ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT

FOR

THE PROPOSED RESIDENTIAL DEVELOPMENT AT L.R. No.7149/138 IN SYOKIMAU, MACHAKOS COUNTY

GPS COORDINATES: -1.38067 & 36.92432 for Latitude and Longitude Respectively

APRIL 2021

DECLARATION AND SUBMISSION

We the undersigned consultants, on behalf of the proponent, **Indesign Makumbi Limited** of **P.O Box 67961 - 00200, Nairobi, Kenya**, submit the following Environmental and Social Impact Assessment Report, for the proposed Residential Development in Syokimau/ Mlolongo area, Mavoko Sub-county in Machakos County. The Environmental and Social Impact Assessment has been carried out according to the Environmental Management and Coordination (Amendments) Act, 2015 and Environmental (Impact Assessment and Audit) Regulations, 2003; Rev. 2018. In undertaking this task, we endeavoured to comply with the legal requirements, institutional frameworks and international best guidelines. The required professional's standards and practices were also applied in carrying out the ESIA study. To the best of our knowledge; we declare and submit that all information contained in this ESIA report is an accurate and a truthful representation of the ESIA process of the proposed Residential Development Project as hereupon described.

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LIST OF ACCRONYMS AND ABBREVIATIONS

CBD	Central Business District
EA	Environmental Audit
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMC	Environmental Management and Coordination
EMCA	Environmental Management and Coordination Act
EOHS	Environmental, Occupational Health and Safety
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GOK	Government of Kenya
KP	Kenya Power
L.R	Land Reference
MAVWASCO	Mavoko Water and Sewerage Company
ME&NR	Ministry of Environment and Natural Resources
MSDS	Material Safety Data Sheets
NEAP	National Environmental Action Plan
NEMA	National Environment Management Authority
OHS	Occupational Health and Safety
OSHA	Occupational Safety and Health Act
PPE	Personal Protective Equipment
SDGs	Sustainable Development Goals
ToRs	Terms of Reference
WRA	Water Resources Authority

EXECUTIVE SUMMARY

This Environmental and Social Impact Assessment Report is for the proposed Residential Development in Syokimau/ Mlolongo area, Mavoko Sub-county in Machakos County by Indesign Makumbi Limited on the existing piece of land that is owned by them, located at L.R No. 7149/138. The construction and development of the proposed 15No. Residential blocks features are elaborated in Chapter Two of this ESIA report. The purpose of this assessment was to provide the baseline information upon which subsequent environmental audit studies if any shall be based in line with Environmental (Impact Assessment and Audit) Regulations 2003, Rev. 2018. These regulations require that such projects classified as either high, medium or low risk must undergo an EIA to determine their suitability on the site and identify possible negative impacts that may arise as a result of the proposed Residential Development Project. This ESIA was carried out at the proposed project site for the proposed residential apartments project (referred to as 'the project' in this report) situated off Nairobi - Mombasa Highway in Syokimau.

The proponent intends to develop and use the houses for residential purposes subject to necessary approvals. The proposed project designs/plans have been done by Archsmart Creations Limited and have been approved by the County Government of Machakos (Mavoko sub-county) as per the approved architectural designs annexed in this report where finer details can be obtained. The proposed site is within an area with mixed development. A change of use for the proposed development has been acquired from Mavoko Sub-County, Machakos County for the change of use from single dwelling to Multi-dwelling units. The proposed site was vacant as at the time of the study though it had been cleared of vegetation with shrub stumps still evident on the site.

The proposed project shall be implemented in two phases and shall inject a total of 378 residential units comprised in 15 blocks. Blocks 1 - 7, D1 and D2 rises upto 5th Floor while Blocks 9-14 rise up to 9th Floor. The numbered blocks features apartments comprised of 24No. One Bedroom, 132 No. Two Bedroom, 132No. Three Bedroom and 18No. Four Bedroom units. Blocks D1 and D2 each has 36 bedsitters. The proposed project shall also entail construction of adequate parking, construction of surface drainage systems for management and disposal of surface runoff and construction of the internal access roads; power and water supply infrastructure. Adequate parking is provided for on the ground floor for the blocks 9-14 as well as on the site plan. Since the proposed project is new, the proposed works shall further include construction, electro-mechanical and civil works. The proposed project shall have a single access gate and shall be enclosed in a perimeter stone fence. There shall be protected dustbin cubicles. Other features include underground water storage, storm water drains and a guard house.

During the construction and operational phases of the proposed project, several activities shall be undertaken and every activity is bound to have effects or impacts to one or many aspects of the environment. These impacts may be positive or negative, reversible or irreversible, short term or long term, significant or insignificant. For this case, the Kenyan Environmental laws and regulations, require one to undertake an ESIA process as per EMCA Cap 387 as well as the EIA/EA Regulations 2003, Rev. 2018. It is thus a legal requirement for the Proponent- Indesign Makumbi Limited to develop and submit an ESIA Study Report to the National Environment Management Authority (NEMA) for decision-making on the housing construction process and this ESIA Study Report presents information required for the protection/ conservation of the environment during the construction, operational and decommissioning activities impact to the environment. This ESIA Study Report thus constitutes the final stage in the ESIA process for the proposed Indesign Makumbi Limited Residential Development Project. The ESIA Study has evaluated the proposed project in terms of construction,

operational/ occupational and decommissioning stages and thus will help NEMA in making an informed decision about the approval of the proposed project.

The key objective of ESIA is to mitigate conflicts with the environment at the vicinity during construction, operation and decommissioning phases. 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 integrated with social, demographic, economic and political elements. Housing is a basic human need but unfortunately there has always been a shortfall of the same which manifests in the proliferation of shanties all over the main urban areas across the country. The EIA process is an important tool of environmental management for sustainability but it is only successful with monitoring for flexibility to cater for any changes. There is thus a growing recognition of the importance of protection and management of the environment and the natural resources unlike in the past where policy makers directed all the efforts in economic development without due regard to the resource base on which the economic development depend on. As a result, there has been unprecedented environmental degradation due to the lack of environmental conservation resulting to unsustainable development. More recently developers, spurred on by regulators world over, have recognized the need for change in order to safeguard the environment.

For the case of the proposed Indesign Makumbi Residential Project, there is limited supply of land especially near Nairobi CBD and the ever-increasing demand for housing has fuelled the need the development of multi-dwellings in an effort to alleviate the housing shortage. This led the proponent to seek a change of use as indicated to be able to develop the proposed residential complex. A site survey in the project area indicates that, currently there are other residential complexes that exist within the project area with some still under construction. The approved designs has provided for adequate ventilation and natural lighting, parking, storm water drainage, fire protection measures and water storage as well as open areas. The project area is sewered and the proposed development shall be connected to the Mavoko Water and Sewerage Company sewer. 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. There is however, the need to obtain Kenya Civil Aviation Authority permits in regard to the proposed project heights before construction commences. It is estimated that on approval; the project will take approximately eighteen (18) calendar months to implement.

The major objective of the EIA study as indicated earlier 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, construction, occupation and decommissioning phases. The scope of the assessment study covered the physical extent of the project site and its immediate environs, construction works of the proposed development (ground preparation, foundations, walling, finishes, roofing, fixtures and fittings among others), installation of basic utilities/facilities and services as required by the proposed 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 project.

The output of the ESIA study survey was the production of this Environmental and Social Impact Assessment study report for submission to NEMA for the purposes of seeking an EIA license. The ESIA process has predicted, assessed and analyzed all the possible positive and negative impacts that the project might have on both the natural and human environment and suggested the appropriate

mitigation measures for the significant negative impacts and designed an Environmental and Social Management Plan (ESMP) to address the negative environmental impacts associated with the proposed residential apartment's project. The ESIA reporting exercise, inter alia, constituted the following elements:

- Description of the project location, objectives, scope and justification.
- Evaluation of the project locations, methodologies, procedures and processes to be used in the implementation of the project with other available methodologies and describing any alternatives.
- Conducting a site visit, opportunistic observations, public consultations and personal interviews.
- Evaluation of the products, by-products and wastes likely to be generated by the project.
- Evaluation of the environmental and social effects of the project including socio-cultural effects, direct and indirect effects, short and long term effects on pre-project, project construction and post-project operations.
- Analysis of legal and policy framework relevant to the residential housing sector.
- Drawing up an Environmental and Social Management Plan (ESMP) proposing measures for eliminating, minimizing or mitigating any adverse impacts on the environment including their cost, timeframe and the responsibility for implementation.
- Drawing up an action plan for prevention and management of foreseeable accidents and other worker related hazards during the construction and occupation phases of the project and preparing a final ESIA Study Report for submission to NEMA.

Project Objectives

The objectives of the proposed project include:

i. To construct Three Hundred and Seventy eight (378) housing units in Syokimau area.
ii. To put the current land into more productive and economic use.
iii. To meet the economic desires of the proponent.

Objectives of the ESIA

The objectives of undertaking the ESIA were as follows:

- To identify potential environmental impacts of proposed project and assess the significance of these impacts.
- To assess the relative importance of the various project alternatives.
- To propose mitigation measures for the significant negative impacts of the project on the environment.
- To seek the views and concerns of all the Project Affected Persons or neighbours in regard to the proposed residential project.
- To generate baseline data for monitoring and evaluation of how well the mitigation measures are being implemented during the project cycle.
- To develop comprehensive Environmental and Social Management Plan (ESMP) for the project cycle with mechanisms for monitoring and evaluating the compliance and environmental performance which shall include the cost of mitigation measures and the time frame of implementing the measures.

- To present the results of the ESIA in such a way that they can guide informed decision making by NEMA.

Legal and Administrative Frameworks

The proposed project is governed by Machakos County Government and National legal regulatory and policy framework, which, among others, are meant to ensure good environmental practices at all stages of the project life-cycle. The proposed residential apartment's project is in line with Kenya Vision 2030, Poverty Reduction Strategy Paper (1999), National Housing Policy, 2004 and the Government of Kenya Agenda Four-National Affordable Housing. The project implementation will be affected by several legislations and subsidiary legislations as outlined in Chapter Four of this report. They include: Public Health Act, Cap 242, Water Act 2016, Factories Act, Cap 515, Local Government Act, Cap 265, Penal Code, Cap 63, Energy Act, 2006, OSHA 2007, The Physical Planning Act of 1996 CAP 286, The County Governments Act 2012/2017, EMCA (Water Quality) Regulations 2006, EMCA (Waste management) Regulation 2006, EMCA (Noise and Excessive Vibration Pollution Control) Regulations 2009, EMCA (Air Quality) Regulations 2014 and The Land Planning Act, Cap 303 among others.

Methodology

The ESIA process was carried out using a combination of methods including physical examination; site assessments; laboratory sampling; literature reviews; public meetings and informal interviews/ questionnaires administration with stakeholders' e.g. immediate neighbors and business persons.

The key approach utilized included the following:

i. Environmental screening of the proposed project in line with EMCA Cap 387 and EIA/EA Regulations, we established that the residential development falls under Medium to High Risk Projects (Urban development including establishment of new housing estate developments exceeding one hundred housing units).
ii. A site reconnaissance and visual survey to determine the baseline information of the project area and development of the Terms of Reference for approval by NEMA, the ToR were approved on 9th April, 2021
iii. Analysis of the project documents such as the architectural plans with the proponent and project team.
iv. Assessment of occupational health and safety issues during the implementation of the proposed project.
v. Seeking public views through public meetings, direct Key Informant Interviews and administering of Household questionnaires.
vi. Proposal of feasible mitigation measures to minimize anticipated negative impacts during the project cycle.
vii. Preparation and submission of the ESIA Study report to NEMA.

Environmental Impacts and Mitigation Measures

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

Project Environmental and Social Impact	Proposed Mitigation Measures
Land degradation, excavations and soil erosion	• *Strictly source material from NEMA authorised dealers or quarries* • *Backfill opened up borrow pits and quarries* • *Segregate waste and appropriately store on site before final disposal.* • *Avoid unnecessary movement of soil materials from the site and protect stockpiles.* • *Control construction activities during rainy / wet conditions to mitigate erosion effects to the soil.*
Solid Wastes generation	• *Use of an integrated solid waste management system* • *A Waste Management Plan should be prepared by the Contractor* • *Procure the services of a NEMA licensed waste handler.* • *Skips and bins should be strategically placed and contents disposed at an approved disposal site.* • *Covering of trucks when transporting building materials and waste.* • *No burning, on-site burying or dumping of waste shall occur.* • *Remove and dispose of all demolition waste at an authorized site.*
Storm Water Management	• *Storm water designs should ensure that surface flow is drained suitably into the public drains.* • *Drainage channels should be installed as provided for in the approved plans and designs.* • *Regular inspection and cleaning of storm drains.* • *Storm water generated from roof catchments should be harvested, stored and reused.*
Water use, quality and pollution	• *No mixing of concrete to occur on bare ground.* • *Avoid excessive use of the water supplied by the MAVWASCO.* • *Water abstraction licenses should be obtained from the Water Resources Authority where needed.* • *Undertake regular water quality testing in GOK accredited laboratories*
Wastewater Generation and Disposal	• *Develop and implement a site construction waste and wastewater management plan.* • *Provision of sanitary facilities to the workers during the construction and proper decommissioning of the facilities once construction is complete* • *Channel all liquid waste to the existing MAVWASCO sewer line and install an onsite waste management system as a back up to the sewer.* • *Conduct routine inspection and monitoring of the internal drains to identify and repair any leakages and blockages.* • *Residents should report any incidence of blockages in their units immediately they occur for prompt maintenance.*
Noise and vibration impacts	• *Provision of protective devices like earmuffs/earplugs to workers* • *Restrict noisy construction activities to daytime hours (8am - 5pm).* • *Use equipment that are properly fitted with noise reduction devices such as mufflers.*

Project Environmental and Social Impact	Proposed Mitigation Measures
	• *All noisy activities shall be scheduled concurrently during the construction to reduce the exposure period.* • *Operation of the noisy machinery shall be carried out when necessary and switch them off when not in use.* • *Undertake annual DG sets noise measurements during operations* • *Ensure machinery is well maintained to reduce noise emitted.* • *There should be no unnecessary horning of the involved machinery and vehicles.*
Air pollution and dust generation.	• *Develop a Dust Control Plan.* • *Watering all active construction areas as and when necessary to lay dust.* • *Protect exposed soil and material stockpiles against wind-blown erosion.* • *Cover all trucks hauling soil, sand and other loose materials* • *Use of dust screens/nets around the construction site to contain and arrest dust.* • *Provide workers with dust masks/ facemasks* • *Regular and prompt maintenance of construction machinery and equipment to minimize generation of harmful gases.* • *Maintain vehicles and use Low Sulphur fuels* • *Avoid burning of solid waste at the site.*
Possible Pollution from Waste Oil and Fuel Spills/ hazardous materials	• *Train personnel on the risks of oil spills and leakages.* • *All hazardous materials will be stored in appropriately bunded containers and placed on concrete floor as appropriate.* • *Maintaining spill response kits at the construction site at all times.* • *The site design should incorporate oil sumps at the parking lots* • *Regularly check for leaks from paint containers.* • *Unwanted paint will not be disposed by pouring it on soil or storm water drains.*
Increased traffic flow.	• *Design to allow for deceleration and acceleration to the site.* • *Internal driveways should also be erected with speed bumps to control speed and thus reduce potential accidents.* • *Speed bumps and limit should be set at 5 KMs per hour and signs put up to that effect.* • *Ensure proper planning of transportation of materials to ensure that vehicle fills are increased in order to reduce the number of trips.* • *As far as possible, transport of construction materials should be scheduled for off—peak.*
Visual Impacts	• *The site should be restored through backfilling and levelling.* • *All solid waste and debris from construction site must be cleared* • *Landscaping and planting of vegetation on the site.*
Fire Risks, Accident prevention and Emergency Response Plan	• *Develop an Emergency Response Plan and a Fire Safety Plan.* • *Place portable fire extinguishers at suitable locations on site.* • *Combustible materials used during construction should be stored away from source of ignition.*

