ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT

FOR

THE PROPOSED RESIDENTIAL DEVELOPMENT (APARTMENTS) ON L. R. NO. 209/22274 (ORIGINAL NO. 209/20681) ON MURANG'A ROAD IN NGARA AREA, NAIROBI COUNTY.

Proponent:

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For and on behalf of:
Soil Merchants Kenya Limited

Signed: _____ Date: _____

For: **Soil Merchants Kenya Ltd (*Proponent)***

Proponent's PIN No.: **P051171514D**

Disclaimer:
The proponent proposes a residential development on L.R. No. 209/22274 (Original No. 209/20681) situated on Murang'a Road in Ngara area, Nairobi County. The proposed plans have been submitted to the other relevant departments of the CGN seeking approval while change of user to multi-dwelling units(flats) has been granted. Copies of documents, details and information in the report are what were obtained from the proponent. Portions of this report are based on documents, data and verbal information provided by third party sources and reports prepared by other professionals. The experts may not have independently verified all the information and accept no responsibility for the accuracy of information contained in such reports. Whilst this report and the opinions contained herein are accurate to the best of the experts' knowledge and belief, the experts cannot guarantee the completeness or accuracy of any description based on the supplied information.

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Location sketch map

Copy of Certificate of Title

Copy of Change of user

Copy of the proposed plans (drawings)

Copy of Certificate of Incorporation and PIN Number

Minutes and list of and attendance list for the CPP meeting

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
PAPs	Project Affected Persons
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
CGN	County Government of Nairobi
NWSC	Nairobi City County Water and Sewerage Company

EXECUTIVE SUMMARY

The whole purpose of EIA process is to achieve environmental sustainability directed at management and conservation of the natural resources to ensure the attainment and continued satisfaction of human needs for the present and future generations.

There has for a long time the world over a big gap between the demand and supply of standard housing which has unfortunately resulted in proliferation of shanties and slums all over the main urban centers and Kenya, particularly Nairobi and its environs are no exceptions. Housing, like food ranks very high in the hierarchy of needs and therefore the current situation is a serious social/human drawback. Environmental management refer to the management of man's activities that depend upon the resources of the environment and which have an effect upon the state of the environment. Environmental management and development problems require an integrated approach, as they are so integrated with social, demographic, economic and political elements.

Soil Merchants Kenya Limited hereinafter referred to as *the proponent*; propose to develop a single residential block with residential apartments and related facilities on L.R No. 209/22274 (Original No. 209/20681) (measuring approximately 0.1761 hectares) situated within Ngara area, Nairobi County. The proposed project involves the construction of a single block with one basement, ground, 1^{st} – 22^{nd} floors. The basement floor shall accommodate a store, driveway and parking while the ground floor shall accommodate management office, generator room, transformer room, cleaners room, gatehouse, driveway and parking. The 1^{st}, 2^{nd}, 3^{rd}, 4^{th}, 5^{th}, 6^{th}, 7^{th}, 8^{th}, 9^{th}, 10^{th}, 11^{th}, 12^{th}, 13^{th}, 14^{th}, 15^{th}, 16^{th}, 17^{th}, 18^{th}, 19^{th}, 20^{th}, 21^{st}, and 22^{nd} floors shall be typical each to accommodate 12No. one-bedroom apartments and 15No. studio apartments. The 23^{rd} floor shall be the terrace floor with terrace and drying area while the roof floor shall accommodate water tanks. The proposed project shall have a total of 594No. residential apartments comprising 264No. one-bedroom apartments and 330No. studio apartments. The salient features of the project will include protected refuse room, and the proposed project will be enclosed with a perimeter masonry wall. To aid in vertical movement, four (4) lifts and two staircases/fire escapes are provided. The proposed design has provided for sewerage and other plumbing articulation, and surface run-off drains. The proposed designs/plans have been to the other relevant departments of the CGN seeking approval but change of user multi-dwelling units (flats) has already been granted. (Please *refer to the attached plans/drawings in the annex for the finer details*).

The proposed project site had an old bungalow at the time of the study that shall be demolished to pave way for the proposed development. It is estimated that the project will take approximately 36 calendar months to completion and it is estimated that it will cost **Kshs Three hundred million (300,000,000).**

The trend is fast picking in the area and high-rise 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 neighbourhood are already developed with high-rise buildings, while some others are vacant. In the environs also are a combination of commercial and residential. The limited supply of land especially in many townships and the ever-increasing demand for housing has fueled the unprecedented residential development in the suburbs where single-dwellings but mainly multi-dwellings development in an effort to alleviate the housing shortage. The proactive designs have provided for adequate ventilation and natural lighting, parking, storm water drainage, water storage and sewer reticulation as well as open areas. 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 in the process of transfer to be registered in the name of the proponent.

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

The major objective of the EIA study is to evaluate the effects/impacts of proposed development in relation to the entire environmental aspects aimed at influencing the protection and co-existence of the development with the surroundings as well as the compatibility of the proposed development to the area to ensure and enforce sustainable environmental management during site preparation (site clearance and foundations), construction, occupation/operation and decommissioning phases. The scope of the assessment study covered the physical extent of the project site and its immediate environs, proposed construction works including installation of basic utilities/facilities and services as required by the residential development project; Characterization of the baseline information about the environmental, ecological, social and economic conditions around the proposed project area and the establishment of the potential environmental impacts or other environmental concerns of the proposed project.

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 main positive impacts include but not limited to provision of standard housing and thus wellbeing, provision of business premises thus promotion of commerce and livelihoods, creation of employment throughout the project cycle, optimal use of the land and increase in land value, provision of recreational facilities, 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. With the small size of the plots, usually there is no provision for green areas in such areas and vegetation and trees are mainly found in the designated public places. The foreseeable negative impacts include but not limited to impact (constraints/pressure) to the existing infrastructure i.e. sewer, water, power, road, 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; health and safety hazards; increased dust, 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 (though of very small scale as much of the work is labour intensive), health and safety concerns especially to workers and immediate neighbours due to potential accidents, pollution (from vehicles & generator oils and fuels & the exhausts), fats and greases from the kitchen and disturbance. Hazards associated with construction include but not limited to falling objects, risks from poor scaffolding, ladder and formwork. 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. There are also concerns on increased waste and its management. Other risks and hazards involve fires.

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 suitable dust screens 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. 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 within the stipulated hours. Vehicle/machinery idling should be minimized/controlled and 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, sewerage system will be properly designed (using approved materials), installed and regularly maintained to effectively drain effluent into the municipal sewer. All the materials should be of high quality and to the specifications. Regular monitoring should be made during occupation phase for effectiveness and efficiency. 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 **OSHA** 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.

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 off by backfilling or dumping in approved grounds. 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.
For the fats and greases from the kitchen, fat/grease traps shall be installed and regularly schemed and samples regularly tested in approved laboratories to ensure compliance with set standards.

Public participation was extensive and none of the PAPs raised an objection to the project but there were some issues they wanted taken care of which are discussed in details herein after in the report. They noted that the proposed development is large and may further constrain the already constrained road/traffic and other infrastructure. The proponent applied for change of user (as per the provisions of the Physical Planning Act) from fuel station to multi-dwelling units (flats) which was granted (copy attached in this report).

Generally, the significant impacts of such developments are the respective pressure they exert on the infrastructure due to failure of the central and county governments upgrade the same accordingly through various respective agencies/departments/parastatals/service providers, 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 NEMA, CGN, the neighbours and other stakeholders, environmental experts and other relevant professionals and other relevant institutions throughout the project cycle. The importance of liasing 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.

