses must ensure that they shall engage the services of a registered contractor.

PART IV-Addresses the identification and Reporting of Construction Works Contracts or Projects by the Owner.
Section 17. (l) All construction works, contracts or projects either in the public or private sector shall be registered with the Authority in accordance with the Act.

Compliance; The proponent, once obtained all the requisite permits and licenses must ensure that they shall register the construction site with the Authority.

4.1.16 Climate Change Act, 2016

The Regulations provides for a legal framework to enhance response to climate change; to provide for mechanisms and measures to achieve low carbon development for connected purposes. Climate resilient development in Kenya, and is an important milestone on the country's path towards developing its economy while simultaneously reducing greenhouse gas emissions. Part IV, Section 17 (a) states that national environment management authority (NEMA) has the duty of regulate, enforce and monitoring the compliance on levels of greenhouse emissions as set by the national council provided by the act.
Part IV, Section 23 a person in pursuant of article 70 of the constitution may apply the environment and land court alleging that the person has acted in a manner that has adversely affected efforts towards mitigation and adaptation of climate change
Part V, Section 24 Public participation shall be undertaken in a manner that ensures it makes an impact in the threshold of decision making on climate change.

4.2. Institutional Framework

The environmental impact assessment for the proposed development is influenced by interest of several stakeholders and lead agencies, either exclusively or concurrently. Some of these stakeholders and lead agencies include:

- National Environmental Management Authority (NEMA)
- The National Construction Authority (NCA)
- Director of Physical Planning, Machakos County
- The County Government of Machakos
- Ministry Of Lands, Housing And Urban Development
- The ministry of Environment and Natural resources

4.2.1 The National Construction Authority

The Mandate of the NCA is to regulate the construction industry and coordinate its development. The National Construction Authority empowers the Authority to "Accredit and register contractors and regulate their professional undertakings". The Authority publishes a Register of Contractors that contains the particulars of the construction firm, including the Class of Works and Category for which the firm is registered. The Executive Director is the Registrar of Contractors.

The NCA is also responsible for project registration; project registration is an important step towards streamlining of the construction industry. Developing a projects register will facilitate planning and maintaining of construction records that makes quality assurance not just easier but more systematic.

4.3. Development Policy Framework

The overall development policy framework for the proposed project is captured in various local authority and government documents. The development of this project has been benchmarked against UN and International guidelines.

4.3.1. The World Commission on Environment and Development

The commission commonly referred to as "the Brundtland Commission" is focused on the environmental aspects of development. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resources. Social sustainable development maintains the cohesion of a society and its ability to help its members work together to achieve common goals, while at the same time meeting individual needs for health and wellbeing, adequate nutrition, shelter, cultural expression, and political involvement [9].

4.3.2. The Rio Declaration on Environment and Development

The Rio Declaration on Environment and Development was adopted by more than 178 governments at the United Nation Conference on Environment and Development, known as the earth summit, held in Rio de Janeiro, Brazil from 3rd to 14th June 1992. Under Agenda 21, Principle No. 10 of the declaration underscores that environmental. Issues are best handled with participation of all concerned citizens at all relevant levels. At the national level, each individual shall have appropriate access to information concerning environment that is held by public authorities. States shall encourage and facilitate public participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy shall be provided.

[9] Gro Harlem Brundtland, *Report of the World Commission on Environment and Development:" Our Common Future."* (United Nations, 1987).

The foregoing discussion is relevant to the proposed development because Kenya legislation demands that public must be involved before any development project that is likely to have adverse impacts to the environment is initiated by a project proponent. The environment Act has further established public complaints committee (PCC) where the issues raised by the public in regard to any proposed development can be addressed[10].

4.3.3. Kenya Vision 2030

Kenya aims to be a nation that has a clean, secure and sustainable environment by 2030.The goals for 2030 are: (i) to increase forest cover from less than 3% at present to 4%; and (ii) to lessen by half all environment-related diseases. Specific strategies will involve promoting environmental conservation in order to provide better support to the economic pillar flagship projects and for the purposes of achieving the sustainable Development Goals (SDGs); improving pollution and waste management through the design and application of economic incentives; and the commissioning of public-private partnerships (PPPs) for improved efficiency in water and sanitation delivery. Kenya will also enhance disaster preparedness in all disaster-prone areas and improve the capacity for adaptation to global climatic change. In addition, the country will harmonize environment-related laws for better environmental planning and governance[11]

[10] L. Hens, "The Rio Declaration on Environment and Development," *Regional Sustainable Development Review: Africa. Oxford, UK, Eolss Publishers*, 2005, http://www.eolss.net/sample-chapters/c16/E1-48-43.pdf.

[11] Kenya Vision, "2030: A Globally Competitive and Prosperous Kenya (2007)," *Ministry of Planning and National Development and the National Economic and Social Council (NESC), Government of Kenya, Nairobi (GOK, 2007)*, n.d.

5. PUBLIC PARTICIPATION

5.1. Objectives of the consultation and public participation

The objective of the Consultation and Public Participation (CPP) as required in EMCA chapter 387 was to:-

1. Disseminate and inform the public and other stakeholders about the proposed project with special reference to its key components, location and expected impacts.
2. Create awareness among the public on the need for the EIA for the proposed project.
3. Gather comments, concerns and suggestions of the interested and, would be affected/interested parties.
4. Ensure that the concerns of the interested and, would be affected/interested parties were known to the decision-making bodies and the proponent at an early phase of project development planning.
5. Establish a communication channel between the interested, would be affected/interested parties, the team of consultants and the Government.
6. Incorporate the information collected in the project by EIA Experts.

The purpose for such a process was to identify the positive and negative impacts of the project and subsequently suggest mitigation measures.

5.2. Methodology used in the CPP

The Consultation and Public Participation (CPP) Process is a policy requirement by the Government of Kenya and a mandatory procedure as stipulated by EMCA chapter 387 section 58, on Environmental Impact Assessment for the purpose of achieving the fundamental principles of sustainable development[12]. The process is continuous and is on-going. Questionnaires (see attached) were administered to the local community members around the proposed project site through a public gathering. The views and concerns have been incorporated into the impacts and mitigation measures in section 6 and 7 below.