Project Environmental and Social Impact	Proposed Mitigation Measures
	• *Train and induct workers on fire risks and ERP.* • *Ensure fire and safety warnings are prominently displayed.*
Occupational Health and Safety	• *Appoint fulltime HSE personnel and provide first aid facilities* • *Ensure that HSE briefings are conducted prior to starting work.* • *Keep a record of incidents and accidents on the site* • *Control access to facilities through use of Permit to Work systems* • *Contractor to comply with all other requirements of the Occupational Safety and Health Act, 2007.*
Energy Conservation measures	• *Maximize the use of natural lighting through design.* • *Solar heating and lighting system is proposed in the complex* • *Use of clean fuels e.g. unleaded and de-sulphurized fuels in vehicles.* • *The use of fluorescent lights instead of incandescent ones.*
Security measures	• *Fence the site to restrict movement.* • *Security guards must always guard the gate to the site to keep away intruders and to control movement within the site.*
Disruption of Public Utilities	• *Relocate and appropriately repair all infrastructural public utilities that were damaged/ disturbed.* • *Installation of solar heaters and panels for energy use.* • *Pursue options for drilling a borehole to supplement water supply.* • *Install an onsite waste water management plant.*
Social Issues – employment, and crime	• *Ensure equally distributed employment opportunities for the residents.* • *Sensitize the construction workers, locals, and security personnel to be on the lookout on suspicious activities and liaise with the Local administration.*
HIV/AIDS, STDs	• *Initiate a sensitization and awareness campaign on HIV/AIDS and STDs to workers and en* • *Reduce risk of transfer through provision of male and female condoms for all workers.*
Covid -19 Prevention and Mitigation	• *The Workplace should develop and implement action plans to prevent and mitigate COVID-19* • *Carry out workplace risk assessments addressing Covid-19.* • *Observe preventive measures at the workplace including thermal screening of workers, provision and sensitization of the need to wear facemasks, regular hand washing with soap or sanitizing and social distancing as per Ministry of Health and WHO Protocols.*

Conclusion and Recommendations

According to this ESIA site assessment study, most of the potential impacts of this proposed project on the environment are of low to medium risks and can be mitigated effectively and easily managed without adverse effects on the surrounding environment. The ESIA study Cost and Benefit Analysis indicates that the benefits far outweigh the associated costs and negative impacts. Many of these identified negative impacts are of short to medium term. The socio-economic benefits associated with

the project are long term and rated high, it is therefore proposed that the project proponent should be permitted to continue with the project implementation subject to commitments to the mitigation measures proposed and adherence to all necessary approvals from different Authorities. The project proponent shall continue to work closely with the environmental consultants, NEMA, local residents and Mavoko Sub-county officials to enhance the protection of the environment and to ensure that issues that the environmental concerns might arise are all addressed and integrated into the project at every stage of successive implementation. This way, the co-existence of the proposed residential project with the environment during construction and operation/ occupation phases will be achieved and shall influence the decommissioning phase. The study has evaluated the anticipated impacts and developed an ESMP which should be implemented by the proponent to ensure environmental protection, health and safety of the workers and the general public. It is therefore our recommendation that the proponent be granted an ESIA license to implement the proposed residential project.

CHAPTER ONE: INTRODUCTION

1.1 PROJECT BACKGROUND

Housing market in Kenya has recently become one of the most lucrative businesses, many development companies and individuals are now putting up modern housing units for rental and sale, this has become possible by the many banks and financial institutions which are now offering loans and mortgages to both developers and home buyers at subsidized rates. The proposed residential development is privately owned and is targeted for rental/ sale purposes. The Architectural and structural drawings for the proposed structure have been approved by the Machakos County Government- Mavoko sub-county as well as the change of use from single dwelling to multi-dwelling development granted to the proponent-Indesign Makumbi Limited. This ESIA report gives in detail the project background, its goal and objectives, scope, project justification and cost, baseline information, Policy- legal and institutional framework governing the exercise, identification of impacts and their respective mitigation measures, a clear description of the project's alternatives and a comprehensive Environmental and Social Management Plan to avert or minimize the project anticipated impacts.

The ESIA team of experts were contracted by Indesign Makumbi Limited to carry out an Environmental and Social Impact Assessment Study Report for the proposed Residential Development (15 blocks) at L.R. No 7149/138 located in Syokimau/ Mlolongo, off Mombasa Road in Mavoko Sub-county, Machakos County. The project features different housing sizes as has been outlined in the Chapter Two (Project Description). Through this engagement, the proponent is committed to ensure that the ecological integrity, healthy and sustainability of the environment is not compromised. This necessitated the initiation of the ESIA process for the proposed development. The proponent through the engagement with the environmental and social consultants has ensured that this new project undergoes an ESIA process in an effort to comply with the legal requirement of the Government of Kenya on the fulfilment of the Environmental (Impact Assessment and Audit) regulations 2003;Rev 2018 and EMCA, 1999 (Amendments, 2015).

The purpose of conducting this ESIA process was to predict, assess and analyze all possible positive and negative impacts that the project activities might have on both the natural and human environment and suggest the appropriate mitigation measures for the significant negative impacts and design an effective and responsive Environmental and Social Management Plan (ESMP) to address the negative environmental impacts associated with the proposed residential development project. The scope of this report was to describe the project, identify the salient issues at the site and present the ESMP to the proponent and thereafter submission to NEMA for purposes of obtaining NEMA Project license.

1.2 PRINCIPLE OF ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

The fundamental principle of the ESIA is that every person is entitled to a clean environment and that every person has a duty to enhance and safeguard the environment. EIA is a planning tool which presents methodologies and techniques for identifying, predicting and evaluating potential environmental impacts of projects, policies, plans and programmes in the project cycle (planning, implementation and decommissioning phases). EIA presents decision with the information necessary to determine whether or not a project should be implemented.

The principal Environmental Regulatory Agency in Kenya is the National Environment Management Authority (NEMA). NEMA formulates environmental policies and accords environmental licenses or clearance for projects. The need to undertake an ESIA for the project emanated from the following

observations. Under section 58 (1) *of Kenya Government's Environmental Management and Coordination Act (EMCA), Number 8 of 1999 (Amendments, 2015)* and *Environmental Impact Assessment and Audit Regulations of June, 2003; 2018,* an EIA study is necessary and a fully detailed Study Report is to be compiled and submitted to NEMA for approval before commencing the proposed development. The proposed Residential Development Project is stipulated under the Second Schedule (s.58 (2), (c): 2 Urban Development. The Terms of Reference for the ESIA Study were prepared and approved on 9th April 2021 by NEMA so that an Environmental and Social Impact Assessment for the proposed Residential Development Project could be undertaken.

1.3 SCOPE OF ESIA STUDY

The ESIA study included an assessment of impacts of the proposed project construction, operations and decommissioning phase on the following: -

- Physical environment
- Biological environment
- Socio-economic environment

The study has assessed the impacts of the proposed project on the environment in accordance with the Environmental Management and Coordination Act of 1999 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.
- Development of the project Environmental and Social Management Plan (ESMP)

1.4 PROJECT OBJECTIVES

The objectives of the proposed project include:

i. To construct Three Hundred and Seventy Eight (378) housing units in Syokimau area.
ii. To put the current land into more productive and economic use.
iii. To meet the economic desires of the proponent.

1.5 OBJECTIVES OF ESIA

The overall objective of ESIA is to ensure that environmental concerns are integrated in the proposed project in order to contribute to sustainable development. The core objectives of undertaking the ESIA are to:

- To describe the scope of the proposed project and associated works;
- To establish the baseline environmental status of the project site;
- To identify and assess the potential environmental and social impacts of the proposed Residential Development Project;

- Have a series of dialogues with the identified stakeholders, local residents/ households living around the proposed project site as well as other stakeholders of the project to obtain their views;
- To identify and quantify pollution sources and determine the significance of impacts on sensitive receptors;
- To predict and evaluate environmental and social impacts expected during the construction and operational phases if any;
- To develop mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction and functional phases;
- To design and specify the monitoring schedule necessary to ensure the implementation and the effectiveness of the mitigation measures adopted;
- Propose an Environmental and Social Management Plan (ESMP) to guide the implementation of mitigatory measures and monitoring throughout the implementation of the project and contribute to the overall process of project monitoring and auditing. This will enable the project developer to take timely action to prevent negative environmental and social impacts before they become irreversible; and
- To prepare an ESIA Study Report compliant with EMCA, Cap 387 and in compliance with the acceptable format as stipulated in the Environmental (Impact Assessment and Audit) Regulations, 2003; 2018; properly addressing all the items specified in the Terms of Reference (ToR) approved by NEMA and detailing findings and recommendations from the study.

1.6 PROJECT JUSTIFICATION

Housing has for a long time been recognized as a basic human need, with even recent suggestions that it be made a basic human right. The population of Kenyans towards Nairobi and its surroundings has been rapidly increasing over the years resulting to the inability of most existing accommodation facilities to fully cater for the accommodation demand. The proposed development therefore comes as a timely venture to cater for the existing accommodation deficit more specifically in Syokimau area and its environs.

In the near future, statistics have shown that nearly half of the world population will be living in urban areas. Urbanization 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. Due to the rapid urbanization and higher population growth the housing situation in the country (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 shelter less 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. 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. The government has realized 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 affordable housing in the country. It is a great initiative aimed at providing affordable housing to the urban society who works in Nairobi. 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.

The new developments are also 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; which aim at improving the general environmental quality. This ESIA 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.

The proposed project site conforms to the permitted densities in terms of land use, ground coverage, plot ratio and minimum health and safety requirements. With the residential real estate market coming up with tremendous growth potentials, various entrepreneurs-backed real estate companies have come up with successful residential layouts in and within Nairobi Metropolitan region. With the best international facilities, large-scale land development and club amenities, they have actually recreated the look and feel of the Nairobi Metropolitan real estate market. Highly motivated real estate companies have excelled in developing superb apartment's projects in the city for discerning communities that value strategically located residential layouts. Developers are continuously reinventing to implement innovative residential layout in Nairobi Metropolitan region that gives birth to brilliant housing projects. Developers emphasizes on aspects like comfort, safety and cost efficiency while implementing the world-class residential layouts.

The basis for undertaking this ESIA was that the proposed residential development project constitutes several activities, which would generate considerable changes and significant effects to the environment including land, water, atmospheric resources and biological diversity. The ESIA was thus designed to establish, in advance, some appropriate level of environmental management measures for synchronization with project activities from the planning, implementation, operation and decommissioning stages.

1.7 TERMS OF REFERENCE OF THE ESIA

The general Terms of Reference (ToRs) for this study was to conduct an ESIA for the proposed Residential Development Project with associated civil works on plot L.R NO. 7149/138 in Syokimau, Machakos County. This is in accordance with NEMAs' Environmental (Impact Assessment and Audit) regulations, 2003; 2018 and the Environmental Management and Coordination (Amendments) Act, 2015. Specifically this assessment was commissioned under the following Terms of Reference;

1. The ecological effects. This covered: -
    - Provision of background and baseline information

- The effects of the development on biodiversity diversity both within and outside the project development site i.e. effects on flora and fauna, habitat quality and issue of habitat disruption.
- Surface water run-off, containment and flood control
- Sustainable use of resources and ecosystem maintenance and enhancement

2) Social implications of the development within the locality and nationally. These included:
   - Economic implications of the development, employment and livelihoods
   - Security – threats, risks and enhancement
   - Public health implications.
   - Social cohesion, culture, emigration and communication.
   - Demand and development of infrastructure and social amenities.

3. Determination of the effects on landscape and land use
   - Assessment of the effects on scenery modification
   - Analyzation of the compatibility of the development with the surrounding land uses.
4. Effects of the development on current demands on water resource as well as possible implications on surface and underground water qualities and quantities.
5. Proposition of mitigation measures to be taken during and after implementation of the project; and development of an Environmental and Social Management Plan with mechanisms for monitoring and evaluating the compliance and environmental performance.

1.8 ESIA PREMISES

The key premises that affect ESIA process were established from the initial stages of the project and have provided the general guidance, framework, and commitment to standards acceptable nationally. These premises shall be retained and variations allowed only in certain circumstances with supporting evidence to do so. The premises identified during the screening and scoping exercises include:

- The project area is within the exclusive jurisdiction of the Machakos County Government (Mavoko Sub-county) and Kenyan State Government. Therefore, both the Machakos County and country laws/ national laws and policies, including the environmental laws shall apply;
- The project recognizes the laws and regulations of Machakos County Government – through various departments and the Kenyan State Government as represented by the Ministry of Environment and Forestry, Ministry of Energy, NEMA, the State Department of Water, and the Local Government Environmental Departments, and insists that best options will be adopted for the project execution through liaison with both the Machakos County and National Government relevant Authorities;
- Currently there is no adequate water in the project locality hence the need to drill a borehole on the site. The Project area has Mavoko Water and Sewerage Company sewer line that the proponent can connect to through formal application;
- The Project area is located in a regulated zone – Flight path by Kenya Civil Aviation Authority and approvals should be ought as appropriate;

- There will be provision of solid waste cubicles for temporary storage of waste before disposal to NEMA designated waste dumping site by a contracted NEMA registered and licensed waste handler;
- The project should be designed and operated to comply with local and national laws, together with all the international protocols, agreements and conventions entered into by Kenyan Government as they may be applicable;
- The agreements and understanding reached with government officials during the course of the ESIA process should be respected and honoured throughout the project life cycle;
- Extensive consultations have commenced and will continue to be held with State, County and Local Governments together with the proponent; and
- An Environmental and Social Management Plan (ESMP) will be developed as part of the ESIA process for implementation by the proponent-Indesign Makumbi Limited and the Project Construction Contractor.

1.9 STUDY APPROACH AND METHODS

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 including sampling campaigns. The following steps were involved:

- Environment screening in which the project was identified as among those requiring Environmental Impact Assessment under schedule 2 of EMCA, 1999.
- Environmental scooping that provided the key environmental issues.
- Desk stop studies, consultations, questionnaires and extensive interviews with stakeholders (the neighbours, the proponent and his consultants among others)
- Physical inspection of the site and its environs.
- Public participation and consultation.
- Reporting.

Public participation was achieved through discussion and interviews with the help of tailor made questionnaires; which were evenly distributed to the area residents and neighbours to fill in 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 as well as in the appendices section.

1.9.1 LITERATURE REVIEW

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. A desk study was also conducted to review available reports, plans and maps in order to compile relevant bio-physical and socio-economic information about the study area. The bio- physical information was compiled on environmental aspects such as topography, climate, drainage, soils, geology/hydrogeology, and vegetation among other aspects. The socio-economic environment study covered information on issues such as population, the dimensions of wellbeing and income levels, water supply and sewerage, sanitation levels, infrastructure development, political ramifications and community participation.

1.9.2 FIELD RECONNAISSANCE SURVEY

The ESIA team conducted a reconnaissance survey of the project site in order to familiarize itself with the site location. The reconnaissance survey established the general environmental site conditions, neighboring features and characteristics. The ESIA methodology was therefore underpinned by the field reconnaissance survey.

