

ENVIRONMENTAL IMPACT ASSESSMENT

STUDY REPORT

FOR

THE PROPOSED DEVELOPMENT OF RESIDENTIAL APARTMENTS ON PLOT L. R. NO. 76/496 (ORIGINAL NO. 76/381/III) ALONG THINDIGUA HIGHWAY STREET OFF KIAMBU ROAD IN THINDIGUA AREA, KIAMBU COUNTY.

(GPS Coordinates: Latitude 1°12'16.7"S, Longitude 36°50'13.4"E)

Done Pursuant to the provisions of the Environmental Management and Coordination Act, CAP 387 and the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019 and submitted to the National Environment Management Authority (NEMA)

Proponent:

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CERTIFICATION

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Annexes

Copy of Land Ownership
 Copies of social site assessment completed questionnaires
 Copies of the proposed designs (plans/drawings)

Table 1: Acronyms and Abbreviations Used in This Report

EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
NEMA	National Environmental management Authority
PPE	Personal Protective Equipment
OHS	Occupational Health and Safety
EHS	Environmental Health and Safety
ERPs	Emergency Response plans
NO _x	Nitrogen Oxides
SO _x	Sulphur Oxides
CO _x	Carbon Oxides
EMCA	Environmental Management Coordination Act
Φ	Diameter
PV	Permanent vent
Ha	Hectares
EA	Environmental Audit

EXECUTIVE SUMMARY

Sustainability envisages all aspects of social, economic, political and natural environment. A glance at the development trend in urban centers indicates that there has been rapid development projects which threaten forward planning interventions mainly in the form of un-matching infrastructural expansion. The development wave has caught the authorities napping making a scenario of a demand-led instead of an infrastructure-led type of development. This has the potential to bring forth unprecedented negative social and environmental impacts. The purpose of EIA process is to identify potential impacts of the proposed project and then identifying the avoidable and the unavoidable for the purposes of avoiding the avoidable and proposal of appropriate measures for mitigating the unavoidable for the purposes of ensuring sustainable development. In so doing, adverse impacts are attenuated while enhancing project benefits but this can only be ensured by commitment of the proponent, sound monitoring and supervision for the purposes of initiating any necessary action to limit adverse impacts disclosed by monitoring.

TSAVO SUNSET LTD. hereinafter referred to as the proponent; proposes to develop residential apartments on L.R No. 76/496 along Thindigua Highway Street off Kiambu Road in Thindigua area, Kiambu County. It involves the construction of 377No. studio apartments and 45No. one bed-roomed apartments, 45No. two bed-roomed apartments, and 18No. three bed-roomed apartments (**Total: 485 units of apartments**) on 4 semi-detached 8-storey building blocks. The basement and partly ground floors comprise of parking. The ground to 8th floors will comprise of residential apartments. The roof floor will comprise on open areas and swimming pool. The salient features of the project will include management store and office, power room, generator house, guard house, protected dustbin cubicles, driveways and parking, and the proposed project will be enclosed with a stone perimeter wall with a single gate serving as entry and exit. The proposed design has provided for foul and wastewater disposal system and other plumbing articulation, and surface run-off drains. The apartments are typical in design and accommodation. Accommodation shall comprise of mostly bedsitters with sanitary facilities and one bedroom, two bedrooms, and three bed-roomed apartments with lounge/living room, kitchen, and sanitary facilities. The apartments are in 4 semi-detached blocks rising to nine sky-levels. There shall be staircases and three lift shafts to facilitate access and vertical movement. The proponent has provided for driveway and parking at the basement and ground floors. The proposed designs/plans have been done by Tsavo Architects and have been approved by the Kiambu County Government. (Please refer to the attached plans/drawings in the annex for the finer details).

The proponent's decision to develop is largely fueled by the high demand for houses, government support for private sector participation in housing (basic need) provision, and the potential profits/return to investments. It is estimated that on approval; the project will take approximately 6 calendar months to implement and it is estimated to cost approximately Kenya shillings **Four hundred million (Kshs 400,000,000)**.

The trend is overwhelming in the area and similar projects are complete and others are underway, a trend that has caused a sharp increase in land values in the area due to the demand created for the land in the area by potential investors. Some plots in the neighborhood are under similar development and already occupied, while some others have old bungalows, maisonettes and/or town houses, all of which are in line with the planning policy for the area. The limited supply of land and the ever-increasing demand for housing has fuelled the need for multi-dwellings developments in an effort to alleviate the housing shortage. The proactive designs has provided for adequate ventilation and natural lighting, storm water drainage, water storage and foul and wastewater disposal. From the proposed designs, the essential set local standards (in terms of

physical planning, minimum habitable rooms, basic facilities, health and safety) have been met. The land is registered in the name of the proponent (Please find copy of certificate of lease attached).

The proposed site is within a well-developed area and all the major urban services (electricity, water, sewer, and road network) are available in the area. The relevant legislation has been adhered to in the design (discussed in the body of the report).

Environmental management and development problems require an integrated approach, as they are so integrated with social, demographic, economic and political elements. The scope of the assessment study covered the physical extent of the project site and its immediate environs as may be affected, proposed works and activities including installation of utilities/facilities and services.

Broadly, the terms of reference were but not limited to evaluation of project objectives, the location of the proposed project site, baseline information generation, legal provisions, technology, materials, procedures and processes to be used, in the implementation and operation of the project of the project vis a viz the principles of environmental conservation and the prevailing legal requirements. The methodology for the study involved comprehensive physical inspection of the site and its environs, desktop studies and consultations with the proponent, his consultants and the neighbors among others.

The positive impacts of any project are in the form of sustainability indicators largely categorised into three broad classes as economic inputs, social inputs and environmental inputs. The economic inputs arising from this project come broadly in the form of real income (investments), employment and fixed capital formation. Environmental inputs include clean and healthy general environment and sustainable use of resources. However, the impacts may be more only that they are decentralized and may not be directly attributed to the project. The main include but not limited to provision of standard housing and thus wellbeing, creation of employment throughout the project cycle, optimal use of the land and increase in land value, direct and indirect increase in government revenue, economic-investment hence increases in wealth, creation of market for goods and services and especially construction inputs and many secondary businesses are also likely to spring up during the implementation phase especially those providing foods and beverages to the construction workers and general increase in business around the project site area due to the increased population.

The benefits mentioned notwithstanding, some associated costs may arise as well. The foreseeable negative impacts include but not limited to impact (constraints/pressure) to the existing infrastructure i.e. water, foul and wastewater disposal, power, surface drains (increased storm water/ run off resulting from the roof catchments and as a result of decreased recharge areas), roads among others, Impact to soil especially when laying the foundation and other earthworks and reduction of the green areas, increased noise and vibration mostly during project implementation phase and enhanced potential for social crimes.

Others potentially include air pollution (dust particles emanating from excavation and construction activities and exhausts from the involved machinery), health and safety concerns especially to workers and immediate neighbours due to potential accidents, pollution and disturbance. Hazards associated with construction include but not limited to falling objects, risks from poor scaffolding, ladder and formwork. There is also risk of crossing live underground electric cables during excavations. Poor quality construction materials, poor workmanship and poor standards may also contribute to accidents. Inadequate skills in machinery operation and stress are serious safety hazard. Other risks involve fires.

The ideal strategy to counter identified adverse effects is avoidance and whenever not be possible, alternative strategies of reduction, remediation, and compensation may be explored. Measures can therefore be divided into two categories namely primary measures that intrinsically comprise part of the development design; and secondary measures designed to specifically address the remaining (residual) adverse effects. The proactive design has provided various mitigation measures to ensuring compliance with applicable environmental laws and guidelines including but not limited to lighting, ventilation, space requirements, surface drainage, sewerage system and the structural safety among others.

Sitting, planning and design should ensure compatibility with surroundings and construction standards. To minimize air pollution and soil disturbance/erosion, ensure soil compaction and watering of loose soils on all unpaved access paths/roads, parking areas, dust-generating construction materials at the construction sites in addition to a dust-proof net around the site. Further measures to cater for soil disturbance include use of strip foundation so that ground disturbance shall only be on minimal points. Emission of noxious fumes should be avoided or minimized as possible. To cater for surface drainage, well-designed drain channels have been proposed to harmonize management of the resulting storm water within the site. Storm water/runoff could be greatly reduced by rainwater harvesting and rainwater storage facilities. The drains should be regularly maintained and covered with gratings to avoid accidents and dirt. To reduce noise pollution, portable barriers to shield compressors and other small stationary equipment where necessary should be installed; engines should be switched off when not in use; machineries well maintained, install silencers whenever possible and ensure that the work is carried out during the day. Vehicle/machinery idling should be minimized/controlled. Encourage use of cleaner fuels such as low sulphur diesel and unleaded gasoline. The maintenance should be conducted in appropriate and designated service bays (off-site) to reduce chances of contamination of environment by resulting oils and greases. Any of such oils should be collected and disposed appropriately. For health and safety, the entire sewerage system are properly designed (using approved materials), and shall be installed and regularly maintained to effectively drain effluent into the public sewer line. All workers should be provided with full protective gear (PPE) and they should be trained and sensitised on health, safety and environmental conservation aspects. Qualified personnel must do all scaffolding, ladder and formwork to standards. Any live underground cables on site must be identified if they exist before excavations. Quality materials, skilled labour (where necessary), and the set standards must be put into practice. All precautions (barriers) must be taken to prevent accidents from falling objects. The site should be fenced off during construction to keep off animals and the general public.