Part of the very notable design and practical considerations to at least address infrastructure matters, the proponent has surrendered 1.5metres along the access (rear) road and a 6metres setback along the Murang'a Road (highway). These shall play a very important part in infrastructure such as the significant impact to access road expansion; provision of space for infrastructure installation & expansion and also ensuring the safety of the building from any near-future road and infrastructural improvement needs. Among other design considerations is the incorporation of green technology in design and construction so as to reduce costs of lighting and air circulation

While the proposed EMP and recommended mitigation measures may be considered adequate based on the potential anticipated impacts, the most important aspect is for all stakeholders to appreciate that that there can be no ideal/perfect policies or solutions. Therefore, our attention should focus on seeking formulation of policies and plans, which take into account all known and/or predictable aspects, yet remain flexible enough so that they can be adjusted in the light of actual experience and therefore the need for effective monitoring and evaluation systems.

INTRODUCTION

General overview, Justification and rationale for EIA

Most urban centres in the country are faced with an acute housing shortage and the Nairobi City and its environs is among the worst hit. The increase of city population has not matched with an increase of housing and thus a housing crisis has resulted.

The proponent has proposed a residential development on L.R. No. 209/22274 (Original No. 209/20681) that is in the larger Ngara area, Nairobi County. 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. The proposed project is residential. 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. Integrating *Sustainable Environmental Management principles* in the planning, implementation and throughout the project cycle is vital in reducing/mitigating conflicts and enhancing environmental conservation.

Objectives

The main objective of this EIA study 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

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.

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) Regulations, 2003. 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 foreseably affected by the proposed project.

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

- Physical environment
- Biological environment
- Socio-economic environment

The study has assessed the impacts of the proposed project on the environment and has covered the following activities:

- A review of the policy, legal and administrative framework
- Description of the proposed project
- Baseline information
- Assessment of the potential environmental impacts on the project area
- Development of the Mitigation measures and future monitoring plans
- Social Impact Assessment

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.
Literature review pertaining to the project activities and salient features of the project area was done. This covered the review of the Environmental Management and Coordination Act, relevant studies and reports on the construction including design works and other related sources of information.
During the field investigations, a survey was conducted in order to collect information on biophysical and socio-economic environment of the project development site area and its environs. The following steps were involved environment screening; environmental scooping; physical inspection of the site and its environs; Desk stop studies, consultations, questionnaires and public participation and consultation; Reporting.
Public participation was achieved through an open and participatory public meeting where the public asked questions (which were responded to) and gave their opinions and recommendations. The exercise generated primary data on the socio-economic impacts on the area; anticipated impacts and suitable solutions and recommendations. More details are given elsewhere in the report and as appendices in the annex. Further, consultation and public participation shall be attained through the mandatory advertisements of the proposed project in the Kenya Gazette and mass media as required by law.

Objectives and scope of the proposed project

Whereas the main objective of the proposed project is residential development for some economic gains to the proponent and to those who will be operating therein, 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. The main objective of the proponent is to develop 594No. residential apartments for use, rental or sale purposes. The scope of the project is limited to the geographical location of the L.R. No. 209/22274 (Original No. 209/20681). The site shall be enclosed in a perimeter fence/building lines and all activities including construction material and construction waste storage shall be within the boundaries of the proposed site before unrecyclable wastes are disposed to approved dump sites. There may be minor disturbances or spillover effects to the neighbourhood due to such issues such as noise, dust, traffic etc especially during construction but they shall be reduced to the minimum possible as recommended in the mitigation measures. The proposed development shall entail the development of a single block with one basement floor rising through ground to the 23rd floor plus roof floor whose finer details are given in the description of the proposed project elsewhere in this report.

Justification of the project

Due to the rapid urbanization and higher population growth the housing situation in the county (Kenya) has remained under tremendous pressure. The provision of shelter has not kept pace with the phenomenon and this has resulted in the deterioration of living conditions, increased health hazards, and rapid growth of slums and squatter settlements. The improvement of slums and squatter settlements, and provision of affordable housing to shelterless population will help alleviate the condition of urban and rural poverty as well as increase the productivity of the low-income population through improved public health.

Of late, there has been a marked change in the approach to residential development in the urban areas and mostly in/near the major Kenyan cities. Increasingly, there has been a strong tendency to develop integrated, low cost and secure housing infrastructure; within the confines of fenced boundaries with restricted and well-guarded entrances in the name of gated community.

The prevailing circumstances render this type of development popular in the cities. These types of development are a practical response to the growing insecurity in the urban areas. Such compounds with pooled security have relatively low incidences of robberies, break-ins or even attacks on people. The current practice in the old estates, to physically block some streets and to fix/erect-manned gates to curb insecurity is illustrative of the serious concerns of the urban society, its reformation and coping mechanisms.

The new developments are coming up with modern and efficient drainage and sewerage systems; with *high factors of safety* to handle the ever escalating volumes of waste materials. They are also installed following guidelines from NEMA and other relevant agencies; which aim at improving the general environmental quality. This EIA in its widest sense is the means by which environmental concerns shall be taken into account throughout the life of the development from the initial concept through detailed design, construction and operation to eventual restoration and reuse of the land. Landscaping, ecology, and waste management are given first hand consideration to facilitate adoption of Integrated Ecosystem Management (IEM) and thus sustainable *use of the environment.*

In the near future, statistics have shown that nearly half of the world population will be living in urban areas. The government has realised this changing trend which helps in determining the overall requirement of housing units and ultimately provides a base for policy formation and future planning at macro and micro level in the country. These kinds of developments are therefore backing up the government's initiative and policy to providing 150,000 new houses per year. Though this may still be insufficient since the population growth is exponential plus the rise in rural – urban migration, it is a great initiative aimed at providing affordable housing to the urban society. The development therefore is a welcome idea that will go along in easing pressure to the existing housing infrastructure. The development will go along in increasing the national/local housing stock and quality.

Urbanization is increasing at a high rate. This brings in new classes of people with specialized demands for new and sophisticated lifestyles. People are considering living in houses with standard infrastructure i.e. water, power and modern house design. Again they desire living as a group to enjoy much security and socialism.

With the increased traffic congestion and especially during rush hours, people have opted to live in areas with good road networks and in areas where their time to get to work will not be compromised by traffic delays. The good thing about the proposed development is that it comes with basically all the other associated facilities/services such as recreational and commercial facilities; and infrastructure.

Lack of adequate and affordable housing is clearly exhibited in the entire city in slums and informal settlements.

ENVIRONMENTAL SETTING OF THE PROJECT AREA AND ITS ENVIRONS

PHYSICAL ENVIRONMENT

Climate

The climate of Nairobi and its environs is pleasant for most of the year. It experiences a double (bi-modal) seasonal rainfall pattern (which peaks during the months of April and November) with high to moderate rainfall from April-May and November-December. Mean annual rainfall range is 500-1000mm/year. Relative humidity mean values range from 70 to 80%. Temperature fluctuates between 15ºC and 32ºC in most areas. Areas to the north and west of the city center (CBD) tend to enjoy cooler temperatures and are relatively wet while dry conditions prevail the further to the east and south. The proposed project site is to the north-east of the CBD.

Geology, Soils and topography

The immediate area is gently sloping and in some places is characterized by steep slopes. It has an underlying rock of tuff and trachytes and soils are red and murram which vary in depth. The proposed site is fairly flat.

BIOLOGICAL ENVIRONMENT

Flora

The general area is planted with vegetation (trees) mostly along the roads, plot boundaries and in designated gardens within the respective plot boundaries. The proposed site had no trees at the time of the study. Within and in the site and the immediate neighbourhood, there is no vegetation of special conservation or cultural importance.

Fauna

The site is situated within an area zoned for residential and commercial where human activities have altered the natural habitat for wildlife over the years. Consequently, there are no major animals in the environs except may be birds, insects, and small rodents. Therefore, there is no fauna threatened by the proposed project.