1.9.3 SITE ASSESSMENT

A physical inspection of the proposed site and their surrounding environment was conducted. This was done with an aim of establishing the anticipated positive and negative impacts on the bio-physical environment (hydrology, geology, soils, climatic patterns, Air, Noise, fauna and flora), socio-economic trends (population trends, settlement trends, economic patterns, land uses etc.). Specific objectives of the field assessment included:

a) Obtaining any available information and data from the local public offices including environment, water, lands and health.
b) Undertaking comprehensive consultative public participation exercises so as to reach a large section of the residents as well as other stakeholders.
c) Public consultations were also organized with the residents
d) Evaluating the environmental setting around the proposed site - observations were focused on the topography, land tenure, surface and ground water sources, public amenities, land cover, climate, flora and fauna, soils, etc.
e) Collection of relevant environmental samples for laboratory analysis.
f) Evaluating social, economic, physical and cultural settings in the entire project area.

1.9.4 INTERVIEWS

Interviews with interested and affected parties were conducted with the following objectives;

- To inform local people and leaders about the proposed project;
- To seek views, concerns and opinions of people in the area concerning the project;
- To establish if the local residents foresee any positive or negative environmental effects from the project and if so, how they would wish the perceived impacts to be addressed;

This was achieved through informal interview sessions and structured questions administered to the project area residents. (See attached household questionnaires)

1.9.5 DIRECT OBSERVATION

Onsite, the experts carried out in-situ analysis and assessments through direct observations of the prevailing environmental conditions.

1.9.6 PUBLIC MEETINGS

The study was conducted in a participatory and consultative manner in order to gather compressive information appropriate to the study. The NEMA procedures and standards for conducting ESIAs require stakeholder consultation to be conducted as part of the environmental assessment process through Social Impact Assessments. Both public and stakeholder participation were undertaken during the ESIA study. Various affected and interested groups were consulted through administration

of questionnaires and as Key Informants.

1.9.7 REPORT WRITING AND DOCUMENTATION

In addition to constant briefing with the client, the impact assessment report will be presented to the client before submission to NEMA as required by law**.** The TOR for this ESIA Study was based on the NEMA Environmental Impact Assessment and Audit Regulations, dated June 2003; revised 2018. These regulations require that the ESIA report should contain descriptions of the following where possible:

- The project background including the objectives of the project; **Chapter One**
- A description of the project including: project design, activities, technology, procedures and processes, materials to be used, products, by-products and waste generated during the project construction, operation and de-commissioning phases; - **Chapter Two**
- Description of the recipient environment; - **Chapter Three**
- A description of the national environment legislative and regulatory framework, baseline information and any other relevant information related to the project; - **Chapter Four.**
- Alternative locations, technologies or processes available; analysis of alternatives, and reasons for preferring the proposed design options; - **Chapter Five**
- Public Consultation and Participation as well as measures to prevent health hazards and to ensure security in the working environment for the employees, the project area residents and for the management of emergencies;- **Chapter Six**
- The potential environmental effects of the project, including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated;- **Chapter Seven**
- An Environmental and Social Management Plan matrix outlaying the activities, associated impacts, mitigation measures, monitoring indicators, implementation timeframes, responsibilities, and cost;- **Chapter Eight**
- Conclusions, recommendations for the success of the project; - **Chapter Nine** and
- Any other information that NEMA may require.

CHAPTER TWO: PROJECT DESCRIPTION

2.1 LOCATION OF THE PROJECT

The proposed residential development project site is located within Mlolongo area in Mavoko Sub-County, Machakos County. The project is located on L.R. No. 7149/138 at Latitude **-1.38067** and Longitude **36.92432.** The project location is accessible through two road sections. The first option is the earthen Muthama Access road before joining the 12M access road that terminates at Airport Hotel 67 while the second option is the road leading to Swiss Lounge where the proponent had started the development of an access road as shown in Plate 1 and 2 respectively. The proposed project plot is of regular shape as evident in Figure 1 below. As per the Physical Planning Act, the Change of Use was granted to the proponent from Single dwelling to Multi-dwelling use. The proposed site neighbours several residential apartment's that have come up in the area as well hotels as seen in Figure 1 below.

Figure 1: Project Location

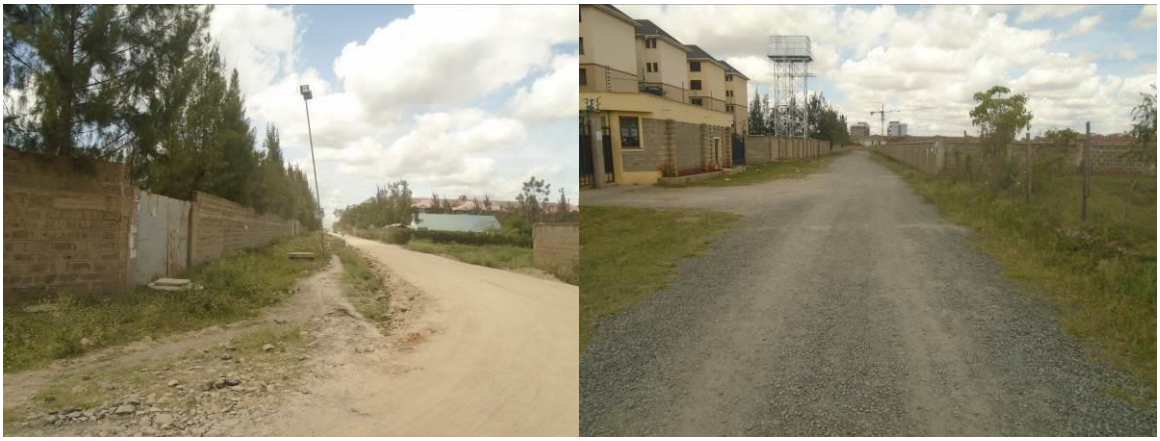

Plate 1: Muthama Access and 12M Access Road leading to the site

Plate 2: Cabro covered road section leading to Swiss Lounge and a section of the Access Road to the Project site

Table 1: Locational Advantage

Site	**Name**
Nearest road	*Muthama Access Road*
Nearest highway	*Nairobi- Mombasa Highway*
Nearest railway station	*Syokimau Railway Station*
Nearest school	*Peer Syokimau School*
Nearest Hotel	*Airport Hotel 67*
Nearest Bus Station	*Mlolongo Bus stop*
Power supply	*Kenya Power*
Water supply	*Mavoko Water and Sewerage Company*
Sewer line	*Mavoko Water and Sewerage Company*

2.2 PROJECT DESCRIPTION

The proposed project is the development of residential complex on Plot L.R No. 7149/138 in Syokimau, Mavoko Sub-county, which is being developed by M/s. Indesign Makumbi Ltd. The site is located in the fast developing area of Syokimau region. The project will offer apartments starting from the spacious 1 BR, 2 BR, 3BR & 4 BR flats. The project is envisioned to provide the highest quality of life to its residents while also encouraging a society that is both sensitive and responsible towards the environment. Designed by a collaborative effort of the best architects and engineers, this complex is being planned to match best living standards. Residents can also expect facilities like an exclusive open-air landscaped area, Gym, Cinema and many more amenities.

The well planned and uniquely designed homes in this project are sure to instill pride in their owners and go a long way in creating a community that is both close-knit, yet outward looking. The complex will also adopt an elaborate system for rainwater harvesting, geared towards partially reducing the strain so typically faced by the other developments. Added to this would be a comprehensive waste management and segregation set up and an in-house sewage treatment plant, both designed to enable proper waste disposal. Also being deployed are various water management plans that would automatically reduce wastage of this valuable resource. Power saving measures like energy-saving light fixtures in common and outdoor areas would also cut down power consumption through installation of water heaters.

2.3 PROJECT COMPONENTS

The overall objective of this project is to develop and avail modern residential apartments in the area. The proposed development project will lead to conversion of the current undeveloped land into a housing complex. The main design components of the project include, but not limited to the construction of 15No. Building blocks of residential housing units with a total of 378 units. The majority of the units for each block include the following common features while the variations per the individual or paired blocks is as presented in Table 1.

- ✓ Lounge
- ✓ Dining area
- ✓ Kitchen
- ✓ Kitchen yard
- ✓ Pantry
- ✓ Balcony
- ✓ Yard
- ✓ Washrooms

Table 2: Block Features

Block No.	**Total Number of Units**	**Construction Phase**	**Description**	**Area (m^2) per Unit**
•	24 One Bedroomed Units	Phase 1	Ground floor and 1^{st} – 5^{th} Floors 4No. One bedroomed units per floor	239.08m^2
2 & 3	48 Three Bedroomed units	Phase 1	Ground floor and 1^{st} – 5^{th} Floors 4No. Three Bedroomed units per floor (One Master Bedroom)	525.88m^2
4 & 5	48 Two Bedroomed Units	Phase 1	Ground floor and 1^{st} – 5^{th} Floors 4No. Two Bedroomed units per floor	403.9m^2

Block No.	**Total Number of Units**	**Construction Phase**	**Description**	**Area (m^2) per Unit**
6	12 Two Bedroomed Units	Phase 1	Ground floor and 1^{st} – 5^{th} Floors 2No. Two bedroomed units (One Master Bedroom)	202.8m^2
7	12 Three Bedroomed Units	Phase 1	Ground floor and 1^{st} – 5^{th} Floors 2No. Three bedroomed units (One Master Bedroom)	321.28m^2
9 & 10	72 Two Bedroomed Units	Phase 2	Ground floor-Parking Typical 1^{st} – 9^{th} Floors shall be comprised of 4No. Two bedroomed units (One Master Bedroom)	423.68m^2
11 & 12	36 Three Bedroomed Units	Phase 2	Ground floor-Parking Typical 1^{st} – 9^{th} Floors shall be comprised of 2No. Three bedroomed units (One Master Bedroom)	261.25m^2
13	36 Three Bedroomed Units	Phase 2	Ground floor-Parking Typical 1^{st} – 9^{th} Floors shall be comprised of 4No. Three bedroomed units (One Master Bedroom)	649.94m^2
14	18 Four Bedroomed Units	Phase 2	Ground floor-Parking Typical 1^{st} – 9^{th} Floors shall be comprised of 2No. Four bedroomed units (One Master Bedroom)	433.94m^2
D1	36 No Bedsitters	Phase 1	Ground floor and 1^{st} – 5^{th} Floors 6 Bedsitters per floor	153.94m^2

Block No.	**Total Number of Units**	**Construction Phase**	**Description**	**Area (m^2) per Unit**
D2	36 No Bedsitters	Phase 1	Ground floor and 1^{st} – 5^{th} Floors 6 Bedsitters floor	$155.62m^2$
Site Plan	Onsite Layout	Both Phases	Guard House Property Office Tool Room 2No. Generator rooms Underground water storage tank Garbage Collection area	Onsite

2.4 RAW MATERIALS INPUTS

During Construction Phase

Construction raw materials i.e. sand, cement, stones, crushed rock gravel, murram, ceramic and glazed tiles, clay tiles, glass, steel metals and metal products, plastic and PVC pipes and materials, ceiling materials (soft board panels), steel pipes, timber and timber products, precast and in-situ concrete products, iron sheets and iron products, electric cables and conduits, painting materials among others. Other inputs shall include necessary fittings and fixtures such as electrical gadgets (switches, sockets, lamps etc), water closet sets and other bathroom accessories, water taps, sinks and kitchen equipment, and general household furniture among others. All these will be obtained from licensed dealers and especially those that have complied with the environmental management guidelines and policies. It is worthwhile noting that most of the construction materials are locally available.

Construction machines including machinery such as excavators, graders, mixers, and bulldozers and other tools and equipment. These will be used for the transportation of materials, clearing of the vegetation and debris, in the construction of the project site. Such machinery will use petroleum products to provide energy.

- **Labour:** A construction labour force of both skilled and non-skilled workers. These will require services such as energy, water supply and sanitation facilities.
- **Water Supply:** Large volumes of water for construction purposes will be required. It will be supplied from the local area supply mains – Mavoko Water and Sewerage Company. This is water for construction, workers' domestic use, dust suppression and material mixing purposes.
- **Power supply:** Power supply will be from the mains grid or provided by generator.
- **Cement** for mortar and concrete used in the construction of walls of the structure walls. Cement will be procured from local suppliers in Mlolongo town.
- **Sand** for building mortar. This will be bought from Mlolongo vendors who are selling sand near the project site that include Mlolongo town.

- **Wood** this will be sourced from the nearby sites and vendors within the project site.
- **Concrete stones/blocks/ bricks**: These will be obtained from local hardware suppliers and vendors in Syokimau/ Mlolongo town.
- **Tiles**: Ceramic tiles will be obtained from local hardware and vendors.

During Operational Phase

The main raw material inputs required for the operation of the proposed Residential Development Project will include:

Water for domestic purposes: This will be obtained from existing water supply in project area from Mavoko Water and Sewerage Company. The proponent will also install roof gutters for water harvesting as well as drill a borehole on the site if viability of groundwater resources is ascertained.

Electricity for night visibility and security lighting: This will be supplied by the Kenya Power on a commercial basis. It is expected that the proposed residential apartment's project will exert minimal pressure on the present power supply system in the area.

Captive Generation through DG Sets: In the event Grid Power failure, it is important to feed the essential loads .The following facilities were considered in designing the DG Capacity: Fire Fighting System; Water Pumping system**;** Fire Lifts etc**.** To meet the Emergency load demand for the building, it is proposed that the proponent shall install 2# Diesel generators. This generator shall be automatically started through AMF logic in case the grid power fails. The generator shall be of Radiator type, outdoor mounted and in Acoustical Enclosure and located at Ground Level as shown in the drawing. Each DG shall be provided with adequate Fuel Oil Tank which will be accommodated in the DG Acoustic Canopy.

2.5 BY-PRODUCTS OF THE PROJECT

Construction products is the final usable premises in the case of the proposed project is residential apartments comprised in 15 building blocks. The residential apartments shall have all the basic facilities to the local standards including connection to the sewer for waste water disposal. The final product shall have all necessary details as per approved designs and as described elsewhere in this report. Construction process does not produce and by-products except waste products. Wastes from construction activities are diverse. They include excavated soils, vegetative materials extirpated from the site, 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 municipal refuse and waste water from the washrooms or general cleaning. All wastes shall be disposed of appropriately as discussed in mitigation measures elsewhere in this report.

Waste water management: The proposed project site is located in an area that has an existing sewer line, therefore the proponent need to apply and connect the proposed residential project to this utility for the management of waste water. The proponent is however, advised to have an onsite waste water management plant as a back-up system in cases of sewer failure. The manhole for the sewer connection should be heavy duty and the inside face of the wall should be plastered with two courses of 10mm thick cement mortar.

Solid waste management: Solid waste management within the project area is normally an individual responsibility to ensure that all the solid waste generated within their households is properly disposed. It's for this reason that the proponent will engage a private service provider who is NEMA compliant (licensed to transport solid waste) to offer his/her services to them at a nominal fee

Storm water management: The proposed project area is a fairly flat topography hence the need to have effective storm water conduits and drain for directing water.

2.6 PROJECT ACTIVITIES

2.6.1 DESCRIPTION OF THE PROJECT'S CONSTRUCTION ACTIVITIES

Preconstruction phase consists of site preparation for further work. It involves site clearing, appointing labourers, procurement of construction material and machinery, getting necessary approvals from statutory authorities. This ESIA assessment is part of this stage.