Effective emergency response plans should be adapted both during the entire project cycle. There should be a specific area for hazardous material storage. Strictly, the **Building Code** and other applicable building standards as may be in force must be adhered to and **The Occupational Safety and Health Act, 2007** must be enforced. An accident/incident record should be kept on site and under care of responsible person and a first aid kit(s) with all basic requirements and the in-charge be trained. To prevent social crimes, the workers should be vetted during recruitment and should be closely monitored and movement out of site should be restricted. Construction workers should not reside on site and should be trained and sensitised on anti-social behaviour.

Throughout the project cycle, sound waste management systems and procedures must be adopted. During the construction phase, the contractor should put in place effective and efficient waste disposal systems. Waste, including excavated soil and debris should be properly disposed of by backfilling or dumping in approved grounds by the County or other relevant government offices. The contractor should provide acceptable and standard sanitary conveniences to the workers during

the construction. On completion, comprehensive landscaping should be done to upgrade the site to appropriate environmental standard.

Generally, the significant impacts of such developments are the respective pressure they exert on the infrastructure due to failure of the central and local governments upgrade the same accordingly through various respective agencies/departments/parastatals, using funds raised through various taxes and infrastructure development levy charged on developers/proponents. The implementation of these is long overdue and the buck stops at the government and or implementing agencies.

The study and a cost and benefit analysis reveals that the benefits far outweigh the associated costs and the benefits can further be maximized with strict adherence to the proposed mitigation measures (the EMPs) and closely working with environmental experts and other relevant professionals, NEMA, County Government and other relevant institutions throughout the project cycle. The importance of liaising is to ensure that variation in predicted impacts is handled appropriately during the project cycle otherwise the major concerns at any point in time should be focused towards avoidance or minimizing the occurrence of negative impacts.

1.0 INTRODUCTION

1.1 General overview, Justification and rationale for EIA

The proponent has proposed to develop residential apartments on plot L.R No. 76/496 along Thindigua Highway Street off Kiambu Road in Thindigua, Kiambu County. The proposed site is idle with little vegetation to be cleared to pave way to the proposed development. The proposed site is within a residential zone (single-dwelling and multi-dwelling) thus is compliant with planning policy. The proposed project is collaborated by the ever growing population coupled with growing economy among others, thus the need for increase in standard residential house units. Besides, the project brings forth various advantages as discussed elsewhere in this report. Housing is a basic need but unfortunately its supply has always lagged behind the demand.

The rationale for the EIA study report is to integrate environmental aspects in the planning and implementation processes of the proposed project to mitigate adverse impacts and enhance the positives. Besides, environmental impact assessment (EIA) for such projects is now a legal requirement. The ultimate objective an EIA is to provide decision makers, relevant institutions/organizations, proponent and other stakeholders with the foreseeable environmental impacts of a proposed activity and therefore enable planning ahead taking into account all predictable outcomes and adequately providing for them for sustainability.

The purpose of the study is to identify foreseeable potential impacts (physical, ecological and cultural/socio-economic) so as to enhance the benefits and at the same time avoid negative impacts (costs) or provide appropriate cost effective measures to remedy the negative impacts that cannot be completely avoided. The study is expected to raise both the potential positive and negative impacts likely to emanate from the proposed project. Integrating *Sustainable Environmental Management principles* in the planning, implementation and throughout the project cycle is vital in reducing/mitigating conflicts and enhancing environmental conservation.

1.2 Objectives

The main objective of this EIA study report was to establish the baseline conditions of the proposed site, evaluate the existing and the anticipated impacts and propose measures to enhance the positive impacts and measures to attenuate the effects of the significant negative impacts.

1.3 Terms of Reference (TOR)

This Environmental Impact Assessment involved the generation of baseline information, establishing the current status of the proposed site and its environs, identification of predictable effects of the development on the environment (including infrastructure, occupational health and safety issues) and direction & magnitude of the changes, analysis of the compatibility of the proposed project with the surrounding land uses (as per the prevailing policy and legal framework) and the proposition of potential mitigation measures to be undertaken throughout the project cycle; and development of an environmental management plan with proposed mechanisms for monitoring and evaluating the compliance and environmental performance.

1.4 Scope of EIA Study

The study has been conducted as per the above TOR and as set out in EMCA, CAP 387 and the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019. i.e. to evaluate the potential and the foreseeable impacts of the proposed project, generation of baseline information evaluation and recommendation of the best alternatives from the options available (if any), the nature, order of magnitude, extent, duration and reversibility of the potential changes. The

geographical scope is limited to the direct and indirect physical extent as may be foreseeably affected by the proposed project.

1.5 Methodology

The methodology involved visits to the proposed site for data collection, relevant desktop study, analysis and interpretation of data collected, analysis of proposed designs, activities and schedules, public participation and consultation with professionals and other stakeholders.

2.0 ENVIRONMENTAL SETTING OF THE PROJECT AREA AND ITS ENVIRONS

2.1 PHYSICAL ENVIRONMENT

2.1.1 Climate

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

Rainy season- November –winds light easterly, usually warm sunny and showery. Mean precipitation ranges at 1,213 mm per annum. Hottest periods are usually during January, February and September, October with temperatures getting as high as 32⁰ C while the coolest periods are between June- July and December with temperatures as low as 10⁰ C.

2.1.2 Topography

The topography of the general area is gentle slopping towards north (with an increasing gradient towards western). This has great influence to the drainage of the general area. There are no rivers or water bodies and forests close to the site.

The proposed development site is flat and will have little or no influence to the movement of surface materials (mostly soil) once set loose; during earth works.

2.2 BIOLOGICAL ENVIRONMENT

2.2.1 Flora

The general area is overgrown with vegetation (trees) mostly along the roads and along the boundaries including compounds. The project area is covered with maize and vegetable plantation which shall be cleared to pave way to the proposed project.

The site plan has made provisions for the integration of landscaping using exotic vegetation. Tree plants will be evenly distributed over the site- at the front, sides and backyard of the building structures; also along the boundary and at the entrance to the site.

2.2.2 Fauna

There is no fauna/wildlife threatened by the development.

Plate 1: Part of vegetation and soil in the area



Source: Site Survey

2.3 SOCIO ECONOMIC ENVIRONMENT

The proposed project site is within an area predominantly residential and therefore almost every other plot in the neighborhood is residential or residential cum commercial related activities. The location is well accessible off Kiambu Road and the general area is near an urban center with various commercial activities including shops primarily to serve the residents and the visitors. Due to proximity to the Nairobi CBD, the area's population is growing by the day with so many people moving there for accommodation and business opportunities. All social amenities (hospitals, schools, religious places, shopping areas etc.) are within easy reach. All major urban infrastructures (electricity, roads, and landline telephony except sewer which is non-existent are connected to the proposed project site. All emergency facilities (ambulances etc.) are within easy reach from the various providers. The area is currently a middle density residential area. There are no sites of cultural, historic or traditional significance in the immediate neighborhood. The area is within the jurisdiction of Kiambu County Government and therefore bound by its by-laws.

2.3.1 Roads and accessibility

The immediate access path is all weather and joins the tar surfaced Kiambu Road near Delta Petrol Station at Thindigua and therefore the site is well accessible.

Plate2: Part of infrastructure in the area



Source: Site Survey

2.3.2 Sewer system

The area is served by a public sewer line. The sewer system reticulation has been effectively designed in the proposed plans and will be connected to each unit and to the public sewer line.

2.3.3 Water resources

The proposed project site shall be connected to the water supply network in the neighborhood. It is proposed that the proposed development will have cold-water storage tanks under the roof to the specifications of the mechanical engineer.

2.3.4 Surface Drainage

The area is fairly level but the proposed design has provided for effective storm water drainage system. The proposed design has provided for internal drains to collect the surface run-off and safe final disposal.

2.3.5 Solid waste Management

The area is within the jurisdiction of the Kiambu County Government, which has the responsibility of disposal of waste. However, the proponent/contractor has an option of contracting a private garbage collecting company. During construction however, construction solid waste - arising from the demolition debris, vegetation materials to be cleared, and construction material wastes (wooden, glass, plastics, sanitary litter etc.) handling may be a challenge. This calls for sound waste management system especially during construction. All solid wastes should be dumped in approved dumpsites and in accordance with the regulations.

2.3.6 Energy

The site will be connected to the national grid. Fossil fuels will power some machinery/equipment.

2.3.7 Communication

The area is well covered by all communication facilities such as landline and mobile services. All these will facilitate communication throughout the project cycle.

3.0 RELEVANT LEGISLATIVE AND REGULATORY FRAMEWORK

3.1 The Environment Management and Coordination Act, CAP 387

The Act entitles every person in Kenya to a clean and healthy environment and aims to safeguard and enhance the environment. Though there are other sectoral laws on environmental conservation, this is the supreme Act. It provides guidelines on issues of environment, stipulates offences and penalties and establishes NEMA. The Act also lists the type of projects, which must be subjected to the EIA process and establishes NEMA.

In compliance with the above regulation, the proponent *appointed experts to conduct this EIA study report to seek approval for the proposed project.*

3.2 Environment (Impact Assessment And Audit) (Amendment) Regulations, 2019

These are entrenched under section 147 of the EMCA. The regulations provide the framework for carrying out EIAs and EAs in Kenya. *This EIA study report is conducted in conformity with these regulations and EMCA, CAP 387.*

3.3 EMCA (Water Quality) Regulations, 2006

These regulations set the standards of domestic water and waste water. The regulations are meant for pollution control and prevention and provides for protection of water sources. *The proposed project has no chance of significantly affecting this since the project will connect to the local supply, and there is no surface water body nearby.*

The proposed project will connect to the public sewer line.