[12] Adapted from "Introduction" in McKeown, Rosalyn. Education for Sustainable Development Toolkit, Version 2, Centre for Geography and Environmental Education, University of Tennessee, July 2002.

6. POTENTIAL ENVIRONMENTAL IMPACTS

6.1. Positive Impacts during Construction

6.1.1. Employment Opportunities

One of the main positive impacts during projects construction phase is the availability of employment opportunities especially to casual workers and several other skilled workers such as building and construction engineers. Employment opportunities are of benefit both economically and socially.

Several workers including casual labourers, masons, carpenters, joiners, electricians, and plumbers are expected to work on the site during the construction phase, most of these will be sourced locally from the surrounding community. Apart from casual labour, semi-skilled, unskilled labour and formal employees are also expected to obtain gainful employment during the period of construction. Generally, employment during the construction phase will lead to multidimensional development in the area and improve several people's living standards.

6.1.2. Optimal use of land

In Africa the UN predicts that the current 400 million urban citizens will exceed 750 million by 2030 and will reach 1.2 billion by 2050[13]. It is also plausible to note that while urban population increases the size of land available for development will continue to decrease. The effect of this trend has been the reduction of farmland and encroachment into animal habitats and migration routes. Thus, it is highly recommended that land being a finite resource must be optimally utilized. The proposed project will see conversion of land currently undeveloped to being a home for over hundred households. The new design will also make it easier for provision of services such as waste management, piped water and electricity.

6.1.3. Economic Growth

Through the use of locally available materials during the construction phase e.g. cement, concrete and ceramic tiles, timber, sand, ballast electrical cables and others; the project will contribute towards growth of the country's economy by contributing to the gross domestic product. The consumption of these materials, oil, fuel and others will attract taxes including VAT which will be payable to the government hence increasing government revenue while the cost of these raw materials will be payable directly to the producers.

6.1.4. Improvement of the Informal Sector

There are usually several informal businesses, which come up during the construction periods of such projects. These include food vendors who benefit directly from the construction workers buying food and other commodities from them. This will promote the informal sector in securing some temporary revenue and hence improve their livelihood.

6.1.5. Market for Supply of Building Materials

[13] Pieterse, E. (2009). African cities: Grasping the unknowable. *Inaugural Lecture, University of Cape Town, August*, *26*.

The project will require supply of large quantities of building materials most of which will be sourced locally in within Athi River, Katani and the surrounding areas. This provides ready market for building material suppliers such as quarrying companies and hardware shops.

6.2. Negative Impacts during construction

6.2.1. Noise pollution

The construction works will most likely be a noisy operation due to the moving machines (mixers, tippers, communicating workers) and incoming vehicles to deliver construction materials and workers to the site. Workers are most likely to be affected since noise beyond some level is itself a nuisance if not maintained within acceptable levels.

6.2.2. Disposal of excavated soil

Site excavations shall be done to the satisfaction of the Principal Consultant's specification hence some materials shall be rejected as waste for disposal. Improper disposal of this category of waste may have adverse impacts on the receiving environment.

6.2.3. Soil Erosion

The excavation and construction activities are likely to loosen the soil particles making them prone to soil erosion. Such problems become serious when the topsoil is left bare and agents of erosion become active. Soil erosion is an important problem both at its source and downstream of the development site. Lost soil will be deposited somewhere, and the location of the deposition could alter downstream hydrology and increase chances of flooding. It may also pose a water quality issue directly as a result of siltation and indirectly from contaminants carried with or attached to soil particles.

6.2.4. Dust Emissions

Particulate matter pollution is likely to occur during the site clearance, excavation and loading and transportation of the construction waste. There is a possibility of PM_{10} suspended and settle-able particles affecting the site workers and even neighbours health.

6.2.5. Increased Water Demand

Both the workers and the construction works will create an increased demand for water in addition to the existing demand. Water will be mostly used in the creation of aggregates for construction works and for wetting surfaces for softening or hardening after creating the formworks.

6.2.6. Generation of Exhaust Emissions

Exhaust emissions are likely to be generated during the construction period by the various construction machinery and equipment. Motor vehicles used to mobilise the work force and materials for construction would cause a potentially significant air quality impact by emitting pollutants through gaseous exhaust emissions.

6.2.7. Building Materials and Energy Consumption

The main sources of energy that will be required for construction of the project will include mains electricity and fossil fuels (especially diesel). Electricity will be used for welding, metal cutting/grinding and provision of light. Diesel will run material transport vehicles and building equipment/machinery. The proponent should promote efficient use of building materials and energy through proper planning to reduce economic and environmental costs of construction activities.

6.2.8. Generation of solid wastes

During construction solid waste will be generated. These include papers used for packing cement, plastics and timber remains among others. Dumping around the site will interfere with the aesthetic status of the area. This has a direct effect to the surrounding community. Disposal of the same solid wastes off-site could also be a social inconvenience if done in the wrong places. The off-site effects could be aesthetic, pest breeding, pollution of physical environment, invasion of scavengers and informal recycling communities.

6.2.9. Risk of accidents

During construction, it is expected that workers are likely to have accidental injuries as a result of accidental occurrences, handling hazardous waste, lack or neglect of the use of protective gear etc. All necessary health and safety guidelines should be adhered to so as to avoid such circumstances.

Workers are also likely to be exposed to diseases from contact with potentially harmful building materials. It is therefore recommended that before the construction activities, materials should be thoroughly inspected and harmonised to the occupational health and safety standards.

6.2.10. Oil spills

The machines on site may be containing moving parts which will require continuous oiling to minimise the usual corrosion or wear and tear. Possibilities of such oils spilling and contaminating the soil and water on site are real. Likewise, moving vehicles on site may require oil change. But these dangers are curbed by maintaining the machinery in specific areas designed for this purpose.

6.2.11. Energy consumption

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

6.3. Positive Impacts during Operation Phase

6.3.1. Increased national housing stock

There is currently a high demand for housing around the Nairobi Metropolis and other cities and towns in Kenya. It has also been projected that 60% of the world population will live in cities by 2050[14]. The growing urban population calls for affordable housing. The proposed project is geared towards filling the existing housing stock gap by availing 408 units for rental and sale. This will add to the supply of housing which is currently a major socio economic problem for Kenya and especially in Nairobi's Metropolis and its vicinity.