During construction phase there will be major impact on the land use pattern, Air Pollution due to construction activities, noise pollution, etc. The implementation of the project's design and construction phase will start with thorough investigation of the site soil chemical and physical properties and water table level determination. The construction of the residential apartment's project shall be as per the approved designs. The construction will be based on the building standards, code and regulations applicable in 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. The County's general bye-laws on building, water and sewerage bye-laws, and Public Health Act must also be adhered to during the construction phase. This phase will be undertaken by a contractor who will be able to handle all the civil works including leveling of the site and clean up including debris that is piled offsite on open areas that are not part of the proposed project plot. The construction will involve but not be limited to the following activities:

- Preparation of land including site clearance which is already undertaken
- Disposal of the existing debris/ materials. All debris and excavated materials will be dumped on approved sites.
- Construction of temporary construction office(s) and store
- Procurement of construction materials from approved dealers;
- Storage of the construction materials;
- Excavation and removal of overburden;
- Transportation of construction materials and disposal of the resulting construction wastes/debris using heavy and light machinery;
- Laying of foundations and structural members;
- Installation of electrical and mechanical fittings onto the structure;
- Finishing of the structure; and
- Landscaping works and earth works to be done mostly on completion of the proposed residential development.

In order to alleviate any negative impacts emanating from the construction and operation activities of the proposed residential apartment's project, relevant and cost effective mitigation measures have been proposed in the ESMP which is part of this report. Key summary descriptions of the construction activities are presented in the following section and they include:

Preparation of land

This activity shall involve site clearance, site levelling and topsoil removal. This will generate solid waste on the site as top-soil, and removed soil debris etc. The selected site land was initially designed for single dwelling, however the land had been left undisturbed and savannah tree types comprised of mainly Acacia spp with grasses interspersed. The Change of use for the multi-dwelling complex was obtained as indicated and as annexed in our appendices. During the commencement of the ESIA process, the site had been cleared and only remains of shrub roots was evident. An access to the site had also been designed and partially cleared. The client was however advised to stop any further activities on the site until a NEMA license for the proposed project is obtained.

Plate 3: Cleared site and soil debris on the adjacent plot

Procurement of building materials

Procuring construction material will lead to increase in temporary air pollution due to vehicular traffic, loading and unloading operations etc. Greater emphasis shall be laid on procurement of building materials which shall strictly be done within the project area and its environs. This makes both economic and environmental sense as it will reduces both the costs and negative impacts of transportation of the materials to the project site through reduced distance of travel. To avoid much wastage of construction materials, the proponent shall order the materials in quotas as at when they are required and the quantities required.

Excavation and foundation works: The proposed project site is located in an area characterized by black cotton soils that are usually not stable for foundation works. The proponents shall carry out extensive excavation activities to ensure a stable foundation to the buildings hence avoiding future calamities such as collapsing of the buildings. Excavation activities shall cause considerable levels of disturbance to the project area and must be limited to day time only. No blasting of stones shall be carried out at the project site. The proponent must ensure that all the excavated soils are properly disposed of away from the construction site preferably areas approved by the Machakos County Government to avoid reducing the aesthetic quality of the areas off site.

The Structural Framework: The foundation and all reinforced concrete structural members e.g. ground beam foundation, columns, beam casting will be carried out in accordance with Ministry of Public works regulations. The best concrete cast must also conform to mixing ration of 1:2:4 reinforced concrete as per the specifications of the structural engineer and be tested in accordance by the material testing section of the Ministry of Public Works.

Masonry and concrete works: Construction of the masonry walls, foundations, floors, pavements, storm water drainage systems, perimeter fence, access road and parking space among other components of the project will involve a lot of masonry work and related activities. General masonry and related activities will include stone shaping, concrete mixing, plastering, slab construction, construction of foundations, and erection of building walls and curing of fresh concrete surfaces. These activities are known to be labour intensive and shall be supplemented by machinery such as concrete mixers.

Roof construction works: The roof construction shall depend on the architectural designs.

Electrical works: Electrical work during construction of the premises will include installation of electrical gadgets and appliances including electrical cables, lighting apparatus, sockets among others. In addition, there will be other activities involving the use of electricity such as welding and metal cutting.

Door/Window Fixtures: The doors and their frames shall be of standard measurement as per the architectural designs and structural engineers' specifications. The windows shall be of steel casement glass and fabricated as proposed in the design concept but must provide adequate light into the house.

Walling and Floor Finishing: The walls will be built of thick reinforced concrete as per the specifications given and plaster, thick cement, sand mix ratio finished in smooth with steel float for the internal walls. Toilets, washrooms and bathrooms will be fitted with ceramic filing as designated tiles.

Fire Fighting System: The detailed fire protection system is being planned in the project. This system shall be implemented in line with the requirements of the Kenya Fire Rules of 2005. The proposed Project design and development has been planned with utmost care and all provisions have been made for the safety and security of the property as well as the personnel. The normal causes for fire in the proposed Project could be due to bursting of gas cylinders short circuit of electrical cables, catching fire during handling and storage of hazardous materials in the facility etc. The building construction will be undertaken while following all the prescribed norms for prevention of fire during construction as well as operation of the facility. Wherever possible, fire proof materials will be used in the construction. The superior electrical cables and other electric appliances will be used in the construction without causing for overloads and resultant fire accidents. The cabling and jointing will be done with utmost care to prevent any short circuits in future.

Security and services: During peak construction, more workers will be employed on site. The majority of these workers will be sourced from the local population in the nearby centers. It is anticipated that no criminal or security threats will be reported from the neighbour-hood. As a control measure the proponent should have a 24 hours security provided.

2.6.2 ACTIVITIES DURING OPERATION PHASE

The activities to be conducted in the proposed project's operation phase are various business activities and accommodation related activities. The normal related activities which include provision of accommodation and all human related activities for the well-being and quiet enjoyment of the residents and their potential guests. Other support services include the general maintenance and cleaning of the premises and laundry. The human activities shall definitely generate some liquid and solid waste. Liquid waste shall include wastewater from the sanitary facilities, kitchen, laundry and general cleaning activities among others. Solid waste shall mainly come from the kitchen, discarded

clothing, packaging materials, vegetative matter, construction waste and debris during repairs, papers e.t.c. These wastes shall be handled as recommended in mitigation measures in handling wastes. Since all residents have a right to quiet enjoyment of the unit, all practical and reasonable measures shall be to ensure peaceful and harmonious co-existence.

Residential services: The main activity during operation is residential accommodation. This is expected not to cause any significant environmental impacts due to the nature save for solid wastes produced during occupation.

Water supply: The water to be used for both construction and during operational phases of the project will be obtained from water supplies-Mavoko Water and Sewerage Company or water vendors as well as the proposed borehole drilling on the site.

Electricity supply: Kenya Power is a limited liability company responsible for the transmission, distribution and retail of electricity throughout Kenya. The main supply to the facility will be from the existing Kenya Power line that is in the project area.

Solid waste: Accumulations of waste in urban areas give rise to problems like bad odour, epidemics of infectious diseases, rodent problems etc. In today's context, matter of concern is how to manage the large quantity of wastes in different forms. Treatment and disposal of such wastes through conventional methods is inefficient as well as unsatisfactory. During the last decade some new biotechnology based options are emerging to solve these problems. Recycling of waste through vermin compost has multi-directional impact. Considering that the Machakos County Government does not provide solid waste management services as per the law requirements, the proponent in partnership with other residents has proposed to contract a private service provider licensed by both NEMA and the Machakos County Government to help manage all the solid waste generated from the estate.

Waste water management:

The project proponent shall cater for waste management in appropriate structures, facilities and operations. These will be provided in such a way as to meet the requirements of the Waste Management Regulations and as stipulated under the EMCA 1999 and as per the relevant EMCA Waste Management (2006) Regulations. In so doing the proponent will pursue waste minimization, recycling and disposal. The proponent commits to handle liquid wastes through a proposed through connection to a MAVWASCO sewer line that passes in the project area or onsite sewerage treatment plant. The sanitary, waste and vent system shall be water tight and gas tight designed to prevent escape of foul gas and odour from various fixtures. Provision of anti-siphon pipes shall be made for hygiene, safety considerations, and to avoid entry of foul smell into occupied areas. Vent system shall be designed to facilitate escape of gases and odour from all parts of sanitary and waste system to the atmosphere at a point above the building and to allow admittance of air to all part of the system, so that siphon action, aspiration or back pressure conditions do not cause loss of seal at traps.

Storm Water Management: Separate and independent rain water drainage system shall be provided for collecting rain water from terrace, paved areas and lawns, in coordination with architects and structural consultants. Perforated pipe drainage system shall be provided for open-to-sky courtyard/lawn.

Fire Fighting System: For protection of the facility against fire, all the units shall be equipped with any one or a combination of the following fire-fighting systems: central fire stores; wet riser system; fire detection and alarm system and different types of fire extinguishers. For storage of water for fire-fighting in case of emergency, a firewater underground and overhead sump will be provided. This will

serve the fire-fighting needs of the project. The warning signs for prevention of fire and plans showing the exit paths for escape from fire will be prominently displayed in the working places and corridors of the buildings.

A parking space: There are designated personal parking space on the Site plan as well as the Ground floor of blocks 9 to 14.

2.6.3 ACTIVITIES DURING DECOMMISSIONING PHASE

Decommissioning is an important phase in the project cycle and comes as the last to wind up the operations/activities of a particular project. The main purpose of decommissioning is to restore/rehabilitate the site to acceptable standards. This is aimed at making the area occupied by the residential apartment's project equivalent or better than its original condition upon decommissioning. During this phase, a project decommissioning plan will be prepared and a report submitted to NEMA before decommissioning commences.

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. This is long period of time and there may be many changes which may not be foreseeable including the technological and legal aspects. The decommissioning may also come earlier than the lifespan of the buildings again due to various reasons like change in physical planning policy or the discovery/realization of a more optimal use of the land. In view of the foregoing and in line with the principles of sound environmental management, it is paramount that the appropriate controls and procedures be put in place at the design, implementation and operational phases of the proposed project to control environmental degradation as this is the only way of simplifying the decommissioning. These measures are recommended elsewhere in the report and in the ESMP.

CHAPTER THREE: BASELINE INFORMATION

3.1 INTRODUCTION

This chapter illustrates the description of the existing environmental status of the study area with reference to the prominent environmental attributes. The study area covers the area falling within 5-km radius from the center of the proposed project area. The existing environmental setting is considered to adjudge the baseline environmental conditions, which are described with respect to climate, hydro- geological aspects, atmospheric conditions, water quality, soil quality, vegetation pattern and ecology, socio-economic profiles of people and land use. The objective of this section is to define the present environmental status which would help in assessing the environmental impacts due to the proposed project. This report incorporates the baseline data generated through primary surveys.

3.2 METHODOLOGY

Appropriate methodologies have been followed in developing the ESIA/ESMP report. The methodology adopted for the study is outlined below:

- Conducting reconnaissance surveys for knowing the study area; and
- Selecting sampling locations for conducting various environment baseline studies.

The sampling locations have been selected on the basis of the following:

1. Existing topography;
2. Drainage pattern and location of existing facilities; and
3. Areas, which represent baseline conditions.

The field observations have been used to:

1. Assess the positive and negative impacts due to the proposed site; and
2. Suggest appropriate mitigation measures for negating the adverse environmental impacts, if any; and
3. Suggesting post-project monitoring requirements and suitable mechanism for it.

3.3 PHYSICAL ENVIRONMENT

3.3.1 CLIMATE

The climatic conditions of the study area are semi-arid, with mean annual temperature varying from 15ºC to 25ºC and a total annual rainfall ranging between 400 mm and 800 mm. Depending on altitude and aspect, mean rainfall and temperature vary widely. Machakos County is generally hot and dry with a bimodal rainfall distribution. There are two rainy seasons but rainfall can be moderate. The long rains are experienced between March and May and the short rains between October and December. There are significant spatial and temporal variations within the County and rainfall reliability is quite low. The cloudiest part of the year is just after the first rainy season, when, until September, conditions are usually overcast with drizzle. The area is characterized by sunny daylights and chilly night. The proposed project site experiences relatively dry conditions just like the entire Machakos County region.

3.3.2 TEMPERATURES

The sunniest and warmest part of the year is from December to March, when temperatures average the mid-twenties during the day. The mean maximum temperature for this period is 27 °C (75 °F). The minimum temperature also remains low during cloudy nights, usually hovering around 11 °C and at times reaching 8°C. Clear skies in January and February also bring colder nights. Temperature range from a minimum of 9.1^0C to a maximum of 26.7 ^{0}C.

3.3.3 RAINFALL

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

3.3.4 WIND FLOWS

The lower winds throughout the year are of the easterly type. Between October and April they shift to the northeast while as from May to September they move to the southeast .Prior to the "Long Rain" season strong winds prevail with an average speed of 22.5 Miles/hour. The rest of the year has wind speed varying from 10 to 15 Miles/hour. However, during night, the winds are usually calm.

3.3.5 GEOLOGY

The project area is situated in an area geologically covered by Nairobi trachyte's which are underlain by Nairobi phonolites. The Nairobi phonolites are underlain by Upper Athi series which are composed of tuffs and sediments. Nairobi Trachytes is dark, non-porphyritic lava with sporadic phenocryst of feldspar. In the project area, the Nairobi Trachytes occurs as several thin flows with inter-bedded materials which are in most cases water-bearing. Nairobi phonolite is dark grey porphyritic lava with tabular insets of feldspar and biotite. Upper Athi Series consist mainly of sandy, sediments, tuffs and welded tuffs. The clays are presented but only in subordinate quantities.

3.3.6 TOPOGRAPHY AND DRAINAGE

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

3.3.7 HYDROGEOLOGY AND SOILS

In general groundwater in volcanic rocks is limited to fractures and erosion levels within the volcanic succession. Fresh lavas are usually not water bearing because of their massive and impervious

nature. The most significant aquifer system west of the project area is the Upper Athi Series aquifer system. This is the main aquifer for boreholes in Upper Machakos, Nairobi and Kiambu areas and is composed of tuffs, lakebeds and sediments. The rocks in the Upper Machakos regions such as Mavoko, Syokimau and Mlolongo area mainly comprise a succession of lavas and Pyroclastics of the Cainozoic age and overlying the foundation of folded Precambrian schist's and gneisses of the Mozambique basement rock which traverses the entire lower eastern region up to Kilimambogo area The crystalline rocks are rarely exposed but occasionally fragments are found as agglomerates derived from former Ngong volcano.

The soils of this area are products of weathering of mainly volcanic rocks. Weathering has produced black cotton soils that reach more than 50 feet (15m) in thickness. Metamorphism process is witnessed in the region that has resulted to major deposits of limestone rich mines.

3.3.8 SOIL CHARACTERISTICS

It is essential to determine the potentiality of soil in the area and to identify the impacts of urbanization on soil quality. Accordingly, the soil quality assessment has been carried out.

The soil sampling locations have been identified with the following objectives:

- To determine the baseline soil characteristics of the study area; and
- To determine the impact of proposed project on soil characteristics.

For studying soil characteristics of the region, soil sampling locations were selected to assess the existing soil conditions on the project site. The samples were collected by ramming a core-cutter into the soil up to a depth of 30 cm. From the in situ assessments, observed that the texture of soil is mostly clayey soils. The sample results for the soil collected are annexed on this report as obtained from Kenya Agricultural and Livestock Research Organization laboratory in Nairobi.