3.4 EMCA (Waste Management) Regulations, 2006

These regulations define the responsibilities of waste generators and define the duties and requirements for transportation and disposal of waste. It provides for mitigation of pollution and provides for hazardous and toxic wastes. The regulations require a waste generator to dispose waste only to a designated waste receptacle. *The proponent shall adhere to the regulations and proposes to contract a NEMA registered waste transporter.*

3.5 The world commission on environment and development–the Brundtland Commission of (1987)

The Brundtland Commission addresses the environmental aspects of development. It has emphasized on sustainable development that produces no lasting damage to the biosphere and to particular ecosystems. In addition to environmental sustainability is the economic and social sustainability. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resource. *The proponent is committed to adhere to the proposed EMP to ensure environmental enhancement and this would first be monitored through the initial environmental audit.*

3.6 National Policy on Water Resources Management and Development

It enhances a systematic development of water facilities in all sectors for the promotion of the country's socio-economic progress, and also recognizes the by-products of these processes as wastewater. It calls for development of appropriate sanitation systems to protect people's health and water resources from pollution. *The proponent has provided for sewer articulation in the design and will connect to the public sewer line and take all precautions to avoid leakages.*

3.7 Occupational Safety and Health Act, 2007

The Act makes provision for the health, safety and welfare of persons employed in factories and other places of work. The provisions require that all practicable measures be taken to protect persons in places of work from dust, fumes or impurities originating from any process within the workplace. The provisions of the Act are also relevant to the management of hazardous and non-hazardous wastes, which may arise at a project site.

The Act provides for all necessary safety precautions to ensure the health and safety of workers. *The proponent has appointed a reputable contractor who is/will be responsible in enforcing the requirements during construction and subsequent repairs and maintenance after project completion.*

3.8 Physical Planning Act of 1996

This is the principle Act governing land planning and the project proponent is required to acquire a Certificate of Compliance or approval letter from the relevant institutions as set out in the Act. The sole objective of the Act is to harmonize development. *The drawings (plans) of the proposed project have been submitted to the various relevant departments for approval.*

3.9 County Governments Act, 2012

The Act empowers county governments to make by-laws in respect of suppression of nuisances, imposing fees for any license or permit issued in respect of trade or charges for any services. County governments are given power to control or prohibit all developments which, by reason of smoke, fumes, chemicals, gases, dust, smell, noise, vibration or other cause, may be or become a source of danger, discomfort or annoyance to the neighbourhood, and to prescribe the conditions subject to which such developments shall be carried on. *In compliance, the EIA report has proposed potential mitigation measures (in the EMP and monitoring plan; and the environmental management Framework in the report).*

3.10 Building code 2000

This provides the basic rules, guidelines and standards for construction. It is a comprehensive document, which every developer/proponent/ contractor should have. *All approvals will be sought before commencement of the work and regular monitoring will follow to ensure compliance with set standards and conditions.*

3.11 Public Health Act- (Revised 1986)

The Act demands the adoption of practicable measures to prevent injurious and unhealthy conditions in the site. The Act requires the proponent to enhance effective management of Nuisances i.e. noxious matter or wastewater as will be discharged from the proposed project throughout the project cycle. To achieve this, systems on the management of both solid and liquid waste (effluent) will be adopted as proposed in the report. *For instance, the effluent will be discharged into the public sewer line. The solid waste shall be handled by a professional 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.*

3.12 National shelter Strategy to the Year 2000

This strategy was formulated to advocate a change in policy in order to allow investors to come in and give the government a hand in providing housing. The government's role was to simply facilitate. *This is the role the proponent wishes to contribute to by investing and reaping some economic returns in the process.*

3.13 Water Act, 2016

Part III section 21 (1) of this Act provides for national monitoring and geo -referenced information systems on water resources to be effected by the Water Resources Management Authority. Following on this, sub-section 2 allows the Authority to demand from any person or institution, within a reasonable time or on a regular basis, specified information, documents, samples or materials on water resources. Under these rules, specific records may require to be kept by a site operator and the information thereof furnished to the authority.

Part IV Section 63 states that "every person in Kenya has a right to clean and safe water in adequate quantities and to reasonable standards of sanitation as stipulated in Article 43 of the Constitution"

Section 110 of the Act allows a person with license (licensee) to supply water to make regulations for purposes of protecting against degradation of water sources. Section 107 and sub-section 1 allows the licensee to construct and maintain drains, sewers and other works for intercepting, treating or disposing of any foul water arising or flowing upon such land for preventing pollution of water sources within his/her jurisdiction.

Section 108 subsections 2 and 3 state that a person shall not discharge any trade effluent from any trade premises into the sewers of a licensee without the consent of the licensee upon application indicating the nature and composition of the trade effluent, maximum quantity of effluent to be discharged on any one day, highest rate of discharge and any other information deemed necessary. The consent shall be issued on conditions including payment of rates for the discharge as may be provided under section 109 of the same Act.

Section 143 subsections 1 (b) of the Act makes it an offence to throw, convey, cause or permit to be thrown or conveyed, any rubbish, dirt, refuse, effluent, trade waste or other offensive matter or thing into or near to any water resource in such a manner as to cause, or be likely to cause, pollution of the water resource.

The proponent shall connect to the local water supply and the public sewer line for water and sewerage services.

There is no surface water body in the vicinity.

4.0 PROPOSED PROJECT LOCATION, DESCRIPTION, AND ACTIVITIES

4.1 NATURE, DESIGN AND DESCRIPTION OF THE PROPOSED PROJECT

The project proposes to develop residential apartments on L.R No. 76/496 along Thindigua Highway Street off Kiambu Road in Thindigua area, Kiambu County. It involves the construction of 377No. studio apartments/bedsitters and 45No. one bed-roomed apartments, 45No. two bed-roomed apartments, and 18No. three bed-roomed apartments (**Total: 485 units of apartments**) on 4 semi-detached 8-storey building blocks. The basement and partly ground floors comprise of parking. The ground to 8th floors will comprise of residential apartments. The roof floor will comprise on open areas and swimming pool. The salient features of the project will include management store and office, power room, generator house, guard house, protected dustbin cubicles, driveways and parking, and the proposed project will be enclosed with a stone perimeter wall with a single gate serving as entry and exit. The proposed design has provided for foul and wastewater disposal system and other plumbing articulation, and surface run-off drains. The apartments are typical in design and accommodation. Accommodation shall comprise of mostly bedsitters with sanitary facilities and one bedroom, two bedrooms, and three bed-roomed apartments with lounge/living room, kitchen, and sanitary facilities. The apartments are in 4 semi-detached blocks rising to nine sky-levels. There shall be staircases and three lift shafts to facilitate access and vertical movement. The proponent has provided for driveway and parking at the basement and ground floors. The proposed designs/plans have been done by Tsavo Architects and have been approved by the Kiambu County Government. (Please refer to the attached plans/drawings in the annex for the finer details). As such the proposed development will maximize on full utilization of the plot. The project is not unique in the area as will be discussed hereafter in this report.

The design and orientation of the proposed project has left ample free space for passage, natural ventilation and lighting.

4.1.1 The Project Specifications

The following are specific descriptions of the project.

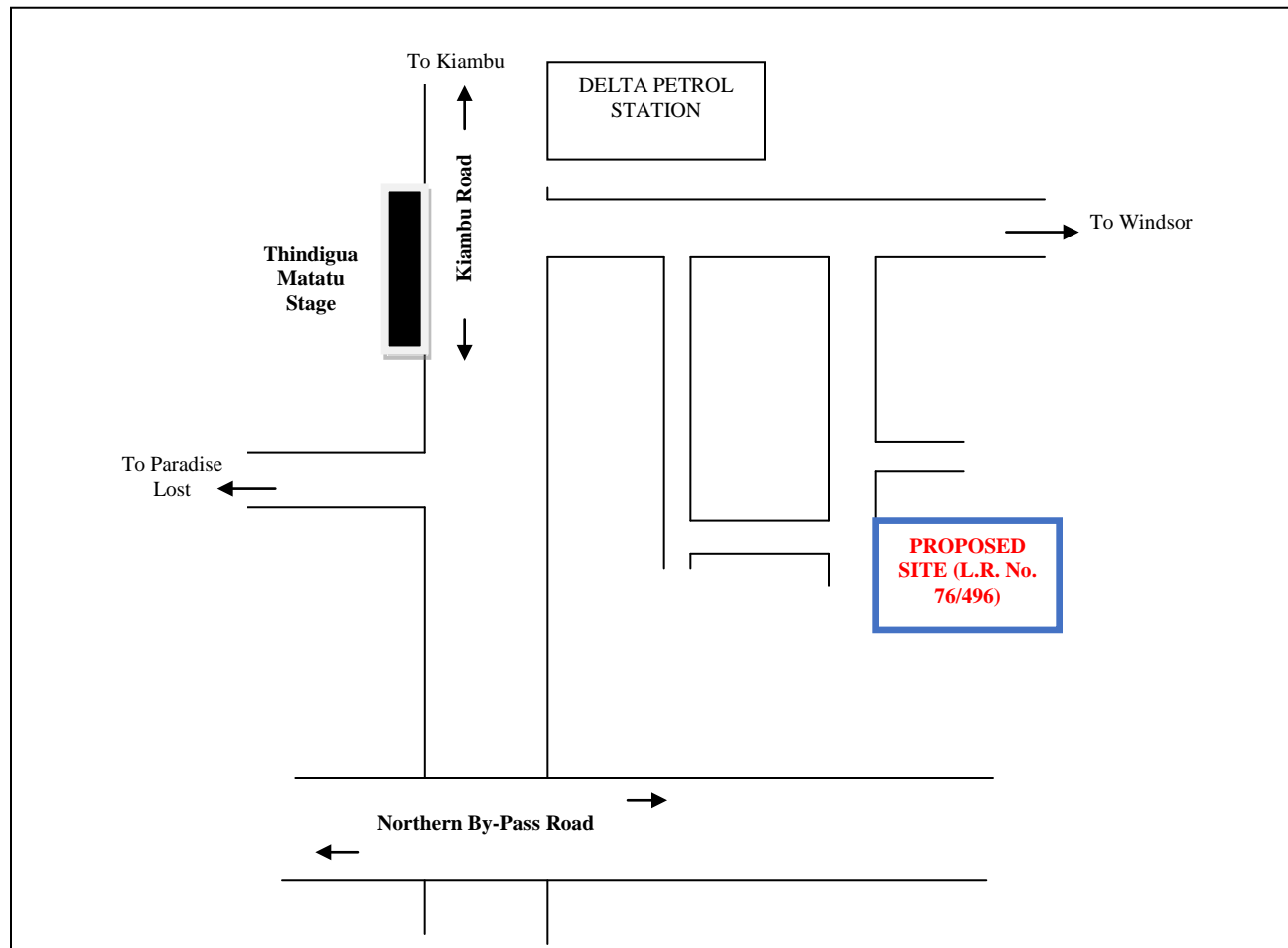
- ❖ The entire property will be enclosed in a perimeter stonewall and reinforced concrete columns
- ❖ Materials to be used will be of approved quality which will include stones, sand, cement, timber, glass, steel, PVC products etc.
- ❖ Strip foundation will be used with depth being determined by the structural engineer and filled with approved hardcore filling; hand packed and well compacted in layers and quarry dust.
- ❖ The ground floor concrete slab will be laid on polythene sheeting i.e. damp-proof membrane (d.p.m) and termite proofed well compacted hardcore.
- ❖ The walling will be of machine cut stones/reinforced columns and approved damp proof courses will be provided to all superstructure walls.
- ❖ The staircases will have 275 treads and 175mm risers and standard handrails
- ❖ The roofs will be pitched pre-painted GCI sheets to structural engineer's detail.
- ❖ Roof finish will be done using gutters and plastic rainwater outlets down pipes provided.
- ❖ All finishes will be of approved materials including parquet, ceramic, cement and clay tiles, and painting. All reinforcement shall be of standard quality to the structural engineer's details