6.3.2. Employment Opportunities

Employment opportunities are one of the long term impacts of the proposed project that will be realised after construction and during the operation and maintenance of the building. These will involve other sources of employment of many skilled and semi-skilled people to work in the proposed residential building.

6.3.3. Incorporation of proper Waste Management System

The project is designed such that there will be provision of a well-planned strategic waste management system. The wastes will thus be collected from the site in bulk and as one unit such that the careless disposal leading to proliferation of wastes within the surrounding areas will be curbed.

6.3.4. Increased Revenue generation

Revenues paid to the national and county government in form of taxes will increase once the project is complete. The value of the plot will increase leading to increased land rates payable to the County government.

6.4. Negative Impacts during operation

6.4.1. Increased Pressure on Infrastructure

The proposed development project will lead to increased pressure on existing infrastructure such as roads, service lines etc due to the increased number of people who will be using these facilities to access the services and facilities in the proposed apartments.

6.4.2. Water use

Domestic consumption of water during the operation phase of the project will involve the use of large quantities of water that will take place due to the increased number of households in the area.

[14] Heilig, G. K. (2012). World urbanization prospects: the 2011 revision. *United Nations, Department of Economic and Social Affairs (DESA), Population Division, Population Estimates and Projections Section, New York*.

6.4.3. Solid Waste Generation

It is envisaged that substantial amounts of solid wastes will be generated from the proposed development once it is complete. The bulk of the solid waste produced during the operation of the project will entail paper, plastic, glass, metal, textile and organic wastes. Such wastes can be harmful to the environment through obstruction of drainage systems, clogging of water bodies and negative impacts on animal health. Some of these waste materials especially the plastic/polythene are not biodegradable hence may cause long-term effects to the environment. Even the biodegradable ones such as organic wastes may be harmful to the environment because as they decompose, they produce methane gas, a greenhouse gas known to have a high warming potential.

6.4.4. Increased storm water flow

The building roofs and pavements will lead to increased volume and velocity of storm water or run-off flowing across the area covered by the units. This will lead to increased amounts of storm water entering the drainage systems, resulting in overflow and damage to such systems in addition to increased erosion or water logging in the Neighbouring areas.

6.5. Positive Impacts during decommissioning

6.5.1. Rehabilitation

Upon decommissioning of the proposed project, rehabilitation of the project site will be carried out to restore the site to its original status or to a better state than it was originally. This will include replacement of topsoil and re-vegetation, which will lead to improved visual quality of the area.

6.5.2. Employment Opportunities

Employment opportunities will be created for the construction workers staff during the demolition phase of the proposed project.

6.6. Negative Impacts during decommissioning

6.6.1. Noise and Vibration

The demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas. This will be because of the noise and vibration that will be experienced as a result of demolishing the proposed project.

6.6.2. Generation of Solid Waste

Demolition works will result in large quantities of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment.

6.6.3. Increased dust emission

Large quantities of dust will be generated during demolition works. This will affect demolition workers as well as the neighbors and plants in the area.

7. MITIGATION MEASURES AND MONITORING PROGRAMMES

7.1. Mitigation of Construction Related Impacts

7.1.1. Air Quality

Controlling dust during construction is useful in minimizing nuisance conditions. It is recommended that a standard set of feasible dust control measures be implemented for all construction activities. Emissions of other contaminants (greenhouse gases, and diesel related particulate matter) that would occur in the exhaust from heavy equipment are also included. The proponent is committed to implementing measures that shall reduce air quality impacts associated with construction.

All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction. This means that construction workers will be trained regarding the minimization of emissions during construction. Specific training will be focused on minimizing dust and exhaust gas emissions from heavy construction vehicles. Construction vehicles drivers will be under strict instructions to minimize unnecessary trips and minimize idling of engines.
Dust emissions will be controlled by the following measures:

- Watering all active construction areas as and when necessary to lay dust.
- Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard.
- Pave, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites.
- Sweep daily (with physical sweepers) all paved access roads, parking areas and staging areas at construction sites.

7.1.2. Minimize the Effects of Noise Emitted from the Site

Significance of noise impacts depends on whether the project would increase noise levels above the existing ambient levels by introducing new sources of noise. Noise impacts would be considered significant if the project would result in the following:

a) Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
b) Exposure of persons to, or generation of, excessive ground-borne vibration or ground-borne noise levels.
c) A substantial permanent increase in ambient noise levels (more than five decibels) in the project vicinity above levels existing without the project.
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

The proponents shall put in place several measures that will mitigate noise pollution arising during the construction phase. The following noise-suppression techniques will be employed to minimise the impact of temporary construction noise at the project site.

- Install portable barriers to shield compressors and other small stationary equipment where necessary.
- Establishment of noise buffer, for example waterfalls to mask the traffic noise.
- Use quiet equipment (i.e. equipment designed with noise control elements).

- Co-ordinate with relevant agencies regarding all substation construction activities in the residential areas.
- Install sound barriers for pile driving activity.
- Limit pickup trucks and other small equipment to a minimum idling time and observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible.
- Construction/Demolition works should be done during the day when people are away and also the outside environment is also noisy.
- Adhere to the provisions of Noise Prevention and Control Rules 2005, Legal notice no. 24 regarding noise limits at the workplace.

7.1.3. Minimise the Effects of Exhaust Emission

In order to control exhaust emissions the following measures shall be implemented during construction:

a) Vehicle idling time shall be minimized
b) Alternatively fuelled construction equipment shall be used where feasible
c) Equipment shall be properly tuned and maintained

This will also be achieved through proper planning of transportation of materials to ensure that vehicle fills are increased in order to reduce the number of trips done or the number of vehicles on the road.

7.1.4. Hydrology and Water Quality Degradation

Soil sampling and trial holes digging will be conducted before construction begins and soil information will be provided to construction crews to inform them about soil conditions and potential hazards. If hazardous substances are unexpectedly encountered during trenching, work will be stopped until the material is properly characterised and appropriate measures are taken to protect human health and the environment. If excavation of hazardous materials is required, they will be handled in accordance with applicable regulations. If suspected contaminated groundwater is encountered in the depths of the proposed construction areas, samples will be collected and submitted for laboratory analysis of petroleum hydrocarbons, metals, volatile organic compounds and semi-volatile organic compounds. Appropriate personal protective equipment will be used and waste management will be done in accordance with applicable regulations. Oil absorbent material and storage drums will be used to contain and control any minor releases of engine and other equipment oil.