Plate 4: Soil vertic properties and composite soil sampling on the site

3.3.9 WATER QUALITY

Understanding the water quality is essential in preparation of Environmental and Social Impact Assessment and to identify critical issues with a view to suggest appropriate mitigation measures for implementation. Selected water quality parameters of water resources sampled in the study area were studied for assessing the water environment and evaluating the anticipated impacts of the proposed project. The purpose of this study was to:

- Assess the water quality characteristics for critical parameters;
- Evaluate the impacts on the water quality; and
- Prediction of impact on water quality by this project and related activities.

The information required were collected through primary surveys and secondary sources. The sample results for the one sample collected and analyzed from Water Resources Authority (WRA) Central Laboratory Testing in Industrial Area are annexed on this report. The results show that the water has high Iron and Fluoride content and the recommended intervention is to de-flouridize the same.

Water Sampling Locations

There was only one sample collected. This sample was collected from Sheba village Estate. The water sample collected comprised of both Borehole and water supply that had been mixed and running for use within the estate. We were not able to collect the samples separately and thus we cannot be able to obtain accurate results from this sample.

3.3.10 AIR QUALITY

The ambient air quality with respect to the study zone of 1 km radius around the project site formed the baseline information. The various sources of air pollution in the area are fugitive dust, industrial and vehicular traffic. The prime objective of the baseline air quality study was to assess the existing air quality of the area. The study area represents mostly mixed zone environment.

Methodology adopted for Air Quality Survey

The baseline status of the ambient air quality has been assessed through a scientifically designed ambient air quality-monitoring network. The design of monitoring network in the air quality surveillance program was based on the following considerations: meteorological conditions on synoptic scale; soil conditions; topography of the study area; representatives of regional background air quality for obtaining baseline status; and representatives of likely impact areas. Ambient Air Quality Monitoring (AAQM) stations were set up at four locations with due consideration to the above mentioned points.

The Ambient Air Quality Monitoring was undertaken in line with Environmental Management and Co-ordination (Air Quality Regulations, 2014). The air quality regulations states that no person, operator or owner of any facility shall cause or allow fugitive emissions to cause the ambient air quality at its property boundary to exceed the limits prescribed under the First Schedule. The Table 4 below provides the emissions allowable guidelines limits at the property boundary. The World Health Organization (WHO) Air Quality Guidelines (AQG) are intended to achieve air quality that protects public health in different contexts. The International Finance Corporation (IFC), Environmental, Health and Safety Guidelines also refer to WHO standards for Ambient Air Quality. The guidelines are in table 5 below.

Based on the proposed project site baseline conditions and envisaged project activities, the experts determined that the key challenge would emanate from dust generation. This resulted to the determination or quantification of PM10 and PM 2.5 concentrations at identified locations around the project site so as to assess compliance with relevant Air quality Regulations. Weather conditions observed during the survey period were normal within with skies day temperatures averaged at 25^0C with light winds and short rains. The measurements were undertaken for 24hrs weighted time for each point between 11^{th} and 13^{th} April, 2021. The measurements results for the four points sampled along the property boundary for Particulate matter(dust) PM_{10} and $PM_{2.5}$ were all within the guideline

values stipulated in the Environmental Management and Co-ordination Act (Air Quality Regulations, 2014) for Ambient Air Quality (100µg/m^3).

Table 3: EMC (Air Quality Regulation 2014) Limits at the property boundary

Pollutant	Time Weighted Average	Industrial area	Residential, Rural and Other Areas	Controlled areas
Respirable Particulate Matter (<l0pm) (RPM)	Annual Average	70 µg/m3	50 µg/m3	50 µg/m3
	24 Hours	150 µg/m3	100 µg/m3	75 µg/m3
PM $_{2.5}$	Annual Average	35 µg/m3	-	-
	24 Hours	75 µg/m3	-	-

Table 4: WHO Air Quality Guidelines

Pollutant	Time Weighted Average	Air Quality Guideline
Respirable Particulate Matter (<10µm)	24-Hr Mean	100 µg/m^3
$PM_{2.5}$	24-Hr Mean	25 µg/m^3

Source: http://apps.who.int/ accessed 25TH April 2021

Table 5: Description of Points and duration of measurements

Site Name	Site Ref No. (Description)	Sample ID	Start Date	Start Elapse Time Reading (hrs.)	Flow Rate (l/m)	Finish Date	Finish Elapse Time Reading (hrs.)	No of Hours	Total Vol sampled (m3)	Mass PM10 collected (ug)	Results
67 hotel boundary	**MP 1-GPS** S 1^0 22′ 54.6″ E 36^0 55′	PM 10	10-April-21	3964.8	5.0	11-April--21	3989.5	24.0	7.20	300	42
		PM 2.5	10-April -21	4233.1	5.0	11-April--21	4258.1	24.0	7.20	400	56

Site Name	Site Ref No. (Description)	Sample ID	Start Date	Start Elapse Time Reading (hrs.)	Flow Rate (l/m)	Finish Date	Finish Elapse Time Reading (hrs.)	No of Hours	Total Vol sampled (m3)	Mass PM10 collected (ug)	Results
	26.6										
Nairobi-Mombasa Highway boundary	**MP 2-GPS** S 1^0 22′ 74.56″ E 36^0 55′ 29.6	PM 10	11-April-21	3989.5	5.0	12-April--21	4010.7	24.0	7.20	500	69
		PM 2.5	11-April -21	4258.1	5.0	12-April--21	4279.0	24.0	7.20	500	69
Sheba boundary	**MP 3-GPS** S 1^0 22′ 84.2″ E 36^0 55′ 86.6	PM 10	12-April -21	4010.7	5.0	13-April--21	4035.9	24.0	7.20	200	28
		PM 2.5	12-April-21	4279.0	5.0	13-April--21	4304.1	24.0	7.20	300	42
Westside undeveloped land boundary	**MP 4-GPS** S 1^0 22′ 20.7″ E 36^0 55′ 24.6″	PM 10	13-April-21	4035.9	5.0	21-April--21	4058.5	24.0	7.20	500	69
		PM 2.5	13-AprIL-21	4304.1	5.0	21-April--21	4327.2	24.0	7.20	500	69

Plate 5: View of the ongoing measurements at daytime along the property boundary

3.3.11 NOISE LEVEL SURVEY

The physical description of sound concerns its loudness as a function of frequency. Noise in general is sound which is composed of many frequency components of various loudness distributed over the audible frequency range. Various noise scales have been introduced to describe, in a single number, the response of an average human to a complex sound made up of various frequencies at different loudness levels. The most common and universally accepted scale is the A weighted Scale which is measured as dB (A). This is more suitable for audible range of 20 to 20,000 Hz. The scale has been designed to weigh various components of noise according to the response of a human ear. The impact of noise sources on surrounding community depends on:

- Characteristics of noise sources (instantaneous, intermittent or continuous in nature). It can be observed that steady noise is not as annoying as one which is continuously varying in loudness;
- The time of day at which noise occurs, for example high noise levels at night in residential areas are not acceptable because of sleep disturbance; and
- The location of the noise source, with respect to noise sensitive land use, which determines the loudness and period of exposure.

The environmental impact of noise can have several effects varying from Noise Induced Hearing Loss (NIHL) to annoyance depending on loudness of noise. The environmental impact assessment of noise due to construction activity, and vehicular traffic can be undertaken by taking into consideration various factors like potential damage to hearing, physiological responses, and annoyance and general community responses.

Identification of Sampling Locations

A preliminary reconnaissance survey has been undertaken to identify the major noise generating sources in the area. Noise at different noise generating sources has been identified based on the activities in the village area, ambient noise due to industries and traffic and the noise at sensitive areas like hospitals and schools. The noise monitoring has been conducted for determination of noise levels at five locations in the study area.

Plate 6: Noise level measurements at the site

A summary of the ambient noise level measurements and environment setting of each noise monitoring location is given in Table 7. The specific details of each of the noise measurements including; (i) the specific dates on which the noise measurements were recorded, (ii) the specific times when noise measurements were recorded, (iii) the specific coordinates at which noise measurements were taken including coordinates for sensitive receptor sites in relation to the proposed project components, (iv) the anthropogenic factors that may have influenced the noise levels recorded (e.g. bird calls, local community conversations, etc.) were also recorded.

Table 6: Details of Noise Monitoring Locations

Location Code	**Location**	***Latitude***	**Longitude**	**Minimum Leq dB (A)**	**Maximum Leq dB (A)**
NMP 001	Adjacent to Sheba Village	-1.38128	36.92474	47.7	59.1
NMP 002	Project end wall with Sheba concrete wall	-1.38044	36.92557	53.2	67.2
NMP 003	Project site Northwest corner point	-1.38002	36.92501	58.9	78.4
NMP 004	Alternative access road to the site	-1.38062	36.92430	52.2	66.1
NMP 005	Adjacent to 67 Hotel	-1.38137	36.92372	55.2	59.6
NMP 006	Entrance Gate	-1.38184	36.9241	50.6	60.1

NMP 007	Muthama Access Road junction	-1.3817	36.92537	50.8	54.6
NMP 008	Mombasa Road Junction to site	-1.38054	36.92839	68.9	81.2
NMP 009	Nairobi-Mombasa Highway	-1.37773	36.9200	68.2	79.5

Based on the results presented in the table above, some of the average noise levels recorded at the proposed project components and selected sites were within permissible limits for residential areas as provided for in the EMC (Noise and Excessive Vibration Pollution Control) Regulations, 2009 which set the maximum limit as 55dB(A) during the day. The locations that registered noise levels that exceeded the maximum occupational exposure (OEL) limits as contained in the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations 2009 included Nairobi- Mombasa Highway.

3.4 BIOLOGICAL ENVIRONMENT

This section describes key biological elements, including the identification and distribution of flora and fauna species within the region of concern (proposed project site and other potentially affected areas). An ecological survey of the study area was conducted, particularly with reference to listing of species and assessment of the existing baseline ecological (Terrestrial ecosystem) conditions in the study area. The present report gives the review of published secondary data and the results of field sampling conducted by the experts.

Methodology adopted for the Survey

The different methods adopted were as follows:

- Compilation of secondary data with respect to the study area from published literature and Government agencies;
- Generation of primary data by undertaking ecological studies in the area; and
- Gathering data for ethno biology.

The ecological study was undertaken to understand the present status of ecosystem of the area, to predict changes as a result of proposed activities and to suggest measures for maintaining the conditions.

3.1.1 FLORA

Natural vegetation in Upper Machakos region (Syokimau, Mlolongo and Athi River) has been cleared to pave way for the establishment of both residential and commercial developments. The natural vegetation in the project area has thus been greatly modified. The remnants of the natural vegetation off the site and its environs are a few scattered *Acacia spp* and grasses. The site had no great vegetation cover as it had been cleared at the time of the assessment.

The general area is planted with vegetation (trees) mostly along the roads, plot boundaries and in designated gardens within the respective plot boundaries. Ecologically, the proposed project location is not in an area of special concern, such as areas designated as having national or international importance (e.g. world heritages, wetlands, biosphere reserve, wildlife refuge, or protected areas). The project will not lead to the extinction of endangered and endemic species, nor the degradation of critical ecosystems, and habitats. The proposed project site, falls within a semi-arid settled zone, with medium density housing and as such the habitats of project area and its surroundings have been highly disturbed and modified. Other areas that are not built up are dominated by pockets of Acacia grassed shrubland.

Plate 7: Flora in the project area

3.1.2 FAUNA

The site is situated within an area zoned for residential and commercial use 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.

3.5 LAND USE

Studies on land use aspects of eco-system play an important role in identifying sensitive issues and taking appropriate actions by maintaining 'Ecological Health' for development of the region. The objectives of land use studies are:

1. To determine the existing land use pattern in the study area;
2. To analyze the impacts on land use in the study area; and
3. To give recommendations for optimizing the future land use pattern vis-a-vis proposed project in the study area and its associated impacts.

Methodology

Urban land use refers to spatial distribution of social and economic activities. Accordingly, an up to date land use inventory is frequently required to facilitate urban planning and growth patterns as well as monitoring urban expansion. The neighborhood is generally characterized by a mix of different uses including commercial and residential land use. The land use pattern of the study area has been studied by analyzing the available secondary data such as the Machakos County Integrated Development Plan. The land use for the project site was initially classified for single dwellings; however policy changes have seen the same locality be permitted for Multi-dwelling units. The area is generally drained by the existing public drainage system along the road. The proposed design has provided for internal drains to collect the surface run-off and safely dispose to the existing drainage system.

Plate 8: Residential apartments and 67 Airport Hotel as seen from the Project site

Plate 9: Nearest Shopping centre at the junction of Mombasa Road

Plate 10: Churches within the Project area

3.6 SOCIO-ECONOMIC ENVIRONMENT

Administratively, Syokimau/ Mlolongo fall within the jurisdiction of Mavoko Sub County, Machakos County. Mavoko Sub County falls to the East of Nairobi. It encompasses some of Nairobi city dormitory centers such as Mlolongo, Athi River and Lukenya. It's worth noting that high land prices within Nairobi City compelled most residents to seek better alternatives in areas close to Nairobi and these areas include Mavoko Sub-county satellite towns. The project area enjoys a close commuter distance to the city. This metropolitan convenience has enticed great investments. Large tracts of agricultural and / or industrial land have been subdivided to pave way for real estate investments. In the last ten years booming real estate sector within Mavoko Sub County has occasioned fast and unpredicted growth that has translated to unplanned settlements. Consequently, the pace and rate of growth has outstripped levels of service provision. Areas that provide residence to majority of the resident population have no; sewerage systems, water supply, social amenities/ infrastructure and are poorly planned. This transformation has led to degradation of neighbour-hoods and standards of living in Mavoko Sub-county. However, the main economic investment within Mavoko Sub-county include real estate and industrial activities.

The proposed project site is within an area predominantly residential with commercial activities and therefore almost every other plot in the neighbourhood is residential and/or commercial activities. Some residential houses in the neighbourhood have been officially or unofficially turned into offices and other commercial uses. All major urban infrastructures (water, electricity, sewer, roads, and

landline telephony) are in close proximity for connection to the proposed project site. The area is within the County Government of Machakos jurisdiction and therefore served by Machakos County infrastructure and is also bound by the County's by-laws.

3.6.1 POPULATION SIZE

The project is located in Mavoko sub-county. This is a peri-urban settlement experiencing rapid demographic and socio-economic change as an integral element of the growth and operation of the growing Nairobi city. The project location is in a built up and commercial set up with employment opportunities availed to local Kenyan residents. Since the facility operates in a highly populated local authority whose demographic factors are urban, the workplace no doubt brings together people from various ethnicity and backgrounds, thereby promoting social integration.

3.6.2 INFRASTRUCTURE ROADS AND ACCESSIBILITY

The property lies on a gravelly road off the tar-surfaced Nairobi - Mombasa Highway. The road is well connected with other tar surfaced roads and therefore the site is accessible and within close proximity to the CBD and other commercial centres.