- ❖ All soil and wastewater drainage pipes laid within the development will be of UPVC material. Those within the building structure and the parking/driveways will be encased in 150mm concrete surround.
- ❖ All internal fixtures and fittings will be to the approved standards and to specifications and will be carried out by qualified personnel
- ❖ Cold water storage tanks will be installed under the roof
- ❖ Other works like the landscaping, plumbing and electrical works will be executed by qualified and competent staff or reputable sub-contractors.
- ❖ A reputable contractor with experienced and skilled manpower will implement the project using suitable approved materials.
- ❖ Internal storm water drains to discharge to the existing public drainage system
- ❖ Sewerage system to discharge to the public sewer line while water and electricity (power) shall be from local water supply and national grid (KPLC) networks respectively.

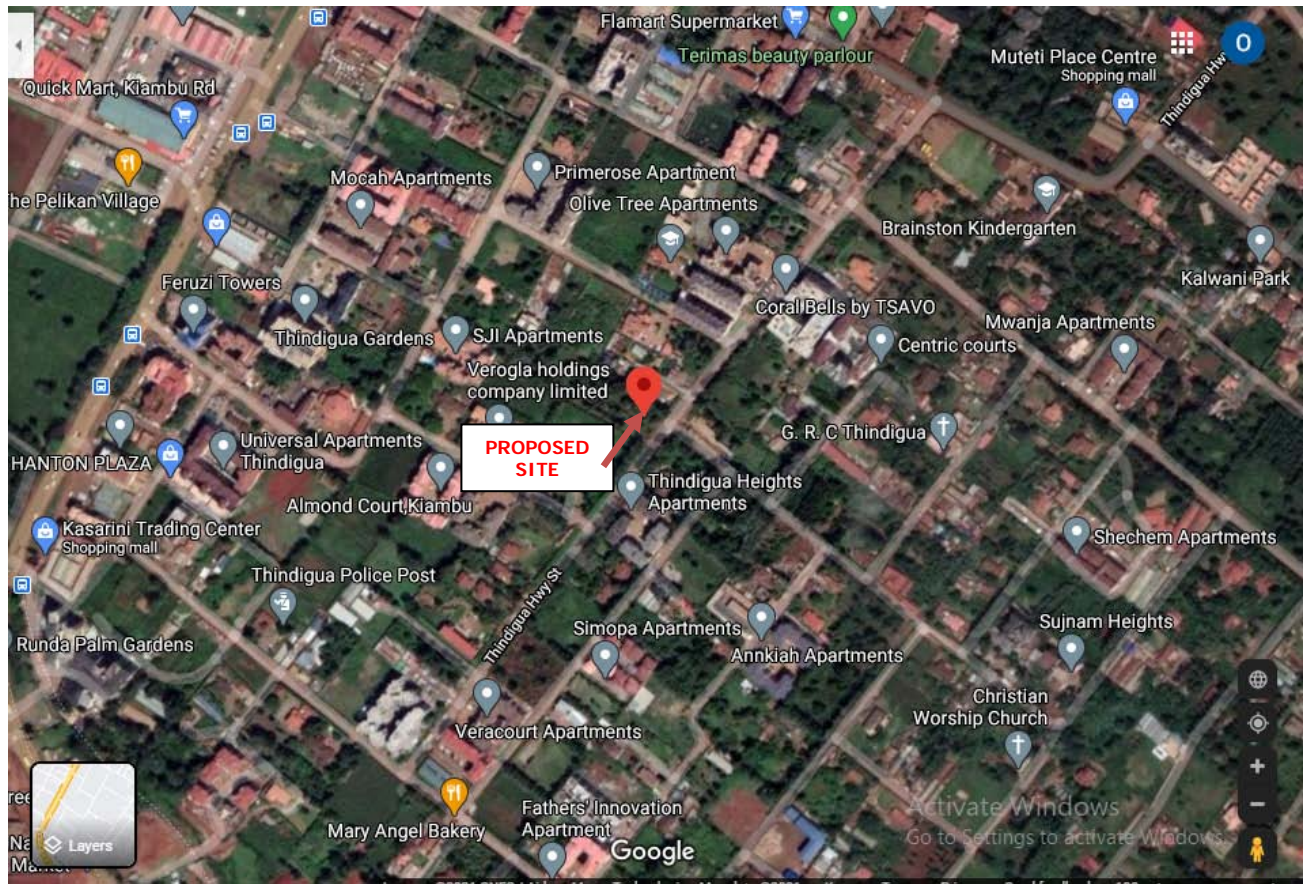
4.2 PROPOSED LOCATION OF THE PROJECT

The proposed project site is Land Reference Number **76/496** along Thindigua Highway Street off Kiambu Road in Thindigua area, Kiambu County.

Sketch map showing site location (not to any scale)



Google map showing the exact site location



4.3 SITE OWNERSHIP

The proposed project site is **Plot L.R. NO. 76/496**. From the proposed designs, the essential set local standards (in terms of physical planning, minimum habitable rooms, basic facilities, health and safety) have been met. The land is registered in the name of the proponent. (Please find the attached ownership documents).

Similar high rise developments have been implemented in the immediate neighborhoods and others are under construction in the general neighborhood.

Plate 4: Some general developments in the neighborhood

Source: Field survey

4.4 PROPOSED PROJECT IMPLEMENTATION (CONSTRUCTION)

The building will be constructed based on applicable building standards of Kenya. These include but not limited to the Building Code and the British Building Standards *BS 8110* and *BS 5950*, *BS4449*, *BS446*, *BS5255*, *BS497*, *BS556* etc. The constructions will as well incorporate environmental guidelines, health and safety measures.

As earlier indicated, the plot is vacant and fairly level.

4.4.1 Construction Activities and inputs

The project inputs include the following:

- Construction raw materials i.e. sand, cement, stones, crushed rock (gravel/ ballast), ceramic tiles and other ceramic fittings, parquet, clay vent blocks, steel and wooden fixtures and fittings, glass, steel metals, timber, painting materials among others. All these should be obtained from licensed dealers and especially those that have complied with the environmental management guidelines and policies.
- Construction machines including machinery such as trucks, concrete mixers, and tools and other relevant construction equipment. These will be used for the transportation of materials, demolition of the existing construction debris, and in the construction of the project. Most of the machinery use petroleum products, as the source of energy but electricity is also available.
- A construction labor force of both skilled and non-skilled workers. These require services such as, water supply and sanitation facilities.
- Large volumes of water for construction purposes. This will be supplied from the local supply.
- Power from the mains grid or provided by generators.

Construction activities include the following:

- Procurement of construction materials from approved dealers.
- Transportation of construction materials and debris using heavy and light machinery.
- Appropriate storage of the construction materials.
- Site works i.e. site preparation, excavation; earth works and filling, laying of foundation, masonry works/building works including roofing, finishes, fixtures and fittings.

- Disposal of the resulting debris/ waste materials. All debris and excavated materials will be dumped on approved sites but should be recycled in then project as much as is possible e.g. in backfilling.
- Electrical, civil, and water engineering and sanitary works. These will be done by reputable expertise.
- Landscaping works and earth works mostly on completion of the proposed development.
- Completion of the development and occupation/operation.

4.5 DRIVEWAY AND PARKING

The proposed project has provided for driveway and parking. According to the proposal, there will be a single gate opening onto a driveway leading to the parking. The proposed design is adequate to avoid accidents during entry and exit. The driveway will be surfaced with concrete slab.