7.1.5. Worker Accidents and Hazards when Handling Hazardous Wastes

Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area shall be provided. In addition the proponent is committed to adherence to the occupational health and safety rules and regulations stipulated in Occupational Health and Safety Act, 2007. In this regard, the proponent is committed to provision of appropriate personal protective equipment, as well as ensuring a safe and healthy environment for construction workers as outlined in the EMP.

7.1.6. Increase of disease Vectors

Disease vectors such as rats, flies, and cockroaches increase where refuse is exposed or uncollected and can be a hazard. Complete refuse collection and handling service will be provided by the proponent so that this is not a hazard in compliance with the Public Health Act and as also required in the Occupational Safety and Health Act, 2007 regarding hygiene at the workplace.

7.1.7. Possible Exposure of Workers to Diseases

Possible exposure of workers to diseases from building materials at construction site shall be mitigated by occupational health and safety standards enforcement as required in the OSHA, 2007.

7.1.8. Worker Accidents during Construction and Operation

Workers accidents especially in deep trenching operations and from gas accumulation in sewers and other confined spaces shall be mitigated by enforcing adherence to safety procedures and preparing contingency plan for accident response in addition safety education and training shall be emphasized.

7.1.9. Reduction of Impacts at Extraction Sites and Efficient Use of Raw Materials

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

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

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

7.1.10. Minimization of Run-off and Soil Erosion

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

7.1.11. Minimization of Construction Waste

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

The proponent shall put in place measures to ensure that construction materials requirements are carefully budgeted and to ensure that the amount of construction materials left on site after construction is kept minimal. It is further recommended that the proponent should consider the use of recycled or refurbished construction materials. Purchasing and using once-used or recovered construction materials will lead to financial savings and reduction of the amount of construction debris disposed of as waste.

Additional recommendations for minimization of solid waste during construction of the project include:-

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

7.1.12. Reduction of energy consumption

The proponent shall ensure responsible electricity use at the construction site through sensitization of staff to conserve electricity by switching off electrical equipment or appliances when they are not being used. In addition, proper planning of transportation of materials will ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts. Complementary to these measures, the proponent shall monitor energy use during construction and set targets for reduction of energy use.

7.1.13. Minimization of Water Use

The proponent shall ensure that water is used efficiently at the site by sensitizing construction staff to avoid irresponsible water use. The proponent will install water-conserving automatic taps and toilets. Moreover, any water leaks through damaged pipes and faulty taps should be fixed promptly by qualified staff.

7.1.14. Controlling Oil Spills during Construction Phase

The proponent will control the dangers of oil, grease and fuel spills during construction by maintaining the machinery in specific areas designed for this purpose. Machinery site repair will be discouraged and repair work restricted to approved garages to avoid pollution from oil, grease and fuel.

7.1.15. Public Health, Safety and Awareness

a) The contractor should provide a small section of the construction site with a shed and a water stand where the food can be served to the construction workers to promote hygiene and health of the employees.
b) A fully equipped first aid kit should be provided at the site.
c) The contractor must have workmen's compensation cover as required by law (The Workmen's Compensation Act), as well as relevant ordinances, regulation and union's agreements.
d) The workers, immediate neighbour and other stakeholders should be sensitized on the dangers and risk associated with the construction works for enhanced self-responsibility on personal safety.
e) The proponent should ensure that the completed buildings are fitted with safety facilities including fire detectors, fire-fighting equipment, fire exits, adequate access and buffer between the residential premises.
f) Disabled access features and safety signage should be placed strategically around and within the buildings.
g) Appropriate sanitation conveniences should be provided at the site as required in the OSHA, 2007 and echoed in the Public Health Act.

7.2. Mitigation of Impacts during Operation Phase

7.2.1. Ensuring Efficient Solid Waste Management

The proponent will be responsible for efficient management of solid waste generated by the project during its operation. In this regard, the proponent will provide waste handling facilities such as waste bins and skips for temporarily holding domestic waste generated from the apartments. Moreover, the proponent will ensure that such waste is regularly and appropriately disposed.

An integrated solid waste management system is recommended. First, the proponent will give priority to Reduction at Source of the materials. This option will demand a solid waste management awareness programme in the management and the residents. Recycling, reuse and compositing of the waste will be the second alternative in priority. This will call for a source separation programme to be put in place. The recyclables will be sold to waste buyers within the project area. The third priority in the hierarchy of options is combustion of the waste that is not recyclable in order to produce energy. Finally, sanitary land filling will be the last option for the proponent to consider. The proponent will adhere to the Environmental Management and Coordination (Waste Management), Regulations 2006.

7.2.2. Wastewater Management

The proponent will ensure that there are adequate means for handling the large quantities of sewage generated from the facility. It will also be important to ensure that sewage pipes are not blocked or damaged so that the waste can be directed to the sewer system since such vices can lead to release of the effluent, resulting in land and water contamination. Such blockages or damages will be fixed expeditiously. Waste water shall be disposed in compliance with the provisions of the Environmental Management and Coordination (Water Quality), Regulations 2006.

7.2.3. Ensure Efficient Energy Consumption

Tenants will be sensitized to ensure energy efficiency in their domestic operations. Hot water solar heating equipment will be installed. Use of solar will reduce the overall electricity consumption. Furthermore, security lights that have to be kept on throughout the night will be powered by solar. Incandescent bulbs will be highly discouraged.

7.2.4. Ensure General Safety

A competent security firm will be engaged to ensure the general safety and security at all times. The existing perimeter wall will be enhanced by installation of electric fence. The proponent is also advised to install CCTV cameras at strategic zones within the compound.

7.2.5. Ensure Efficient Water Use

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

7.3. Mitigation of Impacts during Decommissioning Phase

7.3.1. Efficient solid waste management

Solid waste resulting from demolition or dismantling works will be managed as described in Section 7.2.1.

7.3.2. Reduction of Dust Concentration

High levels of dust concentration resulting from demolition or dismantling works will be minimized as described in Section 7.1.1.