Water Resources

The area has piped water and there no surface water body in the immediate neigbourhood. Water supply is adequate mainly supplied from groundwater through boreholes, the piped network, rivers and

streams and shallow wells. Boreholes drilled within the area indicate that there are sufficient volumes of underground water.

Sensitive ecosystems or places of cultural importance

There are no sensitive ecosystems or places of cultural importance in the immediate environs

SOCIO-ECONOMIC ENVIRONMENT

Lying within an area predominantly residential and commercial, the proposed project site is in line with the area's planning policy in terms of land use. Almost every other plot in the neighbourhood is residential or residential/commercial related activities and Guru nanak Hospital is in the neighbourhood of the site. The proposed site is well accessible and in close proximity to the various commercial centres along the connecting roads and Nairobi City Center. Being commercial and/or medium and high density residential area, all social amenities and services (hospitals, schools, religious places, shopping areas etc.) are within easy reach. All major urban services are available (water, electricity, sewer, communication). All emergency facilities (fire brigade, ambulances etc) are within easy reach from the various providers. The area is currently a high and middle density residential area. There are no sites of cultural, historic or traditional significance in the immediate neighbourhood. The area is within the County Government of Nairobi's jurisdiction and therefore served by the CGN's infrastructure and is also bound by the CGN's by-laws.

INFRASTRUCTURE AND SERVICES

Roads and accessibility

The proposed project site is a plot with two immediate access roads (one on frontage and the other at the rear) which are tar surfaced closely connecting to the other roads and therefore the site is well accessible.

Sewer system

The area is served by the main sewer and therefore proposed project shall be connected to the same for disposal of wastewater. The sewer system reticulation has been effectively designed in the proposed plans and will be connected to each unit and to the sewer.

Water resource

The proposed project site is connected to the NWSC water supply network. It is proposed that the proposed development will have cold-water storage tanks to the specifications of the mechanical engineer. It is recommended that the proponent explore harnessing rainwater for general use to minimize pressure on the existing water supply and also intend to drill a borehole.

Surface Drainage

There is an existing common drainage system which drains the area. The proposed design has provided for internal drains to collect the surface run-off and safely dispose to the area drainage system.

Solid waste Management

The area is within the jurisdiction of the County Government of Nairobi, which has the responsibility of disposal of waste. However, the proponent/contractor has an option of contracting a private garbage collecting company. The proposed project has included dustbin cubicles (protected from rain and animals) but this cannot handle construction solid waste - arising from the demolition debris, vegetation materials to be cleared, and construction material wastes (wooden, glass, plastics, sanitary litter e.t.c.). 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.

Energy

The site shall be connected to the national grid but there is need for the proponent to liase with KPLC to cater for the increased demand. Fossil fuels will power some machinery/equipment. Proponent is encouraged to explore solar energy systems.

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.

RELEVANT LEGISLATIVE AND REGULATORY FRAMEWORK

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 legislation. 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.

Environmental Management and coordination Act, 1999, provide a legal and institutional framework for the management of the environment related matters. It is the framework law on environment. Top most in the administration of EMCA is national environmental council (NEC), which formulates policies, set goals, and promotes environmental protection programmes. The implementing organ is national environmental authority (NEMA). EMCA comprises of the parts covering all aspects of the environment.

The Act prohibits discharging or applying poisonous, toxic, noxious or obstructing matters, radioactive or any other pollutant into aquatic environment. The Act requires that operators of projects which discharge effluent or other pollutants submit to NEMA accurate information about the quantities of the effluent. The Act demands that all effluent generated from point sources are discharged only into the existing sewages system upon issuance of prescribed permit from the county governments. *In compliance, the proponent appointed experts to conduct the EIA to seek approval of the proposed project.*

The Environment (Impact Assessment And Audit) Regulations, 2003

The Regulations are entrenched under section 147 of the EMCA, Cap 387 of the laws of Kenya. The regulations provide the framework for carrying out EIAs and EAs in Kenya. The Regulation provide for fees, guidelines, rules, standards and administration procedures in the EIA/EA process. The Regulations' latest amendment of 19th August 2016 (The Environmental Impact Assessment and Audit) (Amendment) Regulations 2016 made significant changes regarding fees payable, various timings and modified the Second Schedule of EMCA, Cap 387. The amendments revised the fees payable and categorised the projects (under) Second Schedule) into low risk, medium risk and high risk. Currently, the prescribed fees directly payable to NEMA is equivalent to 0.1% of the estimated project cost. *This EIA study report is conducted in conformity with these regulations and EMCA, Cap 387.*

The Environmental Management and Co-ordination (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 proponent will connect to the NWSC water supply and there is no surface water body in the immediate environs, and the proponent shall take appropriate measures as provided in the regulations. The development shall be connected to the existing sewer.*

Environmental Management and Co-ordination (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.*

Environmental Management and Coordination (Noise and Excessive Vibrations Pollution) (Control) Regulations, 2009.

The noise and excessive vibrations regulations require that noise and excessive vibrations should be minimized to the largest extent possible ant that this should not exceed particular decibels.

To minimize the impacts of noise and vibrations from the proposed activities, the activities will be limited to working hours between, 8.00 am and 5.00 pm. All possible care will be undertaken to ensure that the machinery are properly greased and oiled to reduce friction and possible noise emission. The proponent shall strictly adhere to the provisions and requirements of these Regulations.

National Environmental Action Plan (NEAP)

According to NEAP, 1994 the Government recognized the negative impacts on ecosystems emanating from development programmes that disregarded environmental sustainability. Established in 1990, the plan's effort was to integrate environmental considerations into the country's economic and social development. Under the NEAP process EIA was introduced.

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.*

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 shall connect to the existing sewer for wastewater disposal.*

OSHA, 2007

The Act makes provision for the health, safety and welfare of persons employed in various 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.

Health

The premises must be kept clean, daily removal of accumulated dust from floors, free from effluvia arising from any drain, sanitary convenience or nuisance and without prejudice to the generality of foregoing provision.

The circulation of fresh air must secure adequate ventilation of workrooms. There must be sufficient and sustainable lighting in every part of the premise in which persons are working or passing. There should also be sufficient and sustainable sanitary conveniences separate for each sex, must be provided subject to conformity with any standards prescribed by rules. Food and drinks should not be partaken in dangerous places or workrooms.

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

Safety

Fencing of premises and dangerous parts of other machinery is mandatory. Training and supervision of inexperienced workers, protection of eyes with goggles or effective screens must be provided in certain specified processes. Floors, passages, gangways, stairs, and ladders must be soundly constructed and properly maintained and handrails must be provided for stairs

Special precaution against gassing is laid down for work in confined spaces where persons are liable to overcome by dangerous fumes. Airs receivers and fittings must be of sound construction and properly maintained. Adequate and suitable means for extinguishing fire must be provided in addition to adequate means of escape in case of fire must be provided.

Welfare

An adequate supply of both quantity and quality of wholesome drinking water must be provided. Maintenance of suitable washing facilities, accommodation for clothing not worn during working hours must be provided. Sitting facilities for all female workers whose work is done while standing should be provided to enable them take advantage of any opportunity for resting.

The Act stipulates that every premises shall be provided with maintenance, readily accessible means for extinguishing fire and person trained in the correct use of such means shall be present during all working periods.

The Act state that regular individuals' examination or surveys of health conditions of industrial medicine and hygiene must be performed and the cost will be met by the employer. This will ensure that the examination can take place without any loss of earning for the employees and if possible within normal working hours.

The Act provides for development and maintenance of an effective programme of collection, compilation and analysis of occupation safety. This will ensure that health statistics, which shall cover injuries and illness including disabling during working hours, are adhered.