4.6 PROJECT BUDGET

The construction is estimated to cost approximately Kenyan shillings **Four hundred Million (Kshs 400, 000,000)** and is estimated to take approximately 24 months to implement.

5.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

5.1 The proposed Alternative

The EIA study report has been prepared for submission to NEMA; facts, findings and recommendations/proposals of which are based on the proposed site, design, materials and proposed technologies. This helps in evaluating and examining the foreseeable effects of the project on the environment and therefore assisting in addressing how the proposed development has to ensure that all environmental measures are complied with during both the implementation and operational phases.

The alternative consists of the proponent's/applicant's final proposal with the inclusion of the legal guidelines, regulations and procedures as stipulated in the EMCA, CAP 387 which aims at reducing environmental impacts to the maximum extent practicable. Appropriate Environmental Management Plans have been prepared as per the proposed project.

5.2 Relocation Alternative

Relocation option to a different site is an option for the project implementation. At the moment, the proponent has no alternative sites for relocation. Finding and acquiring land to accommodate the scale, type and size of the project and completing official transaction on it may take a long period. Besides, there is no guarantee that such land would be available and suitability is another very important factor, which cannot be ignored.

Although monetary costs should not be used to justify a wrong project, this would also call extra costs in terms of money and time for example whatever has been done and paid to date would be a direct loss to the proponent. This may also lead to a No Action Alternative situation. The other consequence is that it would discourage both foreign and local investors especially in the housing sector that has been shunned by many public and private investors hence aggravating the housing short fall. In consideration of the above concerns and assessment of the current proposed site, relocation of the project is not a viable option. The problem is further aggravated by the fixed characteristics of land and the bottlenecks of the planning policy.

5.3 The No Action Alternative

The No Action Alternative 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. The anticipated insignificant environmental impacts resulting from construction, and occupation activities would not occur.

This option will however, involve several losses both to the project proponent/land owner and other stakeholders; society and Government. The landowner will continue to pay high taxes on the underutilized property. The No Project Option is the least preferred with reasons such that there will be no incremental housing stock, forfeiture of economic benefits that would accrue to the proponent, the public and the government, and it could also discourage investors wishing to invest in the housing sector.

From the analysis, it becomes apparent that the No Project Alternative is not the appropriate alternative.

5.4 Alternative Design and Technology

Various alternative designs and technology has been evaluated by the proponent and various professionals involved i.e. the architect, engineers, and surveyors and environmental consultants. After extensive discussions and relevant considerations, the various options were assessed and the most optimal design and technology were agreed as per the proposed plans, materials and technology.

5.5 The Comparison of Alternatives

Under the proposed Development Alternative, the project would create more and standard housing stock and would provide employment directly and indirectly to the public. It's providing jobs for the workers during construction. After completion more jobs would be generated during occupation. Under the No Action Alternative, there would be no development at all. There would be no benefits from the site and neither would there be the insignificant environmental Impacts.

Provided the Environmental Impact mitigation measures are implemented as well as adoption of sound construction management practices, negative impacts will be avoided/minimized. However, commitments related to development alternative would ensure that potential impacts are minimized to levels of insignificance as envisaged in the EMP.

5.6 Mitigation for the Proposed Action

Mitigation measures for the proposed action are included hereinafter in this report.

6.0 SOCIAL IMPACT ASSESSMENT

This is a very important and an integral part of the EIA process, which is a legal requirement and a very important tool for collection of the data and especially the baseline/background information. The SIA helps bring out the contentious issues and gives a chance to those who may be affected by a proposed project to give their views, inputs and opinions and any significant issue is addressed at the initiation stage. This enables evaluation of the public and neighbors views and is thus a very important part of the study. Those who responded had no objection to the project. The proposed type of development has been embraced in neighboring land parcels that are developed with similar developments and others are ongoing. Like in all other areas, they also mentioned the need for forward planning for the purposes of infrastructure expansion, which they cited as a major disadvantage.

The issues of importance as in pressure on existing infrastructure, noise, potential pollution, dust and safety (during construction) arose and they demanded that appropriate measures should be taken to address them. They also raised the issue of potential security enhancement risk including social crimes especially during construction and also mentioned the need for sound drainage system and solid waste management. They also indicated that flats bring people together and are able to share their problems together and in a way has some notable advantages such as reduction in security costs. In summary, the residents main concern were infrastructure including water, electricity, sewer, and surface runoff which they generally indicated the need for the relevant authorities and institutions to address urgently. Respondents indicated the need to protect the residents from dust during construction. Reported potential advantages include increase in business to those running businesses, and offices around the proposed site, increased housing stock and employment but some indicated that the potential benefits will only accrue to the proponent and the trickledown effect to them is negligible.

The issues raised and many others foreseeable have been adequately addressed in the report and in the EMP.

Some completed questionnaires are attached in the annex.

7.0 POTENTIAL IMPACTS

Construction activities involve a series of defined physical operations, which include site preparation; excavation works, building works etc. All are potentially significant sources of particular impacts both significant and insignificant. On completion, the activities during the operational phase also have potential impacts. The following are foreseen to comprise potential impacts:

7.1 POSITIVE IMPACTS

Provision of housing and income generation

Housing is a basic good and a major contributor to productivity. Supply of standard and affordable housing has always lagged behind demand for the same and the proposed project has a contribution towards reduction of the deficit. The proposed project shall also increase cash flows to the proponent whether by renting or sale of the units.

Promotion of healthy competition, convenience and uniformity in land use

The area has been for a long time restricted to single dwelling units but this has now changed and housing demand has opened up the area for multi-dwellings. This has led to the majority of the plots being developed with flats and the process is ongoing in others. The proposed project shall blend well with the rest. It shall also promote healthy competition in housing market, which has an effect on improved service and fair prices.

Optimal utilization of the land

The proposed site has been vacant for a time but the proposed project shall accommodate 17 families thus raising the utility of the land. The proposed use also conforms to the area's land use and is not unique in the neighborhood.

Employment

The proposed project will provide direct and indirect job opportunities to a significant number of the population during construction and occupational phases thus reducing the unemployment and in the process provide livelihood.

Promotion of development

The proposed project has the potential to influence the commercial trends in the area in various ways and in the long run the multiplier effect will lead to development and reduction of poverty. The proposed project shall contribute in overcoming the challenges of today's life including strategies for alleviating poverty and promoting sustainable development.

Increase government revenue

The proposed project shall generate tax revenue for the government directly and indirectly.

Creation of market for goods and services and secondary businesses

The proposed project shall consume various materials during construction such as stones, cement, sand, glass, steel products, wood products, PVC products, ceramic products etc. Various professionals have and shall continue giving their services during both the construction and

operational phases and thus making livelihoods. Those doing commercial activities in the neighborhood shall also have their market widened by the occupants and workers.

7.2 NEGATIVE IMPACTS AND MITIGATION MEASURES

The ideal strategy to counter identified adverse effects is avoidance but when this is not possible, not possible, alternative strategies of reduction, remediation and compensation should be explored. This can be achieved through primary measures that intrinsically comprise part of the development design; or secondary measures designed to specifically address the remaining (residual) adverse effects of the proposed project. The potential impacts can be greatly reduced and this will be much determined by the technology used, nature of the materials, equipment used and level of diligence among others. The foreseeable impacts identified that may not be completely avoided are addressed here below and potential recommended measures provided. As such, the proposed measures also explore opportunities available for improving the situation wherever possible. The initial design should facilitate a high degree of mitigation, built into the scheme from the onset so that the potential for adverse effects is substantially reduced. If consideration of mitigation measures is left to the later stages of proposed project design, it can result in increased mitigation costs because early opportunities to avoid the need for such measures have been lost. In general, primary mitigation measures are likely to be more effective and less likely to cause secondary adverse effects (i.e. the mitigation measures themselves may in turn cause adverse effects).

7.2.1 Increased water demand

The importance of water can never be overemphasized and in fact is increasingly becoming a very hot issue due to the dwindling amounts and the ever increasing demand in several cases culminating to being source of fights amongst communities/users. So to speak, it is a major issue by most of the stakeholders. The proposed development may cause some strain to the existing water supply since construction activities are known to be heavy water consumers and the increase in population proportionately increases water demand thus direct impact to the water supply during both the construction and occupation phases.

Mitigation

- Avoid wastage of the water. Approvals for water supply and use should be sought from the relevant authorities. The contractor should use water bowsers and tankers to bring in water for construction activities i.e. during periods of high water demand (i.e. during slab formation) subject to authorization.
- Roof catchments should be provided with rainwater harvesting systems (gutters, down pipes and water storage facilities) to enhance collection and storage of the would be run-off.
- Sensitize all stakeholders on means and need to conserve water resource. Water conserving taps should be installed that turn-off automatically when water is not in use. They should be encouraged on water reuse/recycling during both construction and occupation phases.

7.2.2 Surface drainage

Run-off generated by rainfall may cause a myriad of consequences in various facets including flooding and its consequences which may include damage to property, health and safety hazards. The drainage layout should ensure effective flow of the anticipated surface run-off emanating from the roof catchments and other areas within the site.

Mitigation

- The designs should ensure that surface flow is drained suitably into the natural drainage system effectively. The internal channels should be designed with regard to the peak volumes and must ensure the safe final disposal of run-off /surface water and must be self-cleaning.
- Drainage channels should be installed in all areas that generate or receive surface water. The channels should be covered with gratings or other suitable and approved materials to prevent occurrence of accidents and dirt entry that may compromise flow of run-off.
- Storm water generated from roof catchments should be harvested, stored and made use in various household activities i.e. general cleaning and garden watering. This will reduce run-off.
- Paving of the side walkways, driveway, parking and other open areas should be done using pervious materials i.e. concrete blocks to encourage water percolation; reducing run-off volume

7.2.3 Soil disturbance

The impacts arising from soil disturbance has already happened since all the foundations and earth works is already done and few activities related to soil excavations shall be of no significant level. However, diligence is required to prevent any effect.