7.3.3. Minimization of Noise and Vibration

Significant impacts on the acoustic environment will be mitigated as described in Section 7.1.2.

8. ANALYSIS OF PROJECT ALTERNATIVES

8.1. Relocation Option

Relocation option to a different site is an option available for the project implementation. At present the landowner/developer does not have an alternative site. This means that he has to look for an alternative land. Searching for a new site may take long with no guarantees for a suitable find. This would also lead to a situation like No Project Alternative option. The other consequence of this is that it would discourage private/local investors especially in the housing sector. In consideration of the above concerns and assessment of the current proposed site, relocation of the project is not a viable option.

8.2. No Project Alternative

The No Project option in respect to the proposed project implies that the status quo is maintained. This option is the most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. This option will however, involve several losses both to the landowner and the community as a whole. The landowner will continue to pay rent for the plot while the plot remains idle hence no income to the owner. The No Project Option is the least preferred from the socio-economic and partly environmental perspective due to the following factors among others:

- It may lead to further land use change (especially agricultural to housing) elsewhere
- It will jeopardize the goal of creating more housing units for the increasing urban population
- No employment opportunities will be created for thousands of Kenyans who will work in the proposed development and the Nairobi Metropolis at large.

From the analysis above, it becomes apparent that the No Project alternative is no alternative to the proponent, local people, and the government of Kenya.

8.3. The proposed development alternative

Under the proposed development alternative, the developer will be issued with an EIA License. In issuing the license, NEMA will approve the proponent's proposed development. The proponent will be required to implement the project in line with the licensing conditions.

8.4. Analysis of Alternative Construction Materials and Technology

The proposed project will be constructed using modern, locally and internationally accepted materials to achieve public health, safety, security and environmental aesthetic requirements. Equipment that saves energy and water will be given first priority without compromising on cost or availability factors. The concrete pillars and walls will be made using locally sourced stones, cement, sand (washed and clean), metal bars and fittings that meet the Kenya Bureau of Standards requirements.

Beautiful and durable re-enforced concrete roofs because they are good in heat insulation with minimal iron sheet roofs. Heavy use of timber during construction is discouraged because of destruction of forests. The exotic species would be preferred to indigenous species in the construction where need will arise. However, this construction methods and technologies to be used will require very little timber.

9. ENVIRONMENTAL MANAGEMENT/MONITORING PLAN

9.1. Introduction

An environmental management/monitoring plan has been developed to assist the proponent in mitigating and managing environmental impacts associated with the life cycle of the project. It is noteworthy that key factors and processes may change through the life of the project and considerable provisions have been made for dynamism and flexibility of the EMP. As such, the EMP will be subject to a regular regime of periodic review.

Table 2**,** Table 3 and Table 4 form the core of this EMP for the construction, operational and decommissioning phases of the proposed project respectively. In general, the Tables outline the potential safety, health and environmental risks associated with the project and detail all the necessary mitigation measures, their financial costs, as well as the persons responsible for their implementation and monitoring. The EMP will be used as checklist in future environmental audits.

9.2. Construction Phase Environmental Management Plan

The necessary objectives, activities, mitigation measures, and allocation of costs and responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts and maximization of positive impacts associated with the construction phase the proposed project are outlined in Table 2

Table 2: EMP for Construction Phase

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
1. Curb project associated conflicts and Lost Time Injuries (LTI) e.g. land ownership disputes.				
Project implementation disputes	Sufficient planning for adequate resources required i.e. financial, personnel and equipment	Proponent & Contractor	Project planning phase	In progress
	Land transfer agreements should be formalized before the project start as per the laws of the land	Proponent/Government of Kenya	Project planning phase	Done
	Community support mobilization and sensitization through consultative forums or questionnaire methods	Proponent & EIA Experts	Project planning phase	Done
	Change of use from single residential dwelling to multiple residential dwelling	Proponent & County government	Project planning phase	Done

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
2. Minimize extraction site impacts and ensure efficient use of raw materials in construction				
High Demand of Raw material	Source building materials from local suppliers who use environmentally friendly processes in their operations	Project Manager & Contractor	Throughout construction period	
	Ensure accurate budgeting and estimation of actual construction material requirements to ensure that the least amount of material necessary is ordered	Project Manager & Contractor	Throughout construction period	10,000
	Ensure that damage or loss of materials at the construction site is kept minimal through proper storage.	Project Manager & Contractor	Throughout construction period	8,000
	Use at least 5%-10% recycled, refurbished or salvaged materials to reduce the use of raw materials and divert material from landfills	Project Manager & Contractor	Throughout construction period	0
3. Minimize vegetation disturbance at and or around construction site				
Vegetation disturbance	Ensure proper demarcation and delineation of the project area to be affected by construction works.	Contractor, Civil engineer & Project Manager	1 month	10,000
	Specify locations for trailers and equipment, and areas of the site which should be kept free of traffic, equipment, and storage	Civil Engineer, Architect and Project Manager	1 month	5,000
	Designate access routes and parking within the site	Civil Engineer, Architect and Project Manager	1 month	5,000
	Introduction of vegetation (trees, shrubs and grass) on open spaces and their maintenance	Architect & Landscape specialist	Monthly to Annually	8,000

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Design and implement an appropriate landscaping programme to help in re-vegetation of part of the project area after construction	Architect & Landscape specialist	2 months	7,000
4. Reduce storm-water, runoff and soil erosion				
Increased storm water, runoff and soil erosion	A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structure will be designed	The Civil Engineer, Mechanical Engineer and Project Manager	1 month	15,000
	Apply soil erosion control measures such as levelling of the project site to reduce run-off velocity and increase infiltration of storm water into the soil.	The Civil Engineer, Mechanical Engineer and Project Manager	1 months	
	Ensure that construction vehicles are restricted to existing graded roads to avoid soil compaction within the project site	The Civil Engineer, Mechanical Engineer and Project Manager	Throughout construction period	
	Ensure that any compacted areas are ripped to reduce run-off.	The Civil Engineer, Mechanical Engineer and Project Manager	2 months	
	Open drains all interconnected will be provided on site	Civil Engineer	Throughout construction period	5,000 per unit
5. Minimize solid waste generation and ensure efficient solid waste management during construction				
Increased solid waste generation	Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Source reduction 2. Recycling 3.Composting and reuse 4. Combustion 5. Sanitary land filling	Project Manager & Contractor	Throughout construction period	10,000