Plate 11: Section of Mombasa- Nairobi Highway and junction of Muthama Access Road

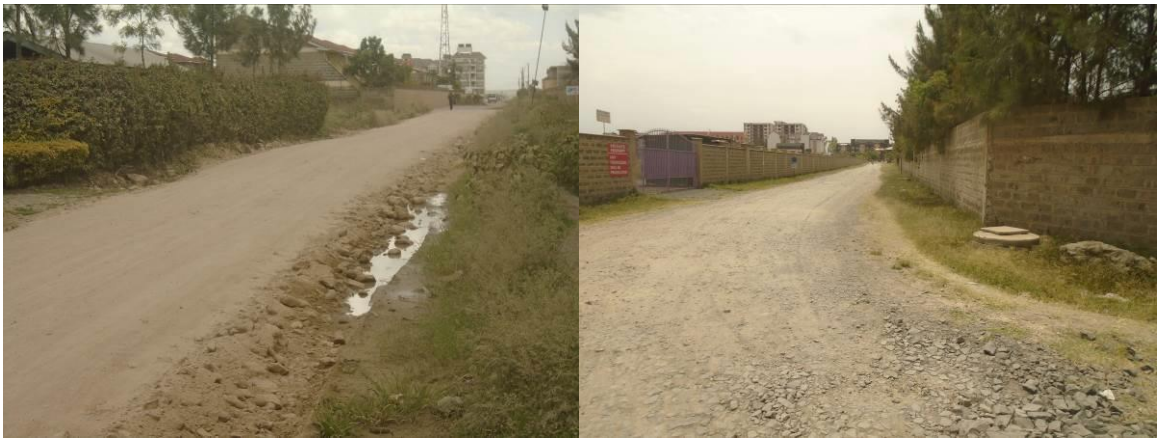

Plate 12: Muthama Access Road and 12M Access Road sections leading to the site

3.6.3 WATER SUPPLY

The proposed project area does have piped water supply from Athi River EPZA by MAVWASCO though it is not reliable. Most residents thus depend mostly on borehole water which they source from the few available boreholes that supply water on private basis in the area. Other sources of water supply within the project area include vendors who supply with water tankers/ water boozers.

Due to the project area water shortage problems, the proposed project shall be connected to the MAVWASCO water supply network. It is recommended that the proponent explore harnessing rainwater for general use to minimize pressure on the existing water supply. It is recommended that appropriate and preventive measures be taken at the design stage to provide for rain water harvesting system and storage which shall otherwise reduce the full dependency on the MAVWASCO supply. This will include gutters, down pipes and suitable water storage tanks for the harvested rainwater. The use of run-off generated within the project area shall be put into consideration, whereby it shall be harvested and stored. This can be used in flashing out toilets thus supplementing the use of normal water supply. The run off can suitably be stored in underground tanks and then pumped/lifted to the sanitary facilities (toilets).

Plate 13: Water storage tanks on neighbouring plots

3.6.4 EDUCATION INSTITUTIONS

According to Population and Demographic Survey (2002), Machakos County had about 850 primary schools, with an enrolment rate of about 81% for both boys and girls. School drop-out rate was estimated at about 6%. Given the County's high population growth rate, additional educational facilities remain a challenge. At the project area, there is lack of educational facilities as established through stakeholder engagements.

Plate 14: School sign post on Muthama Access Road

3.6.5 HEALTH

According to Machakos County Integrated Development Plan, the county has about 110 health facilities, with a doctor/population ratio of about 1:63,000, which indicate an over-utilization of medical personnel. The average distance to a health facility across the County is estimated at 5 Km. Of the most prevalent diseases (Malaria, typhoid, children diseases etc.) and HIV/AIDs that is a major health problem, with an estimated prevalence of 15%.

3.6.6 ENERGY AND ELECTRICITY ACCESS

The site is not served by electricity from the National grid but there are electric lines along the road access to the project site. Upon completion of construction, the proponent will connect the proposed development to the national grid upon acquiring relevant permits. The proponent has proposed to have backup generators but we recommend that installation of solar heaters is feasible.

Construction machinery will require fuel during construction. This will be sourced from legalized dealers.

3.6.7 COMMUNICATIONS

The project area is well covered by communication facilities like Safaricom, Airtel among others. All these providers will facilitate communication during the project construction and operational phase.

Plate 15: Communication Mast as observed from the Project site

3.6.8 SECURITY

There will be two gates to the project site, which will be fully manned 24 hours. The entire area of the project will also be banded with a full stone perimeter fence. Streetlights will as well be installed sufficiently within the project site. The property management is anticipated to engage security firms to beef-up security.

3.6.9 SEWER SYSTEM

The project area has a sewer system that is maintained by the County Government of Machakos through MAVWASCO. The area within which the proposed project site lies is served by MAVWASCO sewer and shall therefore be connected to the same. The sewer system reticulation has been effectively designed in the proposed plans and will be connected to each unit and to the existing sewer system with approval from MAVWASCO. A man-hole (sewer) along the immediate access road to the site.

Plate 16: Existing MAVWASCO sewer line manholes in the area

3.6.10 SOLID WASTE MANAGEMENTS

Wastes from the project will be many and especially during construction (clearing of the existing debris). The area is within the jurisdiction of the Machakos County Government, which has the responsibility of waste disposal. However, the proponent/contractor has an option of contracting a private garbage collecting company. All solid wastes should be dumped in approved dumpsites and in accordance with the regulations. Proper Handling of solid wastes mostly during occupation will be enhanced by the inclusion of sound property management system. As is the case in other similar integrated schemes, it is anticipated that a professional garbage collector will be contracted to supplement the efforts of the Machakos County in garbage collection, transportation and disposal.

Plate 17: Construction solid wastes heaps observed in the project area

CHAPTER FOUR: POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

4.1 General Overview

Environmental Impact Assessment (EIA) is a methodology used to identify the actual and probable impacts of projects on the environment and to recommend alternatives and mitigation measures. The assessment is required at all stages of project development with a view to ensuring environmentally sustainable development for both existing and proposed public and private sector development ventures. Various National Policies and Acts of parliament are discussed below as they relate to the environment management and the sector into which the proposed project has interest.

4.2 Policies

Any EIA must conform to the policy guidelines under its jurisdiction. Recognizing that Environment and Development issues must promote aspirations for an innovative, progressive, and prosperous Kenya, it is the expectation that any development initiatives are reflective of these policies. Policies are normally translated into actionable 'how to" by implementable action plans or programmes, bearing with them a systematic code of ethics for reward at compliance or sanction and penalties otherwise. The policies outlined below are relevant to the proposed project.

4.2.1 NATIONAL ENVIRONMENTAL ACTION PLAN (NEAP)

According to the NEAP-1994 the Government of Kenya recognized the negative impacts on ecosystems emanating from economic and social development programmes that disregard environmental sustainability. Following on this, establishment of appropriate policies and legal guidelines resulted in harmonization of the then 76 existing Statutes into the Environmental Management and Coordination Act (EMCA), cap 387. The NEAP process introduced Environmental Impact Assessment in Kenya culminating in to the development of the Sessional Paper No. 66 on the Environment and Development.

4.2.2 NATIONAL ENVIRONMENT ACTION PLAN COMMITTEE

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

- Contain an analysis of the Natural Resources of Kenya with an indication as to any pattern of change in their quality, distribution and quantity over time.
- Contain an analytical profile of the various uses and value of the natural resources incorporating considerations of intergenerational and intra-generational equity.
- Recommend appropriate legal and fiscal incentives that may be used to encourage the business community to incorporate environmental requirements into their planning and operational processes.
- Recommend methods for building national awareness through environmental education on the importance of sustainable use of the environment and natural resources for national development.
- Set out operational guidelines for planning and management of the environment and natural resources.

- Identify actual or likely problems as may affect the natural resources and the broader environmental context in which they exist.
- Identify and appraise trends in the development of urban and rural settlements, their impact on the environment, and strategies for the amelioration of their negative impacts.
- Propose guidelines for the integration of standards of environmental protection into development planning and management.
- Identify and recommend policy and legislative approaches for preventing, controlling or mitigating specific as well as general diverse impacts on the environment.
- Prioritize areas of environmental research and outline methods of using such research findings.
- Without prejudice to the foregoing, be reviewed and modified from time to time to incorporate emerging knowledge and realities.
- To be binding on all persons and all government departments, agencies, States Corporation or other organ of government upon adoption by the National Assembly.

4.2.3 NATIONAL POLICY ON WATER RESOURCES MANAGEMENT AND DEVELOPMENT

The National Policy on Water Resources Management and Development (1999) seeks to enhance a systematic development of water facilities in all sectors for the country's socio-economic progress, and therefore calls for development of appropriate sanitation systems to protect people's health and water resources from pollution. It also sets guidelines for the utilization of water resources to prevent overexploitation and depletion of the resource.

Development projects, therefore, should be accompanied by corresponding waste management systems to handle the wastewater and other waste emanating there from. The policy also requires that such projects should undergo comprehensive Environmental Impact Assessments that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighborhoods and further downstream are not adversely affected by any emissions or discharges. (GOK, 1999)

4.2.4 POLICY PAPER ON ENVIRONMENT AND DEVELOPMENT (SESSIONAL PAPER NO. 6 OF. 1999)

The paper presents broad categories of development issues that require sustainable approach. The paper harmonizes environmental and development objectives so as to ensure sustainability. The paper provides comprehensive guidelines and strategies for government action regarding the environment and development. The proposed project will proceed under auspices of these guidelines and strategies that foster environmental values in development projects. Among the key objectives of the Policy Paper on Environment and Development (Sessional Paper No. 6 of 1999) are: -

- To ensure that from the onset, all development policies, programmes and projects take environmental considerations into account,
- To ensure that an independent Environmental Impact Assessment (EIA) report is prepared before project implementation, and

- To come up with effluent treatment standards that will conform to acceptable health guidelines.

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

The design of the proposed residential apartment's development project should be such that it adequately addresses the need for a sound waste management system. (GOK, 1999)

4.2.5 PUBLIC HEALTH POLICY

The prevailing public health policy calls upon the project proponent-Indesign Makumbi Limited to ensure that buildings are adequately provided with utilities so that they are fit for human habitation. The proposed development has been designed by professional engineers and architects and as such will have all amenities/ utilities that are essential for safeguarding public health for all people using the facilities. (GOK, 1986)

4.2.6 PHYSICAL PLANNING POLICY

The local Authorities are empowered under section 29 of the Act to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section, therefore allows for the prohibition or control of the use and development of land and buildings in the interest of proper and orderly development of an area. Section 36 states that, if in connection with a development application, the local Authority is of the opinion that the proposed development activity will have a injurious impact on the environment, the applicant shall be required to submit together with the application an Environmental Impact Assessment EIA report. The proposed residential project is in complete cognizance with the provisions of the Physical Planning Act, as it going to sit on land already approved by the County Government of Machakos and a Change of Use was granted as well.

4.2.7 ENVIRONMENT IMPACT ASSESSMENT GUIDELINES POLICY, 2002

The EIA guidelines require that an EIA be conducted in accordance with the issues and general guidelines spelt out in the second and third schedules of the regulations. These include coverage of the issues on schedule 2 (ecological, social, landscape, land use and water considerations) and general guidelines on schedule 3 (impacts and their sources, project details, national legislation, mitigation measures, a management plan and environmental auditing schedules and procedures. This assessment has been conducted according to the EIA guidelines (NEMA, 2003).

4.2.8 THE KENYA VISION 2030

The Kenya Vision 2030 is a policy document outlining Kenya's development programme covering the period between the years 2008 to the year 2030. The objective of Vision 2030 is to help transform Kenya as a newly industrializing, middle-income country providing a high quality of life to all its citizens in a clean and secure environment by 2030. The Kenyan Vision 2030 has a housing and urbanization strategy within its second pillar on investing in the Kenyan society. The Housing and

Urbanization sub-strategy talks of Kenya becoming a predominantly urban country by 2030. The strategy additionally outlines the aim of having an adequately and decently housed nation in a sustainable environment. The medium term goal by 2012 was also to increase the annual production of housing units from 35,000 to over 200,000 annually. The project proponent will therefore help answer Vision 2030's call for housing development initiative by providing affordable housing to the residents of Syokimau and the Country's citizenry at large.

Additionally, the Kenya Vision 2030 also has environmental goals outlined under the social pillar. According to the pillar, Kenya aims to be a clean, safe and sustainable environment by 2030. The country aims to achieve this goal by for example improving pollution and waste management strategies. By commissioning an EIA study for the project, the proponent has displayed his desire to support the Kenya Vision 2030.

4.2.9 BIG FOUR AGENDA

The President's Speech during the 54th Jamhuri Day Celebrations on 12th December 2017 elaborated the specific agenda (Big Four Agenda) and measures the Jubilee administration will focus on and dedicate energy, time and resources over the next 5 (2018-2022) years. The agendas are as follows:

- Enhance manufacturing in the country from 9.2% to 20% of GDP by 2022.
- Food security and nutrition through 100% food and nutrition security commitment.
- Universal health coverage by scaling up NHIF uptake to 100%.
- Affordable housing by implementing 500,000 new affordable homes.

The proposed residential development is aimed at addressing the fourth agenda in regard to affordable housing within the Country.

4.2.10 SUSTAINABLE DEVELOPMENT GOALS, (SDG)

The Sustainable Development Goals (SDGs), otherwise known as the Global Goals, are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. These 17 Goals build on the successes of the Millennium Development Goals, while including new areas such as climate change, economic inequality, innovation, sustainable consumption, peace and justice, among other priorities. The goals are inter-connected – often the key to success on one will involve tackling issues more commonly associated with another. The SDGs work in the spirit of partnership and pragmatism to make the right choices now to improve life, in a sustainable way, for future generations. They provide clear guidelines and targets for all countries to adopt in accordance with their own priorities and the environmental challenges of the world at large. The SDGs are an inclusive agenda. They tackle the root causes of poverty and unite us together to make a positive change for both people and planet.

4.2.11 NATIONAL CLIMATIC CHANGE RESPONSE STRATEGY (NCCRS)

Climate change is considered one of the most serious threats to sustainable development globally. Studies have shown that about 90% of all natural disasters afflicting the world are related to severe weather and extreme climate change events. Impacts of the projected climate change are expected in many sectors such as environment, human health, food security, economic activities, natural resources and physical infrastructure. Kenya acknowledges that the change in the Earth's climate and

its adverse effects are a common concern of humankind. The Ministry of Environment and Mineral Resources (MEMR) has therefore recognized the need to enhance coordination of climate change activities in the country with a view to ensuring a climate-proof socioeconomic development anchored on a low - carbon path. The vision of the Strategy is for a prosperous and climate change resilient Kenya. The mission is to strengthen and focus nationwide actions towards climate change adaptation and GHG emission mitigation. This will be achieved by ensuring commitment and engagement of all stakeholders while taking into account the vulnerable nature of Kenya's natural resources and society.

The objectives are to:

- enhance understanding of the global climate change regime: the negotiation process, international agreements, policies and processes and most importantly the positions Kenya needs to take in order to maximize beneficial effects of climate change,
- assess the evidence and impacts of climate change in Kenya,
- recommend robust adaptation and mitigation measures needed to minimize risks associated with climate change while maximizing opportunities,
- enhance understanding of climate change and its impacts nationally and in local regions,
- recommend vulnerability assessment, impact monitoring and capacity building framework needs as a response to climate change,
- recommend research and technological needs to respond to climate change impacts, and avenues for transferring existing technologies,
- recommend a conducive and enabling policy, legal and institutional framework to combat climate change, and
- Provide a concerted action plan coupled with resource mobilization plan and robust monitoring and evaluation plan to combat climate change.

Public Health (Prevention, Citation. Control and Suppression of COVID-19) Rules, 2020

This is captured in Legal Notice 49 of 2020. The rules requires that in the wake of the Corona Virus Disease 2019 (COVID – 19) pandemic that has ravaged the World over, Kenya has not been spared. COVID – 19 has affected the health, economic and social status of Kenya's population. In line with its mandate, Kenya Law has kept track of the various directives and legislation that the government has passed in tackling the COVID – 19 pandemic. The various presidential addresses on the state of interventions to cushion Kenyan's against economic effects of COVID – 19 have had tremendous implications on legislative reforms in Kenya. The proponent is required to ensure full compliance to Covid-19 Protocols during the entire project life.