Mitigation

- Avoid unnecessary movement of soil materials from the site and provide soil conservation structures on the areas prone to soil erosion mostly to reduce impact by the run-off.
- Depending on the period, monitor construction activities for appropriate and effective control measures of erosion e.g. during rainy / wet conditions, ensure suitable barriers on potential water erosion paths while avoiding wind erosion during dry conditions.
- Conduct standard landscaping after project completion i.e. resurface (pave) open areas after the completion of the project and introduce suitable and well-managed vegetation to generate surface covers on the open areas; to control soil movement by erosion agents i.e. water, animals and wind. It is recommended that landscaping be done on completion of proposed works and introduce appropriate vegetation in open surfaces.
- Ensure suitable storm water drainage channels to effectively discharge water safe to existing public drainage channels. Such channels need to be regularly maintained and repaired to avoid point discharges (have pronounced effect to soil erosion) in case of breakages or blockages.

7.2.4 Noise and vibration

Construction activities generally generate noise and hence affecting the immediate environment. Such noise emanate from the construction personnel, machinery and equipment. During occupation noise will come from vehicles, and other operations within the site. The proposed perimeter stonewall will provide some buffer against noise propagation but the following precautions should be taken in addition.

Mitigation

- Construction works should be carried out only during the specified time i.e. from 0800 hrs to 1700 hrs and should avoid working on Sundays when many residents are expected to be within the environs.
- Use machine cut stone that requires no chisel dressing which can be a major source of noise.
- Sensitize construction vehicles' drivers and machinery operators to switch off engines of vehicles or machinery when not in use.

- Machineries should be maintained regularly to reduce noise resulting from friction.
- The generators and other heavy duty equipment (if present) should be insulated or placed in enclosures to minimize ambient noise levels.
- There should be no unnecessary honking of the involved machinery and vehicles.
- Provision of bill boards at the construction site gates notifying of the construction activity and timings.
- Workers should be provided with relevant personal protective equipment (PPE)/ materials.

7.2.5 Increased Energy Demand

Potentially increased use of energy due to increased energy uses during construction and occupation phases and potential wastage is real. Construction machineries will require fuels (petroleum or electricity) during construction phase. Energy, mainly electricity will also be needed during occupation phase (on completion of the project).

Mitigation

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

- Switch off electrical appliances when not in use and optimize operations of electrical equipment or energised machinery to enhance energy conservation.
- Install or Use energy conserving electric lamps for general lighting. Put off all lights immediately when not in use or when not needed.
- Make use or install alternative source of energy such as solar power, which is renewable. The proponent should include solar power systems, which can be used for lighting and heating purposes.

7.2.6 Sewage and effluent

Sewage encompasses soil and waste water from sanitary facilities and is of significant concern with respect to the environment and particularly to water and soil. In its raw form, it is serious health hazard and emits offensive odours. It must always drain effectively into the proposed sewer systems; via high quality, well designed and laid pipe networks.

Mitigation

- The internal and external sewerage system should be made of hard, strong, durable, smooth, impervious, and non-corrodible materials. All drain pipes passing under building; driveway or parking should be of heavy duty UPVC pipe tube encased in 150mm concrete surround. All manholes on drive ways and parking areas must have heavy-duty covers set and double sealed airtight; as approved by specialists. All waste pipes must have cleaning rodding eyes which must be accessible.
- Sanitary facilities must be kept clean always, through regular washing and disinfecting.
- The design of the sewerage system should consider the estimate discharges from individual sources and the cumulative discharge of the entire project even during peak volumes. The gradient should be sufficient to ensure and maintain maximum depth of flow. Branches should be streamlined in the direction of flow. The sewer system should be constructed to the relevant standards and appropriate quality materials.

7.2.7 Air Quality

Construction activities have the potential to generate air pollutants in the form of dust particles and gas emissions (fumes) from machinery and vehicles. Some Construction machinery and trucks (including small vehicles) generate hazardous exhaust fumes such as Carbon Oxides (CO_x), Sulphur Oxides (SO_x) and Nitrogen Oxides (NO_x).

Dust (particles) as caused by vibrations of machines and vehicle movement suspends in the air mostly during dry spells. Such dust and gases have direct negative impact to the ambient air quality.

Mitigation

- Provide personal protective equipment (PPE) / full protective gear to workers. They should also be trained on occupational health and safety and should be encouraged to go for regular health check-ups.
- Regular and prompt maintenance of construction machinery and equipment. This will minimize generation of noxious gases and other suspended particulate matter.
- Control over areas generating dust particles through regular cleaning or sprinkling of water to reduce dust. The areas can be enclosed to mitigate effects of wind on them.
- Regular air monitoring of quality of air.
- Enclose the site with dust-proof net during the construction.

7.2.8 Oil Leaks and Spills

It is important to note that oil/grease spills / leaks are prevalent in construction sites and in most areas that make use of petroleum products, which contain hard/hazardous elements that are detrimental to the environment.

During occupation phase, oil waste may be generated from the vehicles of the residents if poorly maintained.

Mitigation

- All machinery must be keenly observed not to leak oils on the ground. Maintenance must be carried out in a designated area (protected service bays more suitably outside) and where oils are completely restrained from reaching the ground. Such areas should be covered to avoid storm water from carrying away oils into the soil or water systems by installation of oil interceptors and other suitable facilities.
- All oil products and materials should be stored in site stores or in the contractor's yard and should be handled appropriately to avoid spills and leaks.
- Car park areas and other places handling oil activities (especially during construction) in the site must be well managed. Oil interceptors should be installed in the channels leading from such areas.

7.2.9 Solid Waste

Millions of tonnes of solid waste is generated annually by human activity and may therefore pose great hazard if there are no proper disposal and handling systems. Construction activities contributes to increased solid wastes including stones, wood, glasses, plastics, containers, metal rods, pieces of iron sheets, sharp objects (nails) etc.

On completion and occupation, the project will be generating waste products from various operations and activities; mostly *house refuse including the polythene challenge*. The proactive design has provided for dustbin cubicles but in addition, the following should be adopted:

Mitigation

- The contractor or proponent should work hand in hand with private refuse handlers, NEMA and the Kiambu County Government to facilitate sound waste management as per the prevailing regulatory provisions.
- The wastes should be properly segregated to encourage recycling of some useful waste materials; i.e. some demolished stone and concrete materials used as backfills. This calls for source reduction, recycling, composting and reuse. There should preferably be two bins maintained by every unit, one for organic matter and the other for mineral matter. The receptacles (bins) must be kept in a good condition, and frequently washed and disinfected.
- The collection of waste materials should be made at least once in 24 hours, and it should be done in such a way to minimize nuisance of smell and dust during filling into carts or vans.
- Train or educate the involved stakeholders/tenants on the importance and means of waste (garbage) management and handling especially during occupation phase.

7.2.10 Flora and Fauna

Vegetation has a great effect on the general and localized environment and normally can modify microclimate. Usually, the flora creates a good environment for habitats thus the two may go together more often than not. In consequence, de-vegetation may result to negative effects on the fauna. Singly, the proposed project may appear of no significant impact but the cumulative effect in concert with other current and future projects are capable of significant and serious effects including but not limited to soil erosion, hydrological regime imbalance, decreases in air purifiers (carbon sinks) and thus contribution to global warming etc. The proposed site has maize and vegetable plantation which will be cleared to pave way for the proposed project.

Mitigation

- Landscape and plant vegetation in all open areas after the completion of the project and manage the introduced vegetation on completion of the development to restore or improve the site.

7.2.11 Construction materials

Various construction materials are required for execution of the various respective activities. Poor quality materials, substandard and those materials that pose health or safety hazards should be avoided.

Mitigation

- All materials should be of the appropriate quality and should be sourced from licensed dealers and suppliers who are compliant especially with environmental requirements. Quality should be thoroughly controlled through regular tests.
- Procurement of the materials should follow specifications by the respective consultants such as structural, mechanical and architectural engineers.

7.2.12 Visual Intrusion

Visual impacts occur during earthworks for the foundation of projects and throughout to the completion of the project. However, the proposed project will not by far be out of scale with the existing developments and in the environs. The visual impact will therefore not be significant and will have very little affects to the neighboring activities and the general public and furthermore the site is enclosed. Great care should be taken to protect the neighborhood character.

Mitigation

This may be unavoidable during construction but fortunately the effects are insignificant due to the low magnitude and the small effect relative to the general area.

- Ensure no destruction of the vegetation in the neighborhood and shield off the particular areas of construction with suitable materials. On completing the earthworks, the worked area should be restored through backfilling, leveling and planting of more vegetation so as to blend in a way to merge with existing environment. The building and the choice of colors should be attractive to match the general environment.
- All solid waste and debris from construction site must be cleared on completion.
- Ensure compliance with planning policy for uniformity

7.2.13 Occupational Health and Safety (OHS) and traffic

During construction, there are chances for increased dust, air and noise pollution. These plus other safety hazards such accidents, falling objects, risks from poor scaffolding, ladder and formwork are considered negative impacts. There is also risk of coming across live electric cables during excavations. Poor quality construction materials, poor workmanship and poor standards may also contribute to accidents. Inadequate skills in machinery operation and stress are serious safety hazards. Most of the contractors hire on casual basis and therefore do not take responsibility of training the workers on health and safety. The entry and exit points to the development may also pose the danger of imminent accidents if not properly designed.