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Through accurate estimation of the sizes and quantities of materials required, order materials in the sizes and quantities they will be needed rather than cutting them to size, or having large quantities of residual materials	Project Manager & Contractor	One-off	0
	Ensure that construction materials left over at the end of construction will be used in other projects rather than being disposed of.	Project Manager & Contractor	One-off	0
	Ensure that damaged or waste construction materials including cabinets, doors, plumbing and lighting fixtures, marbles and glass will be recovered for refurbishing and use in other projects	Project Manager & Contractor	One-off	0
	Donate recyclable/reusable or residual materials to local community groups, institutions and individual local residents or homeowners.	Project Manager & Contractor	One-off	0
	Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time	Project Manager & Contractor	Throughout construction period	–
	Provide facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements	Project Manager & Contractor	One-off	20,000
	Purchase of perishable construction materials such as paints should be done incrementally to ensure reduced spoilage of unused materials.	Project Manager & Contractor	Throughout construction period	0
	Use building materials that have minimal or no packaging to avoid the generation of excessive waste	Project Manager & Contractor	Throughout construction period	0

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Use construction materials containing recycled content when possible and in accordance with accepted standards.	Project Manager & Contractor	Throughout construction period	0
	Reuse packaging materials such as cartons, cement bags, empty metal and plastic containers to reduce waste at the site	Project Manager, Mechanical Engineer & Contractor	Throughout construction period	0
	Dispose waste more responsibly by dumping at designated dumping sites or landfills only.	Project Manager, Mechanical Engineer & Contractor	Throughout construction period	10,000/ month
	Waste collection bins to be provided at designated points on the site	Project Manager, Mechanical Engineer & Contractor	Throughout construction period	
	Private waste disposal company to be contracted to transport and dispose the solid waste from site	Project Manager, Mechanical Engineer & Contractor	Throughout construction period	15,000
	Running an educational campaigns amongst employees, e.g. through use of posters, to encourage reuse or recycling of the solid waste	Project Manager, Mechanical Engineer & Contractor	Throughout construction period	
6. Reduce dust emissions				
Dust emission	Ensure strict enforcement of on-site speed limit regulations	Project Manager & Contractor	Throughout construction period	
	Avoid excavation works in extremely dry weathers	Project Manager & Contractor	Throughout construction period	
	Sprinkle water on graded access routes when necessary to reduce dust generation by construction vehicles	Project Manager & Contractor	Throughout construction period	15,500
	Personal Protective equipment to be worn always when at work place	Project Manager	Throughout construction period	
7. Minimization of exhaust emissions				

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
Exhaust emission	Vehicle idling time shall be minimized	Project Manager & Contractor	Throughout construction period	0
	Alternatively fuelled construction equipment shall be used where feasible equipment shall be properly tuned and maintained	Project Manager & Contractor	Throughout construction period	0
	Sensitise truck drivers to avoid unnecessary racing of vehicle engines at loading/offloading points and parking areas, and to switch off vehicle engines at these points	Project Manager & Contractor	Throughout construction period	0
8. Minimization of noise and vibration				
Noise and vibration	Sensitise construction vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used.	Project Manager & Contractor	Throughout construction period	0
	Sensitise construction drivers to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as churches, residential areas and hospitals	Project Manager & Contractor	Throughout construction period	0
	Ensure that construction machinery are kept in good condition to reduce noise generation	Project Manager & Contractor	Throughout construction period	25,000
	Ensure that all generators and heavy-duty equipment are insulated or placed in enclosures to minimize ambient noise levels	Project Manager & Contractor	Throughout construction period	10,000
	The noisy construction works will entirely be planned to be during daytime when most of the neighbours will be at work.	Project Manager & all site foremen	Throughout construction period	0
	Comply with the provisions of Noise Prevention and Control Rules 2005, Legal notice no.24 regarding noise limits at the workplace	Project Manager & all site foremen	Throughout construction period	0
9. Minimization of energy consumption				

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
Increased energy consumption	Ensure electrical equipment, appliances and lights are switched off when not being used	Project Manager & Contractor	Throughout construction period	0
	Install energy saving fluorescent tubes at all lighting points instead of bulbs which consume higher electric energy	Project Manager & Contractor	Throughout construction period	5,000
	Ensure planning of transportation of materials to ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts	Project Manager & Contractor	Throughout construction period	5,000
	Monitor energy use during construction and set targets for reduction of energy use.	Project Manager & Contractor	Throughout construction period	5,000
10. Minimize water consumption and ensure more efficient and safe water use				
High water demand	Install water conserving taps that turn-off automatically when water is not being used	Project Manager & Contractor	One-off	10-40 % higher
	Promote recycling and reuse of water as much as possible	Project Manager & Contractor	Throughout construction period	2,000
	Install a discharge meter at water outlets to determine and monitor total water usage	Project Manager & Contractor	One-off	2,000
	Promptly detect and repair water pipe and tank leaks	Project Manager & Contractor	Throughout construction period	5000 per month
	Sensitise staff to conserve water by avoiding unnecessary water use	Project Manager & Contractor	Throughout construction period	0
	Ensure taps are not running when not in use	Project Manager & Contractor	Throughout construction period	1,500
11. Minimize release of liquid effluent				
Generation of wastewater	Ensure that liquid effluent generated by construction workers is directed to the proposed effluent management system.	Mechanical Engineer & Project Manager	One-off	15,000