4.3 Legal Aspects

4.3.1 NATIONAL.

The Constitution of Kenya (2010)

The constitution of Kenya was promulgated on 27th August 2010. Several articles are relevant to the proposed residential apartment's project in relation to the environment. Article 42 states that, every person has the right to a clean and healthy environment, which includes the right-

a) To have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69;

b) To have obligations relating to the environment fulfilled under Article 70.

Article 69: Obligations in respect to the environment

The Article provides that – The State shall-

a) Ensure sustainable exploitation, utilization, management, and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits.
b) Work to achieve and maintain a tree cover of at least ten percent (10%) of the land area of Kenya.
c) Protect and enhance intellectual property and indigenous knowledge of biodiversity and the genetic resources of the communities.
d) Encourage public participation in the management, protection, and conservation of the environment.
e) Protect genetic resources and biological diversity.
f) Establish systems of Environmental Impact Assessment, Environmental Audits and monitoring of the environment, processes and activities that are likely to endanger the environment; and
g) Utilize the environment and natural resources for the benefit of all the people.

Section (2) states that; every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

Article 70: Enforcement of environmental rights

1. It stipulates that: If a person alleges that a right to a clean and healthy environment recognized and protected under Article 42 has been, is being or is likely to be, violated, infringed or threatened, the person may apply to a court for redress in addition to any other legal remedies that are available in respect to the same matter.
2. On application under clause (1), the court may make any order or give any directions , it considers appropriate –

a) To prevent, stop or discontinue any act or omission that is harmful to the environment;
b) To compel any public officer to take measures to prevent or discontinue any act or omission that is harmful to the environment; or to provide for compensation for any victim of a violation of the right to a clean and healthy environment.

For the purposes of this Article, an applicant does not have to demonstrate that any person has incurred loss or suffered injury.

Housing Act (Cap 117), 1990

It is the act under which NHC is established and granted its legal mandates. The act make provision for NHC for establishment of a housing fund, power to loan and grant and repayment of loans as provided within the act, undertake and encourage research and experiment in housing related matters and undertake and encourage the collection and dissemination of information concerning housing and related matters, take part in housing exhibitions and other forms of publicity, undertake and encourage the provision of training in furtherance of the purpose of the and provide training for members of its staff, perform any other duties connected with housing as the ministry may direct, operate a financing institution with powers to borrow fund from the government, overseas agencies, pension and trust funds and any other institution or persons, as well as to collect deposits and saving

from the public to be applied to the financing of residential housing development and related matters and to establish, promote or aid in establishing or promoting, constitute, form or organize companies syndicate or partnerships alone or in conjunction with any other person or institutions for the carrying on of any such functions as the corporate is empowered to carry under this act. (GOK, 1990).

The Environmental Management and Coordination Act, Cap 387

It is the policy of the government (NEAP, GoK, 1994) to "integrate environmental conservation with economic development to provide sustainable development for posterity". Environmental Management and Co-ordination Act, No. 8 of 1999, provides a legal and institutional framework for the management of the environment and development related matters. It is the framework law on the environment, which was enacted on the 14th of January 1999 and commenced in January 2002. Top-most in the administration of the Act is National Environment Council (NEC), which formulates policies, set goals, and promotes environmental protection programmes. The implementing organ is the National Environment Management Authority (NEMA).

Part VIII, section 72 of the Act prohibits discharging or applying poisonous, toxic, noxious or obstructing matter, radio-active or any other pollutants into the environment. Section 73 requires that operators of projects which discharge effluent or other pollutants submit for NEMA accurate information about the quantities and quality of the effluent. Section 74 demands that all effluent generated from point sources are discharged only into the existing sewage system upon issuance of a prescribed permit from the Local Authorities with jurisdiction. Part VI Section 58 stipulates that before any development or project is undertaken, an Environmental Impact Assessment must be undertaken under the rules governing the nature of the project and type of impacts.

This ESIA is in compliance with Section 58 of the Environmental Management and Coordination Act (EMCA) No.8 of 1999 Second Schedule Part 3 (a), and the Environment (Impact Assessment and Audit) Regulations 2003/ 2018. Environmental quality conservation aspects of this project will be realized through the implementation of the Environmental and Social Management Plan aimed at mitigating the potentially negative impacts and enhancing the potentially positive impacts predicted through this ESIA study.

The Environment (Impact Assessment and Audit) Regulations, 2003

The Regulations supplements EMCA, 1999. In the following Sections, the regulation states that;

10. (1) On determination of the project report, the decision of the Authority, together with the reasons thereof, shall be communicated to the proponent within forty-five days of the submission of the Comprehensive Project Report (CPR). (2) Where the Authority is satisfied that the project will have no significant impact on the environment or that the CPR discloses sufficient mitigation measures, the Authority may issue a license in Form 3 set out in the First Schedule to these Regulations. (3) If the Authority finds that the project will have a significant impact on the environment and the CPR discloses insufficient mitigation measures, the Authority shall require that the proponent undertake an Environmental Impact Assessment study in accordance with these Regulations. (4) A proponent who is dissatisfied with the Authority's decision that an Environmental Impact Assessment study is required may within fourteen days of the Authority's decision appeal against the decision to the National Environmental Tribunal in accordance with regulation 46.

11. (1) An Environmental Impact Assessment study shall he conducted in accordance with terms of reference developed during the scoping exercise by the proponent and approved by the Authority-NEMA. (2) The terms of reference shall include matters required to be considered in the making of an

Environmental Impact Assessment as may be contained in the Second Schedule to these Regulations and such other matters as the Director General-NEMA may in writing require.

12. (1) An Environmental Impact Assessment study shall be conducted in accordance with the general Environmental Impact Assessment guidelines and sector Environmental Impact Assessment guidelines set out in the Third Schedule to these Regulations. (2) Sector environmental impact assessment guidelines shall be developed by the relevant lead agency in consultation with the Authority.

Environmental Management and Coordination (Water Quality) Regulations, 2006

This Legal Notice on Water Quality provides that anyone who discharges effluent into the natural environment shall be required to apply for Effluent Discharge License. The license for discharge is Ksh. 5,000 while annual license fee for discharge into the environment will be Ksh. 20,000 or 100,000 depending on the facility. Non-compliance with the regulations attracts a fine not exceeding Ksh. 500,000 and the polluter pay principle may apply depending on the court ruling. During the construction phase, the contractor shall obtain the necessary discharge permits. The contractor will abide by the conditions of the discharge license(s), which may include quality trend monitoring and data archiving.

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. The regulations provide for mitigation of pollution and handling of 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 (NEMA, 2006)

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

This regulation prohibits any person to cause unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. Part 11 section 6 (1) provides that no person shall cause noise from any source which exceeds any sound level as set out in the First Schedule of the regulations. The contractor will prepare a Noise Control Plan (NCP) to reduce the possibility of adverse noise impacts to human health in the project area.

Environmental Management and Co-ordination (Air Quality) Regulations, 2014

This regulation is referred to as "The Environmental Management and Coordination (Air Quality) Regulations, 2014". The objective of these Regulations is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. The general prohibitions state that no person shall cause the emission of air pollutants listed under First Schedule (Priority air pollutants) to exceed the ambient air quality levels as required/ stipulated under the provisions of the Seventh Schedule (Emission limits for controlled and non-controlled facilities) and Second Schedule (Ambient air quality tolerance limits). The regulations provides for the establishment of emission standards for various sources, including as mobile sources (e.g. motor vehicles) and stationary sources (e.g. industries) as outlined in the Environmental Management and Coordination Act, 1999. It also covers any other air pollution source as may be determined by the Minister in consultation with the Authority. The Regulations prohibits the Proponent from:

- ✓ Acting in a way that directly or indirectly cause or may cause air pollution to exceed levels set out in the second Schedule to the Regulations
- ✓ Allowing particulates emissions into the atmosphere from any source not listed in the six schedule of the Regulations
- ✓ Causing ambient air quality in controlled areas (listed in Schedule Thirteen) to exceed those stipulated under second Schedule.
- ✓ Allowing (during construction and demolition) emission of particulate matter above the limits stipulated in Second Schedule.
- ✓ Causing or allowing stockpiling or storage of material in a manner likely to cause air pollution.
- ✓ Causing or allowing emissions of oxides of nitrogen in excess of those stipulated in the eleventh Schedule of the Regulation

The Environmental Management and Co-ordination (Controlled Substances) Regulations, 2007; Legal Notice No. 73

The Controlled Substances Regulations defines controlled substances and provides guidance on how to handle them. The regulations stipulate that controlled substances must be clearly labelled with among other words, "Controlled Substance-Not ozone friendly" to indicate that the substance or product is harmful to the ozone layer. Advertisement of such substances must carry the words, "Warning: Contains chemical materials or substances that deplete or have the potential to deplete the ozone layer." Persons handling controlled substances are required to apply for a permit from NEMA. Products containing controlled substances include air conditioners, air coolers, refrigerants, portable fire extinguishers, heat pump equipment, dehumidifiers, insulation boards, panels and pipe covers, pre-polymers, etc. The proponent is thus required to comply with these regulation during the project implementation phase.

The Occupational Health and Safety Act (OSHA), 2007

This legislation provides for protection of workers (employees) during construction and operation phases. It is tailored at implementation of the EHS plan in compliance with the relevant sections of this Act. The following are some of the provisions of the act:

PART VI – HEALTH – GENERAL PROVISIONS

Cleanliness: Section 47

(1) Every workplace shall be kept in a clean state, and free from effluvia arising from any drain, sanitary convenience or nuisance, and, without prejudice to the generality of subsection (1)—

(a) Accumulations of dirt and refuse shall be removed daily by a suitable method from the floors and benches of workrooms, and from the staircases and passages;

(b) The floor of every workroom shall be cleaned at least once in every week by washing or, if it is effective and suitable, by sweeping or by any other method;

(c) All inside walls and partitions, and all ceilings or tops of rooms, and all walls, sides and tops of passages and staircase, shall:

i. Where they have a smooth impervious surface, at least once in every period of twelve months, be washed with hot water and soap or cleaned by other suitable method;

ii. where they are kept painted with oil paint or varnished, be repainted or varnished at least once in every period of five years, or such other period as the director may deem necessary, and at least once in every period of twelve months be washed with hot water and soap or cleaned by other suitable method; and

iii. In other cases, be kept whitewashed or colour washed, and the whitewashing or colour washing shall be repeated at least once in very period of twelve months.

(2) An occupier who contravenes the provisions of this section commits an offence.

Overcrowding: Section 48

1) An occupier shall ensure that his workplace shall not, while work is carried on, be so overcrowded as to cause risk of injury to the health of the persons employed therein.
2) Without prejudice to the generality of subsection (1) a workplace shall be of sufficient size for work to be carried out with ease and shall further have the necessary free space and , having regard to the nature of the work ,an adequate amount of air for each employee, the minimum permissible being ten cubic meters per person:
3) Provided that, in determining, for the purposes of this sub-section the amount of cubic space in any room, no space more than four point five metres from the floor shall be taken into account, and where a room contains a gallery, the gallery shall be treated for the purposes of this subsection as if it were partitioned off from the remainder of the room and formed a separate room.
4) Every workroom shall be not less than three metres in height, measured from the floor to the lowest point of the ceiling or, where there is no ceiling, to the lowest point of the roofing material.
5) Provided that, if the Director is satisfied that owing to the special conditions under which the work is carried on in any workroom the application of the provisions of this subsection to that workroom would be inappropriate or unnecessary, he may by certificate in writing exempt the work room from those provisions subject to any conditions specified in the certificate.

Ventilation: Section 49

(1) An occupier shall ensure that effective and suitable provision is made for securing and maintaining, by the circulation of fresh air in each workroom, the adequate ventilation of the room.

(2) The Minister may by rules, prescribe a standard of adequate ventilation for workplaces or for any class or description of workplaces or part thereof and for any other places of work.

(3) An occupier who contravenes the provisions of this section commits an offence

Lighting: Section 50

(1) An occupier shall ensure that effective provision is made for securing and maintaining sufficient and suitable lighting, whether natural or artificial, in every part of his workplace in which persons are working or passing.

(2) All glazed windows and skylights used for the lighting of workrooms shall, so far as practicable be kept clean on both the inner and outer surface and free from obstruction. Provided that this subsection shall not affect the white-washing or shading or windows and skylights for the purpose of mitigating heat or glare.

(3) Nothing in subsections (2) and (3) or in any rules made there under, shall be considered as enabling direction to be prescribed or otherwise given as to whether any artificial lighting is to be produced by any particular source of light.

50.(1) An occupier shall ensure that effective provision is made for securing and maintaining sufficient and suitable lighting, whether natural or artificial, in every part of his workplace in which persons are working or passing.

Work Injury Benefits Act 2007 (WIBA)

This is an Act of Parliament to provide for compensation to employees for work related injuries and diseases contracted in the course of their employment and for connected purposes.

PART II — OBLIGATIONS OF EMPLOYERS

Section 7: Employer to be insured

(1) Every employer shall obtain and maintain an insurance policy, with an insurer approved by the Minister in respect of any liability that the employer may incur under this Act to any of his employees.

(2) The Minister may exempt from the provisions of sub-section (1), an employer who provides and maintains in force a security which complies with the requirements of subsection (3), and any exemption under subsection (3) shall continue in force only so long as the security is maintained.

(3) For the purposes of subsection (2), a security shall consist of an undertaking by a surety approved by the Minister to make good, subject to any conditions specified in the security, any failure by the employer to discharge any liability which the employer may incur under this Act to any of its employees up to an amount approved by the Minister.

(4) Any employer who contravenes the provisions of subsection (1) commits an offence and shall on conviction be liable to a fine not exceeding one hundred thousand shillings or to imprisonment for a term not exceeding three months, or to both.

(5) If the contravention in respect of which an employer is convicted is continued after the conviction, the employer is guilty of a further offence and liable in that respect to a fine not exceeding ten thousand shillings for each day on which the contravention continues.

Section 8: Registration of employer.

(1) Every employer carrying on business in Kenya shall within the prescribed period and in the prescribed manner –

(a) Register with the Director;

(b) Furnish the Director with the prescribed particulars of their business; and

(c) Within a period determined by the Director furnish additional particulars as the Director may require.

(2) The particulars referred to in subsection (1) shall be furnished separately in respect of each business carried on by the employer.

(3) An employer shall, within thirty days of any change in the particulars so furnished notify the Director of such change.

PART III — RIGHT TO COMPENSATION

Section 10: Right to compensation

(1) An employee who is involved in an accident resulting in the employee's disablement or death is subject to the provisions of this Act, and entitled to the benefits provided for under this Act.

(2) An employer is liable to pay compensation in accordance with the provisions of this Act to an employee injured while at work.

(3) An employee is not entitled to compensation if an accident, not resulting in serious disablement or death, is caused by the deliberate and wilful misconduct of the employee.

(4) For the purposes of this Act, an occupational accident or disease resulting in serious disablement or death of an employee is deemed to have arisen out of and in the course of employment if the accident was due to an act done by the employee for the purpose of, in the interests of or in connection with, the business of the employer despite the fact that the employee was, at the time of the accident acting:-

(a) In contravention of any law or any instructions by or on behalf of his employer; or

(b) Without any instructions from his employer.

(5) For the purposes of this Act, the conveyance of an employee to or from the employee's place of employment for the purpose of the employee's employment by means of a vehicle provided by the employer for the purpose of conveying employees is deemed to be in the course of the employee's employment.