The immediate neighbours and workforce involved would be exposed to these hazards. Food for the construction workforce is usually provided by mobile individuals who usually operate without licenses. This can compromise health of the workers especially if such foodstuffs are prepared in unhygienic conditions. There is also the potential risk of traffic accidents along the road around the entry point due to the heavy trucks and machinery entering and leaving the site. It is important to note that the proposed design has taken care of all the basic set standards in a work place such as space, lighting, ventilation etc.

Potential Mitigation Measures

- All workers should be provided with full protective gear. These include working boots, overalls, helmets, goggles, earmuffs, masks, and gloves among others. Factories Act abstract should be posted at a strategic point on site. The requirements of the **Factories and other places of work Act** should be strictly adhered to, the **Building Code** and other relevant regulations.

Only specialised machine operators should operate machinery and specialised equipment and all moving parts should be provided with appropriate guards.

- Properly design to allow for deceleration and acceleration to the site. Clearly indicate direction of traffic especially during construction.
- A first aid kit(s) should be provided within the site. This should be fully equipped at all times and should be managed by a trained person. The contractor should not expose workers to stress inducing factors.
- The contractor should have workmen's compensation cover. It should comply with workmen's compensation Act, as well as other ordinances, Regulations and union Agreements.
- Sanitary facilities should be provided and standard cleanliness of the facilities maintained.
- Individuals preparing food for the workers at the site should be controlled and monitored to ensure that food is hygienically prepared.
- Workers should always be sensitised on social issues such as drugs, alcohol, diseases particularly HIV/AIDs etc. There should be a training program to facilitate this by the contractor.
- Billboards should be suitably erected on the onset of the project. The signs should indicate and inform the public e.g. 'DANGER! HEAVY VEHICLES TURNING'. The traffic along the connecting road should be controlled especially during construction phase.

7.2.14 Construction Safety

Construction work can be particularly hazardous. Personal protective equipment, fire safety, electrical safety, and other precautions are essential for safe construction work. Follow these guidelines when visiting or working at construction sites:

- Do not walk, stand, or work under suspended loads. If you raise a load, be sure to crib, block, or otherwise secure the load as soon as possible.
- Avoid placing unusual strain on equipment or materials.
- Be prepared for unexpected hazards. BE ALERT!
- Proper personal protective equipment, (i.e. safety shoes, hardhat, goggles, Respiratory Equipment and gloves) must be used at all times on the site or as conditions warrant. Jewelry should be avoided.
- Prior to the start of construction, all areas should be inspected for the presence of potentially hazardous energy in the area should be located and precautions taken.
- Workers should be trained on the proper use of tools and protective equipment.
- Great care must be given to excavations and the safety of the machinery, tools and other equipment such as scaffolding, ramp or ladder must be guaranteed. Accident prevention should be the overriding safety precaution. A qualified person should always be on site to oversee the working.

Contractors and project managers should use barriers and guards as necessary to protect employees, and visitors from physical hazards. Areas that typically require permanent or temporary protection include the following:

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

7.2.15 Emergency Response Plans- ERPs

Emergencies and disasters are a reality of everyday life. Workers/ people must therefore be sensitized and prepared on how to react during both the construction and occupational phases. Absence of such plans may be risky since there would be no guidelines to handle or control emergencies should they occur.

Mitigation

- The contractor/proponent should initiate and develop effective ERPs to cater for various eventualities such as fire outbreaks, and other accidents/incidents that are likely to occur. Training is prerequisite in planning ahead. Such plans must be properly documented and made available to all.
- Regular drills should be conducted on possible incidences

7.2.16 Enhanced Social crime risks

Due to the influx of construction workers on site, there are chances of introduction of individuals with potentially anti-social behaviors such as thieves/thugs, drug users and traffickers and may pose a risk to the community both during the implementation and occupational phases.

Mitigation

- Adopt strict hiring guidelines to lock out the bad elements and limit movement outside the site. The contractor has a responsibility of sensitising the workers on social issues such as HIV/AIDS, drugs and other social issues through regular training and social gatherings and strict monitoring. Workers should not be housed on site.

7.2.17 Security

The need for security can never be overemphasized whether personal or for property. During construction, security is very important in any site. This ensures that materials are in order. It also controls movement within the site especially for the intruders who might be injured by the materials and other hazardous features available within the site. Security is also of paramount importance during the operational phase of the project.

Mitigation

- Enclose the site using suitable walls to beef-up security and to control movement as proposed in the design and employ security guards who must always guard the site/property and document movements on the site/ property
- Strategically install lighting as well as security alarms

7.2.18 Fire Preparedness

Potential causes of fire are many and varied electrical faults, smoking, gas leaks, carelessness etc. Fire incidences result to economic and social drawbacks. It is therefore always important to consider the issue of fire by bringing in the element of preparedness. In this regard, the design should provide and recommend implementation of fundamental firefighting measures and control facilities.

Mitigation:

- Install an automatic fire alarm system for the entire project mostly on occupation, provide 2No. 30m hose reels and provide for adequate fire reserve water storage tanks with an automatic booster pump for hose reel and 4No. 9kgs water fire extinguisher. Provide 3No. powder or carbon dioxide extinguishers on the ground floor (for the parking)
- Provide appropriate Fire Hydrant Ring main with suitable outlet points.
- All installation to follow Kiambu County Government Fire Masters requirements approval.
- Conduct regular firefighting drills/simulations to sensitize workers/residents and adapt an emergency response plan for the entire project during occupational phase.

- Ensure that all firefighting equipment are strategically positioned, regularly maintained and serviced.
- Provide fire hazard signs such as 'No Smoking' signs, Direction to exit in case of any fire incidence and emergence contact numbers should be provided as well as the assembly points.

7.2.19 Project Completion

At one point in time, the proposed project, if approved will be completed after the first phase of the project (implementation), which will pave way for the second phase (occupation). At this point, the contractor will leave the site after officially handing over the completed project to the proponent. Before leaving the site, the proponent should ensure that the contractor does or causes to be done the following: -

- Comprehensive landscaping of open areas should be done.
- All waste materials must be cleared and removed from the site. However, these should be disposed appropriately and to the approved dump sites in accordance to the laid down regulations.
- The structures should be cleared, cleaned and rubbed of any dust particles before occupation.

8.0 DECOMMISSIONING PHASE

Decommissioning is an important phase in the project cycle and comes as the last to wind up the operations/activities of a particular project. The main purpose of decommissioning is to restore/rehabilitate the site to acceptable standards.

Quality and standard housing projects of this nature have a lifespan of between 50 and 100 years which is much dependent on the maintenance quality. This is long period of time and there may be many changes which may not be foreseeable including the technological and legal aspects. The decommissioning may also come earlier than the lifespan of the buildings again due to various reasons like change in physical planning policy or the discovery/realization of a more optimal use of the land. It is therefore recommended that an EIA be conducted when the time for decommissioning comes so that all aspects will be looked at against the prevailing conditions and requirements. However, the purpose of decommissioning is mainly to rehabilitate the project site to an acceptable standard and all efforts should be geared to making the site as close as possible to its original state before the project was implemented. The decommissioning will in brief involve demolitions of the structures, removal of debris and landscaping. The other social implications involve the laying off workers who may be employed thus will lose their income, issues of safety and health etc. due to the fact that nobody knows the future, it is highly recommended that an EIA be prepared when the time comes since quit may come earlier or later due to the vagaries of weather, human behavior and policy changes among other factors and quantification and accurate prediction of the likely potential impacts is quite difficult.

In view of the foregoing and in line with the principles of sound environmental management, it is paramount that the appropriate controls and procedures be put in place at the design, implementation and operational phases of the proposed project to control environmental degradation as this is the only way of simplifying the decommissioning. These measures are recommended elsewhere in the report and in the EMP.

9.0 ENVIRONMENTAL MANAGEMENT AND MONITORING PLANS

The environmental management plan involves risk management strategies that should be undertaken by the project proponent and all the stakeholders to mitigate environmental degeneration. They are approaches to monitor, control, reclaim and restore the environment to a sustainable state. EMPs for projects thus provide logical frameworks within which the identified issues of environmental concern can be mitigated or monitored i.e. provide a checklist for project monitoring and evaluation. The EMP is meant to address the existing impacts and the potential foreseeable impacts. Currently, there are no significant existing impacts on the proposed site since the property is used for residential purposes.

Environmental monitoring involves measurement of relevant parameters, at a level of details accurate enough, to distinguish the anticipated changes. Monitoring aims at determining the effectiveness of actions to improve *environmental quality*.

The environmental management and monitoring plans have been developed and outlined to bring home the key findings of the *Environmental Impact Assessment*, recommending necessary mitigation actions, defining roles, monitorable indicators and the estimated cost.

The EMPs outlined here after addresses the identified issues of concern (potential negative impacts) and mitigation measures as well as roles, costs and monitorable indicators that can help to determine the effectiveness of actions to upgrade the quality of environment; as regards the proposed project/new flats. The EMPs have considered both construction and occupation phases.