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Conduct regular checks for pipe blockages or damages since such vices can lead to release of the effluent into the land and water bodies	Mechanical Engineer & Project Manager	Throughout construction period	3,000/ month
	Monitor effluent quality regularly to ensure that the stipulated discharge rules and standards are not violated	Mechanical Engineer & Project Manager	Throughout construction period	3,000/ Month
12. Minimize occupational health and safety risks				
Approval of building plans	Ensure that all building plans are approved by the Local Authority and the local Occupational Health and Safety Office	Developer	One-off	5,000
Registration of the premises	Registration of the premises under the Occupational Safety and Health Act, 2007 Laws of Kenya is mandatory	Developer	One-off	5,000
General register	A general register should be kept within the facility as stipulated in Sec 122&123 of the Occupational Safety and Health Act, 2007.	Project Manager & Contractor	One-off	0
Posting of abstract of Act, rules and notices	There shall be displayed at prominent places within the site the prescribed abstract of the OSHA and the relevant notices as stipulated in section 121 of the OSHA, 2007.	Project Manager & Contractor	One-off	2,500
Incidents, accidents and dangerous occurrences.	Ensure that provisions for reporting incidents, accidents and dangerous occurrences during construction using prescribed forms obtainable from the local Occupational Health and Safety Office (OHSO) are in place.	Project Manager, Developer & Contractor	Continuous	5,000/ month
	Enforcing adherence to safety procedures and preparing contingency plan for accident response in addition safety education and training shall be emphasized.	The Contractor, Project Manager& Site Safety Officer	Continuous	11,600

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
Insurance	Ensure that the premises are insured as per statutory requirements (third party and workman's compensation)	Developer	Annually	_
Safety, health and environment (SHE) policy	Develop, document and display prominently an appropriate SHE policy for construction works	Project Manager, Developer & Contractor	One-off	2,300
Health and safety committee	Provisions must be put in place for the formation of a Health and Safety Committee, in which the employer and the workers are represented	Project Manager	One-off	5,500
Sanitary conveniences	Suitable, efficient, clean, well-lit and adequate sanitary conveniences should be provided for construction workers	Project Manager	One-off	9,000
Medical examination	Arrangements must be in place for the medical examination of all construction employees before, during and after termination of employment	Project Manager, Developer & Contractor	Continuous	500 per examination
Machinery/equipment safety	Ensure that machinery, equipment, personal protective equipment, appliances and hand tools used in construction do comply with the prescribed safety and health standards and be appropriately installed maintained and safeguarded	Project Manager, Developer & Contractor	One-off	_
	Ensure that equipment and work tasks are adapted to fit workers and their ability including protection against mental strain	Project Manager, Developer & Contractor	Continuous	_
	All machines and other moving parts of equipment must be enclosed or guarded to protect all workers from injury	Project Manager	One-off	_

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Arrangements must be in place to train and supervise inexperienced workers regarding construction machinery use and other procedures/operations	Project Manager	Continuous	5,000 per training
	Equipment such as fire extinguishers must be examined by a government authorized person. The equipment may only be used if a certificate of examination has been issued	Project Manager	Continuous	5,000 per examination
	Reports of such examinations must be presented in prescribed forms, signed by the examiner and attached to the general register	Project Manager	Continuous	3,000 per examination
Storage of materials	Ensure that materials are stored or stacked in such manner as to ensure their stability and prevent any fall or collapse	Project Manager	Continuous	5,000
	Ensure that items are not stored/stacked against weak walls and partitions	Project Manager	Continuous	_
Safe means of access and safe place of employment	All floors, steps, stairs and passages of the premises must be of sound construction and properly maintained	Project Manager & Contractor	Continuous	_
	Securely fence or cover all openings in floors	Project Manager & Contractor	One-off	_
	Provide all staircases within the premises with suitable handrails on both sides	Project Manager & Contractor	One-off	
	Ensure that construction workers are not locked up such that they would not escape in case of an emergency	Project Manager & Contractor	Continuous	_
	All ladders used in construction works must be of good construction and sound material of adequate strength and be properly maintained	Project Manager & Contractor	One-off	_

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
Emergency preparedness and evacuation procedures	Design suitable documented emergency preparedness and evacuation procedures to be used during any emergency	Project Manager & Contractor	One-off	4,000
	Such procedures must be tested at regular intervals	Project Manager & Contractor	Every 3 months	4,000
	Ensure that adequate provisions are in place to immediately stop any operations where there in an imminent and serious danger to health and safety and to evacuate workers	Project Manager & Contractor	One-off	6,000
	Ensure that the most current emergency telephone numbers posters are prominently and strategically displayed within the construction site	Project Manager & Contractor	One-off	2,000
	Provide measures to deal with emergencies and accidents including adequate first aid arrangements	Project Manager & Contractor	Continuous	5,000
First Aid	Well stocked first aid box which is easily available and accessible, should be provided within the premises	Project Manager & Contractor	One-off	5,000
	Provision must be made for persons to be trained in first aid, with a certificate issued by a recognized body.	Project Manager & Contractor	One-off	5,000
13. Ensure the general safety and security of the site and surrounding areas				
Increased Pressure on Infrastructure	Coordinate with other planning goals and objectives for the region	Architect, Project Manager, Contactor and the Developer	Continuous	18,000
	Upgrade existing infrastructure and services, where feasible.	Architect, Project Manager, Contactor and the Developer	Continuous	

Insecurity	Ensure the general safety and security at all times by providing day and night security guards and adequate lighting within and around the construction site.	Security Officer, Project Manager & Police	Continuous	15,000
	Body-search the workers on entry, to avoid getting weapons on site, and leaving site to ensure nothing is stolen.	Security Officer	Continuous	
	Ensure only authorised personnel get to the site	Security Officer	Continuous	
	Security alarms will be installed	Security Officer	Continuous	
14. Environmental monitoring of the project				
Environmental concern during the construction phase	Due to the magnitude of the project the proponent will liaise with the environmental consultants throughout the construction phase and ensure that the conditions of approval are adhered to.	Proponent, Contractor and Consultant	Throughout construction phase	

9.3. EMP for operational phase

The necessary objectives, activities, mitigation measures, and allocation of costs and responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts and maximization of positive impacts associated with the operational phase of the office project are outlined in **Table** 3 below

Table 3: EMP for Operation Phase

Expected Negative impact	**Recommended Mitigation Measures**	**Responsible Party**	**Time Frame**	**COST (KSHS)**
1 Minimization of solid waste generation and ensuring more efficient solid waste management				