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

The Physical Planning Act, Cap 286

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 proposed project is compliant with the

planning policy which permits the development of commercial and apartments. *The drawings (plans) of the proposed project has been submitted to the other relevant departments of the CGN seeking approval while change of user from petrol station to multi-dwelling units (flats) has already been granted.*

County Government Act of 2012

The Act was a repeal of The Local Government Act in conformity with the new constitutional dispensation. 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, EIA study report has proposed potential mitigation measures (in the EMP and monitoring plan; and the environmental management Framework in the report.*

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. The proponent shall abide by the provisions of the Code and a*ll approvals will be sought before commencement of the work and regular monitoring will follow to ensure compliance with set standards and conditions.*

Public Health Act, Cap 242

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. *The effluent will be discharged into the existing sewer. 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.*

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.*

The Water Act, 2002

Part II, section 18, of the Water Act, 2002 provides for national monitoring and information systems on water resources. Section 73 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 75 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 land for preventing pollution of water sources within his/her jurisdiction. *The proponent is connected and will remain connected to the NWSC water supply while liquid waste disposal (read soil and waste water) is to the existing sewer.*

SOCIAL IMPACT ASSESSMENT/CONSULTATION & PUBLIC PARTICIPATION

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/CPP helps bring out the contentious issues and gives a chance to those who may be affected by a proposed project to give their views.

In principle, the respondents raised no objection to the proposed project. Issues mentioned regarding the proposed development are about the constraints to the infrastructure and services. This is quite true because the increased population brought about by the proposed project shall require to use the same existing community infrastructure and services/facilities and thus may affect the current state or equilibrium.

The proponent has applied for change of user (from single-dwelling to multi-dwelling units (flats)) as per the provisions of the Physical Planning Act and was granted. During change of user, public participation is conducted through a notice on the proposed site and a newspaper advertisement. Like in most other areas, they mentioned the need for forward planning by the CGN 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). They also raised the issue of potential security enhancement risk especially during construction. In summary, the respondents have no objection to the proposed project because of the various advantages associated with such project but also indicated of the need the government to look into infrastructure including roads, water, electricity, sewer, and surface runoff. Respondents indicated the need to protect the residents from dust, falling objects and debri during construction. They were worried what will happen if a falling object or debri damaged property or cause accident during construction to which the proponent is well aware of that there is legislation that governs such matters and among the available remedies include compensation as per the prevailing legislation among other provisions. They also advised non-interference with existing infrastructure particularly sewer to avoid inconveniences that may arise due to obstruction and leakages during excavations. Reported potential advantages include sharing of costs, increase in business to those running businesses 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.

Consultation and public participation is very important and thus all parties must be heard. Where there are genuine objections (none were raised for this project anyway), the reasons must be stated and a decision reached based on the weight of the reasons, their nature and if they are mitigatable or not among other factors. In our opinion, constraint to infrastructure and services does not wholesomely warrant denial of a proposed project such as this one since there is room for improvement by the service providers UNLESS there are sites or functions with cultural importance or sensitivity which is not the case here. On the same note, it is good we remind ourselves that the numerous change of user and subdivisions in many areas of the city was brought about by the various prevailing factors at various points in time and the same may be needed at this point in time to move the country forward and meet the demands for the ever increasing population which is posing a big environmental challenge. It would be unfair to deny one entity or person to carry out the development while others are still ongoing and others will come up in the neighbourhood in future and all are served by the same infrastructure and services. The government's role in housing provision is mostly to provide enabling environment for the private sector.

Having identified infrastructure and services as a serious challenge for future development, the relevant agencies should develop a road map for addressing the same in time.

Photos taken during the CPP meeting held on proposed project site


OPPO Reno4


OPPO Reno4


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OPPO Reno4

MEETING NOTICE!!!

The proponent (Soil Merchants (K) Ltd) of L.R. No. **209/22274** (original No. **209/20681**) proposes a residential development (apartments).

Among other requirements, the development must be subjected to the Environmental Impact Assessment (EIA) process and in this case EIA Study.

One of the basic requirements of the EIA process is Consultation and Public Participation (CPP) of the project affected persons (PAPs) and all stakeholders. In this spirit, we are inviting the public for a meeting to be held on the proposed project site on **18th October 2022** starting at **10AM**. You are all welcome for any clarifications, views, queries, opinions and recommendations.

For any communication, kindly contact Wilfred on 0723522722, the office or or the proponent's representative on the ground.

One of the 'Meeting Notice' pinned in the area

Source: Field survey

RESETTLEMENT ACTION PLAN

The proposed project is not anticipated to displace any person or facility. The reason being, the proposed project is being implemented on a land parcel recently and legally acquired in overt and arms-length transactions (through purchase on a willing buyer willing seller basis) by the proponent.

As at the time of the study the subject plot was vacant and the previously existing buildings and structures already demolished. Information obtained indicate that the land was acquired by the proponent in a vacant status (as-is basis) and thus, there arose no need at any one given time to move or resettle anyone.

Should the need arise in future for expansion of the proposed project (after implementation) where extra land may be needed, the proponent will at that time explore the options available in consultation with the people and property that may be affected by such proposal, the government and all the stakeholders subject to the prevailing law and rules of natural justice. In such a scenario, the proponent may opt to acquire or lease the land on a willing-buyer willing-seller basis.

PROPOSED PROJECT LOCATION, DESCRIPTION, AND ACTIVITIES

NATURE, DESIGN AND DESCRIPTION OF THE PROPOSED PROJECT

The proposed project involves development of residential apartments, auxiliary and associated facilities. The development will be in a single block appropriately designed in terms of orientation and adequate voids to ensure adequate natural lighting and ventilation.

The basement floor shall accommodate underground water tank, driveway & parking and a small store while the ground floor shall accommodate driveway and more parking, management office, generator room, transformer room, gate house and cleaners' room. The other floors i.e. 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st and 22nd floors shall each accommodate 12No. one-bedroom apartments and 15No. studio apartments. The 23rd (terrace) shall accommodate a caretaker room, terrace and drying yard. The roof floor shall partly accommodate water storage tanks. The proposed project shall have a total of 594No. residential units comprising of 264No. one-bedroom apartments and 330No. studio apartments.

For each of the one-bedroom and the studio apartments; there are two typologies. For each of the typology, type A shall be smaller in area than type B. For studio apartment, each shall a have the main area, toilet/bath and cooking area (type A) and in addition, type B shall have a balcony. For one-bedroom apartments, each shall have lounge, kitchen and toilet/bath (Type A) and in addition, Type B shall have a balcony.

The roof shall accommodate solar panels and solar water heating systems. Other salient features of the project will include four lifts and two staircases/fire escapes for vertical movement, and a perimeter masonry wall lines. As such, the proposed development will maximize on full utilization of the plot.

In addition to this, the development will include provision of key infrastructure including power connection and installation of transformer(s), storm water drainage systems, outdoor lighting, and sewerage and water reticulation to the local adoptive standards.

The project specifications

The following are specific descriptions of the project.

- The entire property will be enclosed in a perimeter masonry wall 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 has been used whose depth as determined by the structural engineer and filled with approved hardcore filling; hand packed and well compacted in layers and quarry dust. Because the soils are fairly stable- factors conducive for structural development, there were be no major deep excavation works except for the foundations bases.
- The ground floor concrete slab is 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 has been provided to all superstructure walls.
- The staircases will have standard handrails, 250mm trends and 150mm risers
- The roofs will be flat concrete slab appropriately finished or where necessary; pitched galvanized iron sheets on timber members 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 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 on 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 along the road
- Sewerage system to discharge to the existing sewer while water and electricity (power) shall be from the local supply network and national grid (KPLC) networks respectively.