Table 2: EMMP FOR CONSTRUCTION & OCCUPATION PHASES

ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED MITIGATION AND ASPECTS FOR MONITORING	RESPONSIBILITY DURING DESIGN, CONSTRUCTION AND DEFECTS LIABILITY PERIOD	RESPONSIBILITY AFTER DEFECTS LIABILITY PERIOD	MONITORING MEANS (C) = CONSTRUCTION (O) = OCCUPATION	ESTIMATED COSTS (KSHS)	MONITORING INDICATORS AND FREQUENCY
Soil disturbance	<ul style="list-style-type: none"> Control earthworks & compact loose soils Install drainage structures properly Landscaping on project completion Control and manage excavation activities Control activities especially during rainy conditions Provide soil erosion control and conservation structures/means where necessary. Ensure standard appropriate practices on the provided gardens 	Contractor	Proponent	(c) Inspection (o) Routine maintenance (c) Inspection (o) Routine maintenance	200,000	<ul style="list-style-type: none"> Vegetation cover Type of machinery and equipment Paved area
Changes in land use-extent	<ul style="list-style-type: none"> Plant vegetation after project completion even if in pots. Ensure compliance with existing planning policy 	Proponent and contractor	Proponent	Inspection and records inspection	50,000	<ul style="list-style-type: none"> conserved vegetation records
Changes in hydrology/impended drainage	<ul style="list-style-type: none"> Proper Installation of drainage structures Install cascades to break the impact of water flowing in the drains Ensure efficiency of drainage structures through proper design and maintenance Provide gratings to the drainage channels 	Contractor	Proponent	(c) Inspection (o) Routine maintenance	200,000	<ul style="list-style-type: none"> Amounts of storm water Efficient storm water drains
Air pollution	<ul style="list-style-type: none"> Enclose the site with dust-proof net during construction. Water should be sprayed during the construction phase of excavated areas during dry conditions. Control speed and operation of construction vehicles Prohibit idling of vehicles. Ensure sound condition of construction machinery and equipment. Engage sensitive construction workers. 	Contractor	Proponent / Contractor	c) Inspection/ observation	500,000	<ul style="list-style-type: none"> Amounts of dust Extent of paved area Type of machinery Amounts of emission
Noise pollution	<ul style="list-style-type: none"> Erect suitable barriers to control noise. Sensitize drivers of construction machinery on effects of noise. 	Contractor	Proponent / Contractor	c) Inspection/ observation	240,000	<ul style="list-style-type: none"> Ear muffs/ Buffers/ Mufflers

	<ul style="list-style-type: none"> Maintain plant equipment (if present). Construction activities to be restricted to daytime. Workers in the vicinity of or involved in high-level noise to wear safety & protective gear. 					
Water resources	<ul style="list-style-type: none"> Management of water usage. Avoid unnecessary wastage. Recycling of water at the construction phase where possible. Make use of roof catchments to provide water i.e. for general purpose. 	Contractor	Contractor / Proponent	(c) Inspection/ observation	2,000,000	<ul style="list-style-type: none"> Water amounts used Roof catchments and storage
Oil pollution	<ul style="list-style-type: none"> Proper storage, handling and disposal of new oil and used oil wastes as per waste regulations. Maintain plant and equipment to avoid leaks. Maintenance of construction vehicles should be carried out in the contractor's yard (off the site). Provide oil interceptors along the drains leading from car park and potentially oil risk areas. 	Contractor	Contractor	(c) Inspection/ observation	160,000	<ul style="list-style-type: none"> Incidences of spillage Poorly disposed wastes Composition of runoff
Road safety	<ul style="list-style-type: none"> Enforce speed limits for construction vehicles especially along roads leading to the site Provide bill boards at the site/entrance to notify motorists about the development 	Contractor	Proponent , Traffic & roads Dept/trans porters	(c) Inspection/ observation	40,000	<ul style="list-style-type: none"> Bill boards Safe access
Public health, occupational health and safety	<ul style="list-style-type: none"> Train staff/workers on occupational health and safety. Provide full protective gear & workmen's compensation cover in addition to the right tools and operational instructions & manuals during construction. Adopt sound waste management system to ensure proper solid waste disposal and collection facilities. Adopt sound housekeeping practices. Sensitize residents on environmental management. Design of sewerage system should be as provided in the plans and should be constructed to approved size and design, standard and of approved materials. Engage the services of qualified personnel and/or ensure training. Ensure use of standard construction materials and to the specifications. Avoid undesirable, substandard, hazardous or unauthorized materials during construction & maintenance. Sensitized staff on social/health issues such as drugs Ensure machinery and equipment servicing and maintenance as per schedules & legal requirements Post strategically the Factories and Other Places of 	Contractor, supervising Foreman	Proponent where relevant	(o) Observation (o) Observation	1,600,000	<ul style="list-style-type: none"> Training records Waste receptors Clean sanitary facilities First aid kits and training Sensitive workers

	<p>Work Act Abstract & provide material safety data sheets</p> <ul style="list-style-type: none"> • Post clear warning signs e.g. 'No unauthorized use of machines', ensure there are guards on moving parts etc. • Provide fully equipped First Aid kits & train staff on its use • Ensure adherence with the legal requirements- Factories Act. • Sensitize residents on environmental management. • Ensure Kiambu County certifies and issues occupation certificates. 					
Vegetation	<ul style="list-style-type: none"> • Avoid unnecessary removal of vegetation. • Landscaping and planting vegetation in all disturbed areas. 	Contractor Contractor	Proponent	(o) Observation (o) Observation	80,000	<ul style="list-style-type: none"> • State of waterways • State of landscape vegetation
Record Keeping	<ul style="list-style-type: none"> • Collection and analysis of relevant environmental data of the site 	Proponent/c ontractor	Proponent	Data collection & analysis	40,000	<ul style="list-style-type: none"> • Relevant environmental records
Fire safety and preparedness	<ul style="list-style-type: none"> • Install firefighting equipment as provided elsewhere in the report. • Conduct training on firefighting, evacuation and emergency response. • Sensitize the residents on fire risks i.e. conduct regular fire drills. • Adapt effective emergency response plan. • Maintain/service firefighting machinery regularly. • Provide emergency numbers at strategic points. 	Contractor	Proponent	(o) Observation	220,000	<ul style="list-style-type: none"> • Firefighting equipment • Training records • Display of emergency numbers
Water quality and waste management	<ul style="list-style-type: none"> • Follow NEMA regulations. 	Proponent/c ontractor	Proponent	Data Collection	100,000 per year	<ul style="list-style-type: none"> • Records
Security	<ul style="list-style-type: none"> • Provide security guards and facilities during the entire project cycle. 	Contractor	Proponent	(o) Observation	300,000	<ul style="list-style-type: none"> • Security guards • Security lights and records

Table 3: EMMP FOR DECOMMISSION PHASE

Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
1. Demolition waste management			
a) Any component related with the project that will not be used for other purposes must be removed and recycled/reused as far as possible.	Contractor, Proponent	One-off	-
b) All wastes must be removed and recycled, reused or disposed of as per a licensed methods.			
c) Where recycling/reuse of the project components, gadgets and other demolition waste is not possible, the materials should be taken to a licensed waste disposal site.	Contractor, Proponent	One-off	-
d) Donate reusable demolition waste to any willing party.	Contractor, Proponent	One-off	-
2. Rehabilitation of project site			
a) Implement an appropriate re-vegetation program to restore the site to its original status.	Contractor, Proponent	One-off	-
b) Consider use of indigenous plant species in re-vegetation.	Contractor, Proponent	One-off	-

10.0 CONCLUSION AND RECOMMENDATIONS

The necessity for housing can never be overemphasized. Unfortunately, its supply has since time immemorial lagged behind the supply of the supply of the same and the gap seems to widen. In view of this, the government focuses on facilitating production of approximately 150,000 new house units per annum and thereby calling for partnership with the private sector in providing housing facilities/infrastructure to bridge the gap.

This study indicates that the construction and occupation/operation of the proposed (housing) project will have positive impacts, which include employment, increase in the national/local housing stock and quality, increase in Government revenue, and improvement of standards of living. However, despite the outlined positive impacts, the proposed development will come up with some negative impacts mainly increased pressure on existing infrastructure. Other impacts include potential pollution (to air, water, and soil) mostly during construction phase, enhanced security risks and social crimes, and increased waste (solid and liquid) generation among others.

The proposed project design has integrated mitigation measures with a view to ensuring compliance with the applicable laws and procedures. The structures should be built to the required planning/architectural/structural standards of the County Government. During project implementation and occupation, sustainable environmental management should be ensured; avoiding inappropriate use of natural resources, conserving nature and guaranteeing health and safety of all people, working on the project, general public and inhabitants of the project.

From the foregoing and taking into consideration of all the foreseeable and relevant aspects, the proposed project is a timely venture with a positive and significant contribution to the government housing policy and development goal. It is thus our recommendation that the project be allowed to go ahead with the implementation provided the outlined mitigation measures are adhered to. Major concerns should nevertheless be focused towards avoidance or minimizing the occurrence of impacts that would degrade the general environment. This will however be overcome through close following and implementation of the recommended Environmental Management and Monitoring Plans (EMPs).

We also recommend that the proponent also work closely with the environmental Experts, the council and other bodies to enhance the facilitation of the issues of concern identified. This will also help in solving any problem arising and which may not have been foreseeable during the EIA study report. This will ensure that environmental concerns are integrated into the project at every stage of the implementation phase. It will enhance the co-existence of the proposed project with the environment, during the entire project cycle. The various service providers (power, sewer, water, garbage collection etc.) must assess the respective requirements. The proposed design has met the basic requirements such as the minimum habitable room sizes and basic social services; the reason why they have been approved by the relevant authorities. It is recommended that that on approval, the proponent should implement the project on the proposed drawings and if alterations are necessary, approval should be sought. Conservation resources such as energy and water within the project during construction and occupation phases should be encouraged. Sound construction practices aimed at environmental conservation should also be adopted and special attention should be paid to the extended sources of raw materials such as water, sand, stones, and energy. Some construction 'waste' materials can be re-used in other areas and forms.

Wastes should be reduced to the minimum as this will save on costs and at the same time preventing environmental pollution. The operators during both the construction and operational phases should exercise diligence in all activities to ensure environmental sustainability.

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ATTACHMENTS

1. Copy of land ownership document
2. Copies of social site assessment completed questionnaires
3. Copies of approved designs (plans/drawings)