Expected Negative impact	Recommended Mitigation Measures	Responsible Party	Time Frame	COST (KSHS)
Solid waste generation	Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Source reduction 2. Recycling 3.Composting and reuse 4. Combustion 5. Sanitary landfilling.	Proponent/Property Managers	One-off	5,000/Month
	Provide solid waste handling facilities such as waste bins and skips	Proponent/Property Managers	One-off	10,000
	Ensure that solid waste generated is regularly disposed of appropriately at authorised dumping sites	Proponent/Property Managers	Continuous	10,000/month
	Donate redundant but serviceable equipment to charities and institutions	Proponent/Property Managers	Continuous	0
	Comply with the provisions of Environmental Management and Co-ordination (Solid Waste) Regulations 2006	Proponent/Property Managers	Continuous	0
2 Minimise risks of liquid waste release into environment				
Liquid waste release into the environment	Provide adequate and safe means of handling liquid waste at the premises	Proponent/Property Managers	One-off	
	Conduct regular inspections for pipe blockages or damages and fix them appropriately	Proponent/Property Managers	Continuous	500 per inspection
	Ensure regular monitoring of the sewage discharged from the project to ensure that the stipulated sewage/effluent discharge rules and standards are not violated	Proponent/Property Managers	Continuous	500/parameter

Expected Negative impact	Recommended Mitigation Measures	Responsible Party	Time Frame	COST (KSHS)
	Comply with the provisions of Environmental Management and Co-ordination (Water Quality) Regulations 2006	Proponent/Property Managers	Continuous	0
3 Minimize energy consumption				
Energy Use	Switch off electrical equipment, appliances and lights when not in use	Proponent/Property Managers	Continuous	–
	Install occupation sensing lighting at various locations such as the parking areas which are not in use all the time	Proponent/Property Managers	One-off	10-40 % higher than ordinary lighting
	Install energy saving fluorescent tubes at all lighting points within the building instead of bulbs which consume higher electric energy	Proponent/Property Managers	One-off	10-40 % higher than ordinary lighting
	Monitor energy use during the operation of the project and set targets for efficient energy use	Proponent/Property Managers	Continuous	5,000/month
	Sensitise workers on how to use energy efficiently	Proponent/Property Managers	Continuous	500/month
4 Minimize water consumption and ensure more efficient and safe water use				
Water management	Promptly detect and repair water pipe and tank leakages	Proponent/Property Managers	Continuous	5,000/month
	Workers/visitors to conserve water e.g. by avoiding unnecessary toilet flushing	Proponent/Property Managers	Continuous	500/month
	Ensure taps are not running when not in use	Proponent/Property Managers	Continuous	500/month

Expected Negative impact	Recommended Mitigation Measures	Responsible Party	Time Frame	COST (KSHS)
	Install water conserving taps that turn-off automatically when water is not being used	Proponent/Property Managers	One-off	10-40 % higher than ordinary taps
	Install a discharge meter at water outlets to determine and monitor total water usage	Proponent/Property Managers	One-off	5,000
5 Minimization of health and safety impacts				
Implement all necessary measures to ensure health and safety of workers and the general public during operation of the offices as stipulated in the Occupational Safety and Health Act,2007		Proponent/Property Managers	Continuous	–
6 Ensure the general safety and security of the premises and surrounding areas				
Ensure the general safety and security at all times by providing day and night security guards and adequate lighting within and around the premises		Proponent/Property Managers	Continuous	10,000/month
7 Control of informal activities around the project site				
Mushrooming of Informal Settlement		Local Administration; Local Authority	Continuous	0
8 Ensure environmental compliance				
Undertake an environmental audit within 12 months after operation commences as required by law		Consultant	12 months after operation commences	40,000

9.4. Decommissioning Phase

In addition to the mitigation measures provided in Table 2 and **Table** 3, it is necessary to outline some basic mitigation measures that will be required to be undertaken once all operational activities of the project have ceased. The necessary objectives, mitigation measures, allocation of responsibilities, time frames and costs pertaining to prevention, minimization and monitoring of all potential impacts associated with the decommissioning and closure phase of the project are outlined in Table 4 below.

Table 4: EMP for Decommissioning Phase

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (KShs)
1. Demolition waste management				
Demolition waste	Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Source reduction 2. Recycling 3.Composting and reuse 4. Combustion 5. Sanitary land filling.	Project Manager & Contractor	Once-off	5,000
	All buildings, machinery, equipment, structures and partitions that will not be used for other purposes must be removed and recycled/reused as far as possible	Project Manager & Contractor	Once-off	15,000
	All foundations must be removed and recycled, reused or disposed of at a licensed disposal site	Project Manager & Contractor	Once-off	7,000
	Where recycling/reuse of the machinery, equipment, implements, structures, partitions and other demolition waste is not possible, the materials should be taken to a licensed waste disposal site	Project Manager & Contractor	Once-off	0
	Donate reusable demolition waste to charitable organizations, individuals and institutions	Project Manager & Contractor	Once-off	0
2. Rehabilitation of project site				
Site degradation	Implement an appropriate re-vegetation programme to restore the site to its original status	Project Manager & Contractor	Once-off	0

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (KShs)
	Consider use of indigenous plant species in re-vegetation	Project Manager & Contractor	Once-off	0
	Trees should be planted at suitable locations so as to interrupt slight lines (screen planting), between the adjacent area and the development.	Project Manager & Contractor	Once-off	0

10. CONCLUSION AND RECOMMENDATION

10.1. Conclusions

1) The proposed development project is a worthy investment by the proponent and broadly with no doubt will contribute significantly to the increased housing stock and by extension spur economic development.
2) Key positive impacts that will result from the project include; growth of the economy, boosting of the informal sector during the construction phase, provision of market for supply of building materials, employment generation, increase in government revenue and optimal use of land.
3) Negative environmental impacts that will result from establishment of the proposed project which include pressure on the existing facilities, noise pollution, dust emissions, solid waste generation, increased water demand, increased energy consumption, generation of exhaust emissions, risk of workers accidents, possible exposure of workers to diseases, increased
4) Negative impacts can be sufficiently mitigated by implementation of the proposed EMP

10.2. Recommendations

1) The proponent shall implement the measures outlined in the EMP as well as adhering to all relevant national and international environmental, health and safety standards, policies and regulations that govern establishment and operation of such projects.
2) Maximize positive impacts as much as possible as exhaustively outlined within the report. These measures will go a long way in ensuring the best possible environmental compliance and performance standards.
3) The developer be licensed to implement the project.

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