(The finer details of the proposed project can be found in the copies of the architectural drawings attached in the Annex)

PROPOSED LOCATION OF THE PROJECT

The proposed project site is Land Reference Number 209/22274 (Original No. 209/20681) in Ngara area, Nairobi County. GPS coordinates on a section of the site are S 01^0 16' 15.6'' and E 036^0 49' 44.8'' at an elevation of approximately 1675m ASL. The project site is on Murang'a Road, one of the many plots between Desai Road and Okoth Aura Road; near opposite Seldom Hotel. The proposed project site is in the neighbourhood of Kenya Institute of Curriculum Development(KICD) and Guru nanak Hospital among other institutions and businesses. *A location sketch map is attached in the annexe.*

SITE OWNERSHIP AND ZONING

The proposed project site i.e. L.R No. 209/22274 (Original No. 209/20681) measures approximately **0.1761 hectares (0.4351 acres)**. The proposed project site is registered in the name of the proponent (Soil Merchants Kenya ltd) under a lease of 50 years with effect from 01/07/2019. A copy of the Certificate of Title is herewith attached in the annex of this report. The plot is for use of residential purposes therefore considered compliant with the proposed use and more so having even changed user from fuel station to multi-dwelling units(flats). The proposed drawings have been submitted to the other relevant offices of the CGN seeking approval. High-rise developments have been implemented in the immediate neighbourhood including some of the immediate neighbouring plots which are under similar construction and others are complete with similar proposed developments. The entire Ngara area has embraced high-rise development as the norm.

PROPOSED PROJECT IMPLEMENTATION (CONSTRUCTION)

The buildings 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, BS4466, BS4461 etc*. The constructions will as well incorporate environmental guidelines, health and safety measures.

With the previous existing developments on site already demolished, the first activities shall involve excavation and ground preparation and laying out of the foundations followed by the erection of the

substructure and consequently superstructure. There is vegetation on site so there is no threat of vegetation removal.

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 (such as doors windows), 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 labour 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. It will be supplied from the mains or mobile bowsers with approval by the relevant departments
- Power from the mains grid or provided by generators.

Construction activities include the following:

- Procurement of construction materials from approved dealers.
- Construction of temporary construction office(s) and store
- Transportation of construction materials and debris using heavy and light machinery.
- Appropriate storage of the construction materials.
- Site works i.e. site clearing, 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.

DRIVEWAY AND PARKING

The proposed project has provided for driveway and parking within the plot and in particular the basement floor and ground floors. The proposed entry and exit should be designed appropriately to avoid accidents during entry and exit. The driveway is opening directly onto the access road.

PROJECT BUDGET

According to the proponent, the construction is estimated to cost approximately kshs **Three hundred million (Kshs 300,000,000)** and is estimated to take approximately thirty-six (36) calendar months to complete.

ACTIVITIES DURING OPERATION PHASE

The activities to be conducted in the proposed project's operation phase are the normal residential and related activities which include provision of accommodation and all human related activities for the well-being and quiet enjoyment of the potential home residents and their potential guests and service providers. Other support services include general maintenance and cleaning of the premises and laundry. The human activities shall definitely generate some liquid and solid waste.

ACTIVITIES DURING DECOMMISSIONING PHASE

Quality and standard projects (buildings) of this nature have a lifespan of between 50 and 100 years which is much dependent on the maintenance quality. 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 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 loose 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.

CONSTRUCTION PRODUCTS, BY-PRODUCTS AND WASTES

Construction products is the final usable premises in the case of the proposed project is residential apartments and related facilities. All the proposed facilities shall have all the basic facilities to the local standards including connection to the existing sewer for waste water disposal. The final product shall have all necessary accommodation details as described elsewhere in this report and in the architectural drawings. Construction process does not produce by-products. Wastes from construction activities are diverse. They include excavated soils, vegetative materials extirpated from the site, wastes (pieces) from iron sheets, timber, glass, plastic and PVC materials, steel metals, broken stones; tiles and debris not to mention packaging materials. Wastes during occupation is mainly in the form of general house refuse and the waste water. All wastes shall be disposed off appropriately as discussed in mitigation measures elsewhere in this report.

CLIMATE CHANGE ADAPTATIONS AND MITIGATION STRATEGIES

Climate change has become real due to the past human activities. Among the main issues include global warming, change in weather patterns, extinction of species, dwindling resources etc. it is very important that we focus on various coping and adaptation strategies in an effort to mitigate and slowly reverse on the actions that aversely accelerate climate change.

It should be noted that environmental enhancement is a universal responsibility and everyone must take part during each and every action or activity because it is the cumulative individual actions that make or destroy the environment at large. Singly, one's action may appear negligible but that the accumulative effect from the millions of people across the globe.

Among the very important strategies include harvesting of rain water; harnessing solar power and designing of buildings to utilize natural lighting during the day. Harvesting of rain water shall not only reduce the strain on water resources but shall also greatly reduce surface runoff which eventually cause flooding, loss of life and damage to property. Harnessing of solar power also reduces the constraints to the power supply and reduce the negative impacts associated with production of power at various sources particularly the diesel-powered power generating plants.

Another very important strategy is sound waste management. The action plan should include reduction of waste generation at source, re-use and recycling. Waste reduction, recycling and re-use saves on resources and promotes a clean environment. Management of waste shall involve reduction of waste, segregation to encourage re-use and recycling and sound final disposal as provided by the Waste Regulations.
With the advancement of technology that exist today, wastewater treatment is another very important strategy where wastewater is treated and re-used.

During construction, suitable technologies must be adopted to ensure that open areas allow for water percolation to recharge of underground water. This shall also reduce the surface runoff.
Adequate and suitable ventilation at the design stage shall also promote natural ventilation thus reducing the need for artificial ventilation and associated negative impacts. Where artificial ventilation must be put in place, substances that damage the environment must be avoided.

Water conserving systems must be put in place while tree planting should be practiced due to the role played by trees in cleaning the environment not to mention other important uses. When planting trees, the right species must be identified.

The government's proposed target of achieving 10% forest cover must be institutionalized such that it becomes an objective in every proposed project and thus more effort must be put in internalizing the objective in all people.

The proponent's commitment to such strategy can be exhibited in the willingness and effecting the surrender of 1.5metres along the access (rear) road and a 6metres setback along the Murang'a Road (highway). The surrendered land shall play a very important part in infrastructure installation and expansion for current and future needs. Among other design considerations is the incorporation of green technology in design and construction so as to reduce costs of lighting and air circulation

ALTERNATIVES INCLUDING THE PROPOSED ACTION

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 the premises preparation and during operational phase.
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 residential project.

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. The land may also be available elsewhere but there could be no demand for the apartments.

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.

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.

Alternative design and technology

Various alternative designs and technology has been evaluated by the proponent and various professionals involved in planning and design i.e. the architect, engineer, and planner. 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.

Waste Water Management Alternatives

Alternative one: connection to Municipal sewer system
Connection to the main sewer line will solve the waste water management issue at a very minimal cost and in an environmental efficient manner. The area is served by a municipal sewer and thus shall be connected to the same.

Alternative two**:** use of septic tank
This involves the construction of a septic tank for disposal of wastewater which is more expensive to construct and operate.

Alternative three**:** wastewater treatment plant/system
This involves the construction of a series of lagoons for digestion of microorganisms and subsequent treatment of the waste water. This alternative comes with one main advantage in that the treated water could be used for irrigation either in farmland or the compounds. However, it comes with one disadvantage in that it requires a bigger area of land and requires a lot of monitoring so as to ensure that the waste water is treated to the standards before being released to the environment.

Alternative four**:** Bio-digesters
The use of a bio-digester is also another environmentally friendly alternative since it will "digest" the wastewater and make it useful (recycling).

The comparison of alternatives

Under the proposed development Alternative, the project would create more and standard housing stock and related facilities and would provide employment directly and indirectly to the public. It would provide 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.

Mitigation for the proposed Action

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

POTENTIAL IMPACTS

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 apartments.

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 is fast changing and the planning policy has opened up the area for multi-dwelling and commercial. This has led to the majority of the plots being developed with high-rise commercial and residential developments and the process is ongoing in others. The proposed project shall blend well with the area. 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 was previously used by the previous proprietor for a petrol station and thus accommodated not even one family but the proposed project shall accommodate many individuals and households (at least 594) thus raising the utility of the land. The proposed use also conforms to the other land use in the neighbourhood.

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.

Land Values

The opening up of the area by the planning policy and the rush for the plots by commercial developers has led to a sharp increase in land values in the area and in the neighborhood due to the

potential high returns after development. This has also led to attraction of middle income groups with improved economic status.

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 e.t.c. 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 neighbourhood shall also have their market widened by the occupants and workers.

Promotion of social cohesion

The development will bring together people with diverse traditions and culture. It will lead to promotion of cultural interaction.

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.

Part of the very notable design and practical considerations to at least address infrastructure matters, the proponent has surrendered 1.5metres along the access (rear) road and a 6metres setback along the Murang'a Road (highway). These shall play a very important part in infrastructure such as the significant impact to access road expansion; provision of space for infrastructure installation & expansion and also ensuring the safety of the building from any near-future road and infrastructural improvement needs.

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. 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 from the well, 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.
- The NWSC should ensure long lasting and reliable water supply within its jurisdiction.
- Provide notices and information signs to the involved stakeholders on means and needs to conserve water resource i.e. 'KEEP/LEAVE THE TAP CLOSED', 'WATER IS LIFE. SAVE IT' etc. this will awaken the civic consciousness of the community with regard to usage and management of the water resources.
- Install water conserving taps that turn-off automatically when water is not in use
- Explore alternative water source(s) to supplement NWSC water supply such as borehole subject to authorization

Surface drainage

As rain falls on a certain area, part of the rainwater is lost through evaporation in the air or percolation into the ground while the remaining overflows the surface as storm water. The run off

from catchments is largely influenced by the size of the catchments, topography, the imperviousness of the surface (i.e. roof, road surface etc) and open surface.

In this particular project some of the surface water/run-off will mainly be absorbed within the property i.e. open areas. However, these (open) areas are limited since much land will be covered by house structures, roads and pavements. Therefore, as rain falls much water is anticipated to overflow the surface as storm water. In connection to this, the amount of water reaching storm water drain system will be large.

The surface drainage system has been considered to manage storm water such as may be derived from the paved areas (street-wash), courtyards and roof catchments of the houses. Open (concrete drainage-inverted concrete drains) channels will be use to drain the site off the excess surface water/storm. The channels shall take the influence of the site's gradient and will effectively drain water in to drain channels.

The aim of a good surface drainage is to prevent land and human settlement from being saturated with water. Poor drainage causes dampness to building structures as well as water stagnation. Damp is very bad from every point of view. Apart from the annoyance it causes by unpleasant smell, foul air and mildew, which makes it impossible to store supplies of house-hold goods, it is positively dangerous to health and also to the building structure. Damp (as influenced by poor drainage), in the presence of warmth and darkness, breeds germs and mosquitoes and may cause acute and Chronic Rheumatism.

The drainage of the storm water will be greatly compromised especially if it rains, since storm water drain channels will not be present during construction. In addition, it should be realized that a given area of land can only absorb a certain quantity of rain water/surface water. Therefore, in and around the projected area where houses are built close together, the space of land (left open) which is useful in absorbing the surface water is very small. The drainage of the general property comes in handy to enhance the flow of the much-anticipated surface run-off emanating from the roof catchments and other areas within the site, into the drainage systems and watercourses.

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 area 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. Harvesting of rain water shall reduce strain on the existing water supply systems. In this connection, it would be better if gutters are incorporated in the designs as well as down pipes to enhance water collection in to the storage tanks.

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 and enhancing ground water recharge

Soil disturbance and erosion

It is anticipated that some excavations and hence soil disturbance; exposing and setting it loose to the agents of soil erosion. Soil erosion is loss of the top-most soft material on the earth surface (soil) down - slope or transportation by the use of machinery or other equipment including animals. Soil movement is common in construction activities. This mostly happens during the laying of foundations for the projects and site clearing. The top loose material is excavated and transported elsewhere. This also exposes the underlying material to more dangers of degeneration by erosion agents.
However, the issue is not as significant because the land is level and the soils are stable resulting to minimum disturbance to soil except for the excavation to create the basement floor and foundations.

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 neighbouring the building where possible 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 area drainage system. Drainage channels need to be regularly maintained and repaired to avoid point discharges (have pronounced effect to soil erosion) in case of breakages or blockages.

Noise and vibration

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

Construction activities 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. The noise and excessive vibrations Regulations should be strictly adhered to.

Construction activities will be generating noise and hence affecting the immediate environment; i.e. other operations in the nearby. Such noise will emanate from the construction machinery and equipment i.e. concrete mixers, excavators, workers, trucks and other vehicles accessing the site. It will also affect small animals and bird life.

During occupation noise will come from vehicles, and other operations within the site. Production machines generate/ produce a lot of noise. Hearing protection is thus essential when noise exposures cannot be controlled at their source.

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 suppressors or silencers on equipment or noise shields for instance corrugated iron sheet structures.
- Use of 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 horning 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.

Increased energy demand

There will be increased use of energy due to increased energy uses during construction and occupation phases and potential wastage. 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 are not needed. Proponent should explore use of motion sensing lights to enhance this
- 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 purposes
- Explore installation of standby prime generator
- Liase with KPLC for evaluation of energy demand and thus explore installation of transformer(s) as may be necessary
- The building to use green technology in design and construction so as to reduce costs of lighting and air circulation

Wastewater/sewage and effluent

Sewage is the used water or liquid waste of a community, which includes human and household wastes together with street-washings, industrial wastes such as ground and storm-water as may be mixed with it.

Raw effluent/sewage resulting from sanitary facilities and wastewater from washrooms 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 bad odours. it must always drain effectively into the sewer systems; via high quality, well designed and laid pipe networks.

Sound sanitation should be ensured to influence prevention of the sporadic outbreak of diseases dangerous for the general health of the community (within the projected area), workers and the general public. Either controlling or eliminating such environmental factors that contribute in some form or the other to the transmission of the diseases can achieve this.

Mitigation

- ※ Connection to the existing NWSC sewer. The design of the sewer system should consider the estimate discharges from individual sources and the cumulative discharge of the entire project i.e. it must have the capacity to consistently handle the loads even during peak volumes. The gradient should be sufficient to ensure and maintain maximum depth of flow
- ※ 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 roding eyes which must be accessible
- ※ Sanitary facilities must be kept clean always, through regular washing and disinfecting.
- ※ Monitoring of the sewage system for any remedial and emergency action

Air quality

Construction activities have the potential to generate air pollutants in the form of dust particles and gas emissions (fumes) from machinery, standby generator 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. Unseen and odourless, microscopic particles of air pollution is very harmful. Exhaust from diesel engines and dust swirl into an insidious cocktail of tiny particles that can spend weeks airborne. The most harmful are the smallest, less than 2.5 microns in diameter; when inhaled, the lungs or pass directly into the bloodstream and damage arteries

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 and the standby generator. This will minimize generation of noxious gases and other suspended particulate matter.
- Ensure that there is free air circulation. The generator room should be adequately ventilated and the exhaust appropriately located so as not to direct the exhaust to the apartments
- 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 and tests to analyze the quality of air.
- Enclose the site with suitable dust screens during the construction

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. There shall be a standby generator which shall be using oils/greases and fuels

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

Mitigation

- All machinery (if any) 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.
- Fuels and oil/grease for the standby generator should be safely kept and handled
- Car park areas and other places prone to oil and fuel leaks or spills such as the generator room in the site must be well managed. Oil interceptors should be installed in the channels leading from such areas and should be regularly monitored.

Solid Waste

Millions of tonnes of solid waste is generated annually by human beings 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.

Construction activities results to increased solid wastes within the sites. Such waste materials include excavated soil, stones, construction debris, wood, broken glasses, containers and other packaging materials, rods of metal, pieces of iron sheets, extirpated vegetation on the site, kitchen materials and other house refuse especially during the occupation of the project etc.

On completion, the site will be generating waste products from various operations and activities-*house refuse*. Removal and disposal of house refuse comes under public cleaning and is very important and costly item on the CGK budget. If it is not removed promptly away from the generation points (various), it accumulates in large heaps harbouring rats, flies and vermin which disseminate germs of disease. A good deal depends upon the mutual cooperation between the County governments and the public. Proper maintenance and use of dustbins is the key to the satisfactory solution of the problem of sanitary storage and collection of refuse without causing nuisance.

Waste management involves *storage, collection, transportation and disposal*. Therefore, bins come in handy during storage and collection; both in the house and on foot paths for the disposal of whatever rubbish such as paper wrappings, cigarette ends etc., into them instead of scattering them all over. Transportation of the collected waste need be simplified and finally, the use of sound method of waste disposal. The proponent shall set aside dust bin cubicles to facilitate solid waste management and other measures should include:

Mitigation

- The contractor or proponent should work hand in hand with private refuse handlers, NEMA and the CGN to facilitate sound waste management as per the prevailing regulatory provisions.
- During construction, the wastes should be properly segregated and separated to encourage recycling of some useful waste materials; i.e. some excavated soils, broken stone materials shall be used as backfills. (Use of an integrated solid waste management system; through a hierarchy of options focussing on source reduction, recycling and reuse, and sanitary land filling).
- On completion, the project management should adapt effective waste management system to handle solid materials that will be generated from various operations. (Use of an integrated solid waste management system; through a hierarchy of options: source reduction, recycling, reuse, and sanitary land filling)
- There should be several bins - The bins should have a close fitting cover, lest stray animals might scatter the refuse. The receptacle(s) must be kept in a good condition, and sanitarily clean by frequent washing and disinfecting. The first action should be reduction of waste at source. All recyclable waste should be recycled or efforts should be made to facilitate segregation and recycle. Any unrecyclable waste should be disposed to approved dump sites and as per the Waste Regulations
- In addition to the bin to be provided, the proponent should provide a number of dustbins strategically on the footpaths of the driveways for the pedestrians to dispose whatever rubbish instead of scattering them on the road surface or compound. These bins should better be fixed to posts one or two feet above the ground so as not to be within reach of dogs and other scavengers etc.
- 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.

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.

Mitigation

- Avoid unnecessary clearing of vegetation by conserving vegetation not in the sections being built up particularly along the road reserve
- 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.

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

Visual Intrusion

Visual impacts occur during earthworks for the foundation of projects and throughout to the completion of the project. However, the proposed project may appear far out of scale with the existing developments and in the environs on the basis that it will be among the tallest at the time. Trees should be planted and that shall further mitigate the potential effects of visual intrusion with the effect of maintaining the character of the site since they will have the effect of shielding the line of site of the building. The choice of paint colour comes in hardy to make the building attractive to sight. However, great care should be taken to protect the neighbourhood 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 existing trees and vegetation not in the direct working areas 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 colours 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

Occupational health and safety (OSHA) 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. OSHA abstract should be posted at a strategic point on site. The requirements of the **OSHA and the labour legislation** 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.
- 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 elected 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.
- Local individuals preparing food for the workers at the site should be controlled to ensure that food is hygienically prepared

- Public awareness campaigns on the prevention and management of prevalent diseases such as malaria, STDs and HIV AIDS.
- Ensure structural components are constructed to the specifications and supervision of a registered structural engineer
- Adapt effective emergency response plans especially during construction phase.
- Properly design to allow for deceleration and acceleration to the site. Clearly indicate direction of traffic throughout the project cycle. Internal driveways should also be erected with bumps to control speed and thus reduce potential accidents. There should be careful design and layout of the site entrance, providing adequate visibility. Visible boards shall be erected to notify of the construction works

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!

Other precautions include:

- 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.

Accident prevention and 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
- Strict adherence to the OSHA and due diligence

Absence of ERPs may be risky since there would be no guidelines to handle or control emergencies if they occur. The proponent and the contractor shall take all necessary steps to prevent accidents in the entire project cycle. All construction safety procedures shall be followed as discussed elsewhere in this report while measures to prevent and manage fires shall be taken as discussed elsewhere in this report. For further management of any foreseeable accidents, the proponent shall develop an ERP which shall be documented and all the residents and business operators shall be provided with the requisite training and annual drills conducted. Chances of accidents and other safety hazards can be considerably reduced by adherence to set standards and use of the right quality materials to the specifications and observance of safety procedures.

The ERP shall typically contain all information on all likely types of emergencies likely to be encountered mainly accidents and fires. The ERP shall include actions to be taken in case of emergencies and shall display emergency contacts (ambulance, doctors, police and fire engines) telephone list; simple instructions on do and don'ts in various emergencies such as fires, LPG incidents, etc. On traffic safety, the road shall be constructed to adoptive standards and all entry and exit points provided with clear views. Bumps shall erected to control speed along the driveway and the parking. The ERP shall also provide for basic First aid training to some of the potential residents. The ERP shall also promote good neighbouriness which shall go a long way in emergency response. Such plans must be properly documented and made available to all. A fire assembly point must be identified and clearly marked for example.

Enhanced Social crime risks

Due to the influx of construction workers on site, there are chances of introduction of individuals with potentially anti-social behaviours 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 responsibly 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.

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

Fire Preparedness

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

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 fire-fighting measures and control facilities.

Mitigation:

- Install an automatic fire alarm system for the entire project mostly on occupation, provide 2No. 30m hose reels for every floor and provide for adequate fire reserve water storage tanks with an automatic booster pump for hose reel and 2No. 9kgs portable dry powder or water extinguisher per floor.
- Provide appropriate Fire Hydrant Ring main with suitable outlet points.
- Install heat and smoke detectors on each floor
- Install manual electric break-glass fire alarm system with secondary power
- All installation to follow Fire Masters requirements approval.
- Conduct regular fire-fighting drills/simulations to sensitize workers/residents and adapt an emergency response plan for the entire project during occupational phase.
- Ensure that all fire-fighting 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 emergency contact numbers should be provided as well as the assembly points.
- Install sprinkler system in parking areas

Conflict with the community

Projects of such magnitude usually attract public uproar (especially from the neighbouring residents and community) if they are not made to own the project. Conflicts usually arise mostly from the foreseen negative impacts.

Potential Mitigation measures

※ Consultation with neighbours on the mitigation measures prescribed for the negative impacts as a way of conflict resolution and neighbourhood association.

Enhanced Social crime risks

Due to the influx of construction workers on site, there are chances of introduction of individuals with potentially anti-social behaviours 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 responsibly 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.

Community Facilities and Social Infrastructure Services

The increased population accommodated in the proposed developments are not necessarily adequately provided with a commensurate increase in the community facilities and services. These include recreation facilities (such as public open spaces, playgrounds and sports facilities), education and health facilities, social and community halls, religious facilities, homes for special needs, police stations, post offices, administration facilities, and roads, water supply, sewer etc. The inadequacy of these facilities has led to unplanned and spontaneous change of use of other properties to accommodate these deserving community facilities and services.

Mitigation

The CGN and other government agencies together with all stakeholders (including developers) should discuss for a solution and come up with a comprehensive development plan.

Project Completion

At one point in time, the proposed project, after approval 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.

ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

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 frequency
Waste management	• Waste minimization by ordering right/accurate quantities and sizes rather than cutting to sizes leaving wastes or ordering excess quantities leaving residuals • Reduction & segregation of waste at source and suitable bins properly labeled to facilitate recycle and/or sound disposal. • Engage the services of NEMA registered waste collector for disposal of solid waste • Sound waste management system by incorporating suitable facilities for collection, segregation and safe disposal of solid wastes to support recycling & reuse. • Proper storage, handling and disposal of new & used oil • Installation of sanitary systems that use less water • Connection to sewer for wastewater disposal • Ensure compliance with Waste Management Regulations, 2006 • Connection to sewer	Proponent/ contractor	Proponent	c) Inspection/ observation	2,500,000	• Continuous
Constraints to infrastructure & services	• Liason with respective service providers for installation/expansion • Adequate provision for infrastructure & services • Installation of internal infrastructure (drainage, water, roads, sewer, parking, rain water harvesting and storage etc) to best standards	Proponent/ Contractor	Proponent	Inspection/observation	5,000,000	• Design level • Monthly
Soil	• Control earthworks & compact loose soils	Contractor	Proponent	(c)	350,000	• Daily

disturbance & erosion	• Install drainage structures properly • Landscaping on project completion • Control and manage excavation activities • Provide soil erosion control and conservation structures/means where necessary. • Ensure standard appropriate practices • Efficient drainage structures by proper design, construction & maintenance			Inspection (o) Routine maintenance (c) Inspection (o) Routine maintenance		
Air pollution	• Enclose the site with suitable dust screens • Sprinkle water to dry soils in excavated areas & earth roads to suppress dust. • Covering friable material loads during transportation • Sound condition of machinery and equipment • Strict adherence to Air Quality Regulations, 2014.	Contractor	Proponent / Contractor	c) Inspection/ observation	1,500,000	• Daily
Noise pollution	• Erect suitable barriers to control noise • Maintain machinery, plant equipment • Construction activities to be restricted between 8 am – 5pm • Workers exposed to high-level noise to wear safety & protective gear. • Adherence to Noise and Excessive Vibration Pollution (Control) Regulations, 2009	Contactor	Proponent / Contractor	c) Inspection/ observation	500,000	• Daily
Increased pressure on resources	• Conservation of resources; use of renewable resources; rain water harvesting & storage; installation of solar energy systems • Sourcing materials from environmentally compliant suppliers/sources • Use of recyclable materials; Installation of water conserving taps; waste water recycling and reuse • Drilling of borehole • Installation of transformer(s) & supplementary sources such as solar systems and standby generators • Ensure electrical equipment, appliances and lights are switched off when not being used • Design to provide for adequate natural lighting	Contractor	Contractor / Proponent	(c) Inspection/ observation	2,000,000	• Monthly

Public health, occupational health and safety	• Train staff/workers on occupational health and safety; Provide full PPEs & workmen's compensation cover in addition to the right tools and operational instructions & manuals • Design and disseminate appropriate emergency response plans • Installation and maintenance of fire prevention, control and management measures • Ensure machinery and equipment servicing and maintenance as per schedules & legal requirements • Ensure adherence OSHA, 2007. • Ensure use of standard construction materials and to the specifications. Avoid undesirable, substandard, hazardous or unauthorized materials during construction & maintenance • Provide fully equipped First Aid kits & train staff on its use • Provide bill boards at the site/entrance to notify motorists and public about the development • Waste water management installations (e.g. Sewers) be isolated from water pipes to avoid contamination of domestic water.	Contractor, supervising Foreman	Proponent where relevant	(o) Observation (o) Observation	1,250,000	• Daily

ENVIRONMENTAL MANAGEMENT/MONITORING PLAN FOR THE DECOMMISSIONING PHASE

Expected Negative Impacts	Recommended Mitigation Measures	Responsibility Party	Time Frame	Cost (ksh)
1. Construction machinery/structures & wastes				
• Scraps and other debris on site	• Use of an integrated solid waste management system i.e. through a hierarchy of options: • Wastes generated as a result of facility decommissioning activities will be characterized in compliance with standard waste management procedures. Disposal locations will be selected by the contractor based on the properties of the particular waste stream. • All buildings, machinery, equipment, structures and tools that will not be used for other purposes should be removed and recycled/ reused say in other projects • Where recycling/reuse of the machinery, equipment, implements, structures, tools and other waste is not possible, the materials should be disposed to approved dumpsites.	Contractor, Proponent/property manager	One-off	2,000,000
• Potential Pollution	• procedures for finding contaminated material during excavations will be established • covering and damping of excavated materials • appropriate storage of contaminated material if found. Ground contamination and storm water contamination will be limited on site by proper handling and storage of materials and equipment.	Contractor, Proponent/property manager	One-off	1,500,000
2. Rehabilitation of project site				
• Vegetation disturbance • Land deformation: soil erosion,	• Implement an appropriate re-vegetation programme to restore the site to its original status	Contractor, Proponent/property manager	One-off	1,000,000

drainage problems • Restoration of site	• During the re-vegetation period, appropriate surface water run off controls will be taken to prevent surface erosion; • Monitoring and inspection of the area for indications of erosion will be conducted and appropriate measures taken to correct any occurrences; • Fencing and signs restricting access will be posted to minimize disturbance to newly-vegetated areas; • Carry out soil tests foe contaminants & if need be scoop out any contaminated soils and replace with uncontaminated soil from another source Comprehensive Landscaping	Contractor, Proponent/property manager	One-off	1,500,000
3. Safety of the project				
Occupational hazards	• Ensure that safety measures have been effectively integrated and positioned in respective areas of the project to control and manage fire outbreaks • Staircases and other hazardous areas shall be suitably protected say using strong rails to avoid occurrence of incidences	Contractor, Proponent/property manager	One- off	500,000
4. Safety and Social-Economic impacts				
• Loss of income • Reduced ability to support dependants • Loss of quality of life • Loss of benefits i.e. medical, insurance cover etc	• The safety of the workers should surpass as a priority of all other objectives in the decommissioning project • Adapt a project – completion policy: identifying key issues to be considered. • Assist with re-employment and job seeking of the involved workforce. • Compensate and suitably recommend the workers to help in seeking opportunities elsewhere. • Offer advice and counseling on issues such as financial matters. • Encourage workers to register with retirement benefits scheme of their choice	Contractor, Proponent/property manager	One- off	4,000,000

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. While provision of housing ranks very high, provision of commensurate commercial and recreational facilities is also very important for convenience and well-being.

This study indicates that the construction and occupation/operation of the proposed (residential development) project will have positive impacts, which include employment, increase in the national/local housing stock and quality, increase in business premises, 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 building code and the CGN. 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. 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 relevant professionals, neighbours, NEMA, CGN 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 study. 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 e.t.c.) must assess the respective requirements. The proposed design has met the basic requirements such as the minimum habitable room sizes and basic social services. 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 of 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.
The purpose of the EIA is to ensure that development options under consideration are environmentally sound and sustainable and that any environmental consequences are recognized early and taken into account in project design. In addition, the ultimate success of the EIA depends upon development of environmental capability and understanding in the agencies and stakeholders concerned.

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11. Relevant government Acts.
12. Sanitation Engineering, *volume I and II*, by R.S. Deshpande

ANNEX: ATTACHMENTS

Copy of Certificate of Title

Sketch map showing location of the proposed site

Copies of the proposed plans

Copy of Change of user

Copy of certificate of Incorporation

Copy of PIN Number certificate

Minutes of Consultation and public participation meeting and attendance list