(6) For the purposes of this section, an injury shall only be deemed to result in serious disablement if the employee suffers a degree of permanent disablement of 40 % or more.

PART VII — MEDICAL AID

First Aid Section 45

(1) An employer shall provide and maintain such appliances and services for the rendering of first aid to his employees in case of any accident as may be prescribed in any other written law in respect of the trade or business in which the employer is engaged.

(2) Any employer who fails to comply with the provisions of sub-section (1) commits an offence.

(3) The Minister may, after consultation with the Council, by notice in the Gazette exempt an employer or class of employers from application of this section.

Section 46: Conveyance of injured worker

(1) If an employee is injured in an accident, which necessitates the employee's conveyance to a hospital medical facility or from a hospital or medical facility to the employee's residence, the employer shall make the necessary conveyance available.

The Kenya Civil Aviation Act, Cap 394

The Act mandates KCAA to authorize and approve the usage of the flight path for the purpose of ensuring the safety of flying aircraft over the proposed project area. The proponent shall comply with the provisions of the Act in seeking authorization from KCAA for the proposed residential development project as it lies in the KAA flight. The proponent is advised to obtain this permit for the appropriate height for the project construction as advised by the Kenya Civil Aviation Authority, through the questionnaire filled and annexed in this report.

The Water Act, 2016

The Act vests the rights of all water to the state, and the power for the control of all body of water with the Cabinet Secretary, the powers is exercised through the Cabinet Secretary and the Water Resources Authority in consultation with the regional water resources boards. It provisions aim at the conservation of water, apportionment, and use of water resources. Part II, section 18, of the Principal Act provides for national monitoring and information archiving system on water resources. Following on this, sub-section 3 allows the Water Resources Authority (WRA) to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specific records may require to be kept by a facility operator and the information thereof furnished to the authority.

Section 25 of the Act requires a permit to be obtained for any use of water from a water resource, and the discharge of a pollutant into any water resource. Under Section 29, application for such a permit shall be subject to public consultation as well as an Environmental Impact Assessment in line with the Environmental Management and Coordination Act, Cap 387. The conditions of the permit may also be varied if the Authority is of the opinion that the water so used is causing deterioration of water quality or causing shortage of water for other purposes for which the Authority lays a higher priority. This is provided for under section 35 of the Act.

Section 73 of the Act allows a person, who has been granted a license to supply water (licensee), to make regulations for purposes of protecting against degradation of their water source(s). Under the Section, the licensee could be a local authority, a private Trust or an individual, and enforcement will under the supervision of the Regulatory Board with jurisdiction. Section 76 states that no person shall discharge any trade effluent from any trade premises into sewers of a licensee without the consent of the licensee upon application indicating the nature and composition of the effluent, maximum quantity anticipated, flow rate of the effluent and any other information deemed necessary. The consent shall be issued on conditions including the payment rates for the discharge as may be provided under section 77 of the same Act.

The proposed project shall require large quantities of water during the construction phase and generation of equally large volumes of surface run-off during construction and operations. The contractor shall seek the necessary permits to obtain water and shall abide by the conditions attached to the permit(s).

Climate Change Act No. 11, 2016

The Act applies to the development, management, implementation and regulation of mechanisms to enhance climate change resilience and low carbon development for the sustainable development of Kenya. Without prejudice to subsection (1), the Act is applicable in all sectors of the economy by the national and county governments to: mainstream climate change responses into development planning, decision making and implementation; build resilience and enhance adaptive capacity to the impacts of climate change; formulate programs and plans to enhance the resilience and adaptive capacity of human and ecological systems to the impacts of climate change; mainstream and reinforce climate change disaster risk reduction into strategies and actions of public and private entities; promote low carbon technologies, improve efficiency and reduce emissions intensity by facilitating approaches and uptake of technologies that support low carbon, and climate resilient development; facilitate capacity development for public participation in climate change responses through awareness creation, consultation, representation and access to information; mobilize and transparently manage public and other financial resources for climate change response; provide mechanisms for, and facilitate climate change research and development, training and capacity

building; mainstream the principle of sustainable development into the planning for and decision making on climate change response; and integrate climate change into the exercise of power and functions of all levels of governance to enhance cooperative climate change governance between the national and county governments.

The public Health Act (Cap. 242)

The Public Health Act has no environmental protection standards. The Act is primarily concerned with the protection of the quality of water supplies and sources used for human, domestic and animal consumption. It contains provisions against environmental pollution by what it describes as "nuisance" that would result in the pollution of the environment by gaseous emissions, solid wastes and liquid effluent in order to protect public health. The Proponent and the contractor are legally bound by this Act to prevent this from happening.

Energy (Solar Water Heating) Regulations, 2012

Regulation 3, make provision for installation of solar water heating system in all premises within the jurisdiction of a local authority with hot water requirements of a capacity exceeding one hundred litres per day to install and use solar heating systems. The responsibility for compliance as per regulation 6 is imposed on:

- Developer of a housing estate, a promoter of the construction, an owner of the premises or an Architect or an Engineer engaged in the design or construction of premises.
- An owner of premises, architect and an engineer engaged in the design, construction, extension or alteration of premises shall incorporate solar water heating systems in all new premises designs and extensions or alterations to existing premises.
- An owner or occupier of premises that has a solar water heating system shall use and carry out the necessary operational maintenance and repairs required to keep the installation in good and efficient working condition.
- An electric power distributor or supplier shall not provide electricity supply to premises where a solar water heating system has not been installed in accordance with these Regulations.
- An owner or occupier to whom these regulations apply may investigate the inclusion of the relevant solar water heating system into a project to be registered under any carbon finance mechanism that may be established from time to time including the Clean Development Mechanism (CDM).

A person who contravenes the provisions of this regulation commits an offence and shall be liable, on conviction, to a fine not exceeding one million shillings, or imprisonment for a term not exceeding one year, or to both. (GOK, 2012).

Urban and Cities Act No 13 of 2011

The Act came into function with regard to Article 184 of the Constitution providing regulations on the classification, governance and management of urban areas and cities and further providing the criteria of establishing urban areas. Part III of the Act gives the regulations and functions of every city or municipality with regard to integrated development plans, which shall include but not limited to environmental plans and disaster preparedness, within the area of jurisdiction in achieving objects of devolved governments under section 174 of the constitution while maintaining the socio-economic rights of the people. Moreover, in the first schedule, the Act enlists the services that any municipality shall provide to its residents which include but not limited to traffic control and parking, water and

sanitation, refuse collection, solid waste management, pollution abatement services among others (GOK, 2011).

Physical Planning Act (Cap 286)

The local Authorities are empowered under section 29 of the Act to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section, therefore allows for the prohibition or control of the use and development of land and buildings in the interest of proper and orderly development of an area. Section 36 states that, if in connection with a development application, the local Authority is of the opinion that the proposed development activity will have a injurious impact on the environment, the applicant shall be required to submit together with the application an EIA report. The proposed project is in complete cognizance with the provisions of the Physical Planning Act, as it going to sit on land already approved by the County Government of Machakos (Mavoko Sub-county).

County Government Act, 2012

Section 109 of the County Government Act (2012) helps counties to ensure effective coordination of spatial developments. Sub - section (2) part C states in part; a spatial county plan shall;

- Indicate desired patterns of land use within the county;
- Address the spatial construction or re-construction of the county;
- Provide strategic guidance in respect of the location and nature of development within the county
- Set out basic guidelines for a land use management system in the county taking into account any guidelines, regulations or laws as provided for under Article 67(2) (h) of the Constitution;
- Set out a capital investment framework for the county's development programs; and
- Contain a strategic assessment of the environmental impact of the spatial development framework.

The Penal Code (Cap 63)

Section 191 of the Penal Code states that if any person or institution that voluntarily corrupts or foils, water for public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offense. Section 192 of the same Act says a person who makes or vitiates the atmosphere in any place to make it noxious to the health of persons/institution, dwelling or business premises in the neighbour-hood or those passing along public way, commits an offense. The vitiation of the atmosphere, corruption of and foiling of the water springs is not an inherent quality of the proposed project's nature. None the less the operational aspects of the project have significantly foreseeable negative impacts. Enforcement of this Act in complimentary with all the aforementioned environmental systems, conserving policies and specific Acts will achieve the desired goals and objectives in this respect. The officers of Machakos County Government with jurisdiction will exercise due diligence.

The National Construction Authority Act (NCA), 2011

The National Construction Authority Act, Number 41 of 2011 is set to streamline, overhaul and regulate the construction industry in Kenya. The industry has for many years suffered poor legislative framework and has been dominated by quacks and unqualified persons. The industry has also suffered a lot of competition from foreign contractors who are seen to offer cheaper and more quality work. The new Act is a win for the public as it guarantees public safety. All contractors must be registered with the Authority-NCA, meaning that shady contractors and quacks will be locked out of the industry. It is an offence to carry out any construction work without first having been registered

with the Authority. The Contractor who will undertake the project will be one who is registered by NCA. The Act also outlines that every development projects must be registered and subsequent construction permit secured from the Authority prior to commencement of the project activities.

The Environment and Land Court Act, 2011

This is an Act of Parliament that gives effect to Article 162 (2) (b) of the Constitution to establish a superior court to hear and determine disputes relating to the environment and the use or occupation of land. The Environment and Land Court is one of the courts contemplated by article 162 (2). It is a Superior Court and has the same status as the High Court. The court is established under section 4 of the Environment and Land Court Act No. 19 of 2011. It has jurisdiction to hear any other dispute relating to environment and land. The jurisdiction of the court is provided under section 13 of the Act. The court has powers to deal with disputes relating to land administration and management. The court is also empowered to hear cases relating to public, private and community land and contracts or other instruments granting any enforceable interests in land. The court also exercises appellate jurisdiction over the decisions of subordinate courts or local tribunals in respect of matters falling within the jurisdiction of the Court. The court further exercises supervisory jurisdiction over the subordinate courts, local tribunals, persons or authorities in accordance with Article 165(6) of the Constitution.

Employment Act 2007

This is an Act of parliament that applies to all employees employed by any employer under a contract of service. The Act came in operation in June 2008. Employment of children is prohibited under this Act.

The Labour Relations Act, 2007

The principal objective of this Act is to provide a legal framework to promote freedom of association and the right to collective bargaining, to streamline the registration process of trade unions, employees organizations and federation of trade unions and employers; organizations to provide mechanisms for the effective management of property, funds and accounts of trade unions , employers organizations and their respective federations, and to promote expedition and conclusive dispute settlements. It provides for establishment and registration of trade unions and employers organization. It sets out the procedure for the application and consequences of registration and also provides for suspension and cancellation of registration of trade unions and employers organizations.

4.3.2 INTERNATIONAL CONVENTIONS AND TREATIES

United Nations Framework Convention on Climate Change (UNFCCC), 1992

The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

African Convention on Conservation of Nature and Natural Resources (1968)

It requires the adoption and implementation of measures necessary to achieve the objectives of this Convention, in particular through preventive measures and the application of the precautionary principle, and with due regard to ethical and traditional values as well as scientific knowledge in the interest of present and future generations. Of particular interest to the housing complex is the requirement to prevent pollution, or any other form of land degradation on land or soil and water; Make provision for prevention of detrimental effects of processes and activities affecting the environment and natural resources as well as the promotion of Sustainable Development (African Union, 1968).

Kyoto Protocol

The essence of the Kyoto Protocol is that it calls for nations to commit themselves to reducing GHG emissions.

Some of the principal concepts of the Kyoto Protocol are:

1) The main feature of the Protocol is that it establishes legally binding commitments to reduce emissions of greenhouse gases. The commitments are based on the Berlin Mandate, which is a part of UNFCCC negotiations leading up to the Protocol.
2) Implementation: In order to meet the objectives of the Protocol, Annex I Parties are required to prepare policies and measures for the reduction of greenhouse gases in their respective countries. In addition, they are required to increase the absorption of these gases and utilize all mechanisms available, such as joint implementation of the Clean Development Mechanism and emissions trading, in order to be rewarded with credits that would allow more greenhouse gas emissions at home.
3) Minimizing impacts on developing countries by establishing an Adaptation Fund for Climate Change.
4) Accounting, reporting and reviewing in order to ensure the integrity of the Protocol.
5) Compliance: Establishing a Compliance Committee to enforce compliance with the commitments under the Protocol.

Paris Agreement.

The Paris Agreement establishes the main framework for cooperative action on climate change beyond 2020 and will replace the Kyoto Protocol.

The key elements

1. To keep global increase in temperatures "well below" 2^0C (3.6F) above pre-industrial times and "endeavor to limit" them even more, to 1.5^0C
2. To limit the amount of greenhouse gases emitted by human activity to the same levels that trees, soil and oceans can absorb naturally, beginning at some point between 2050 and 2100
3. To review each country's contribution to cutting emissions every five years so they scale up to the challenge.
4. For rich countries to help poorer nations by providing "climate finance" to adapt to climate change and switch to renewable energy.

Safety Provision (Building) Convention 1937

This Convention applies to all construction activities, namely building, civil engineering, and erection and dismantling work, including any process, operation or transport on a construction site, from the preparation of the site to the completion of the project. The Convention describes the term 'construction' as;

1. building, including excavation and the construction, structural alteration, renovation, repair, maintenance (including cleaning and painting) and demolition of all types of buildings or structures;
2. civil engineering, including excavation and the construction, structural alteration, repair, maintenance and demolition of, for example, airports, docks, harbors, inland waterways, dams, river and avalanche and sea defence works, roads and highways, railways, bridges, tunnels, viaducts and works related to the provision of services such as communications, drainage, sewerage, water and energy supplies;
3. the erection and dismantling of prefabricated buildings and structures, as well as the manufacturing of prefabricated elements on the construction site;

Article 6 states that: Measures shall be taken to ensure that there is co-operation between employers and workers, in accordance with arrangements to be defined by national laws or regulations, in order to promote safety and health at construction sites while Article 12, Section 1, States that the National laws or regulations shall provide that a worker with the right to remove himself from danger when he has good reason to believe that there is an imminent and serious danger to his safety or health, and the duty so to inform his supervisor immediately.

Convention on Biological Diversity (CBD), 1993

Signed by 150 government leaders at the 1992 Rio Earth Summit, the Convention on Biological Diversity is dedicated to promoting sustainable development. Conceived as a practical tool for translating the principles of Agenda 21 into reality, the Convention recognizes that biological diversity is about more than plants, animals and micro-organisms and their ecosystems. It is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live. It has three main objectives: 1) the conservation of biological diversity; 2) the sustainable use of its components; and 3) the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

4.4 THE NATIONAL ADMINISTRATIVE FRAMEWORK

4.4.1 THE NATIONAL ENVIRONMENT COUNCIL, (NEC)

EMCA 1999 No. 8 part III, section 4 outlines the establishment of the National Environment Council (NEC). NEC is responsible for policy formulation and directions for the purposes of EMCA; set national goals and objectives and determines policies and priorities for the protection of the environment and promote co-operation among public departments, local authorities, private sector, non-governmental organizations and such other organizations engaged in environmental protection programs.

4.4.2 THE NATIONAL ENVIRONMENTAL TRIBUNAL, (NET).

The National Environment Tribunal (NET) is established under section 125 and Part XII of the Environmental Management and Coordination Act (EMCA) No. 8 of 1999. Its principal function is to receive, hear and determine appeals arising from decisions of the National Environment Management

Authority (NEMA) on issuance, denial or revocation of Environmental Impact Assessment (EIA) licenses, among other decisions. Such licenses are, in effect, statutory permission to undertake developments of specified nature. The function arises from EMCA's enumeration (in the Third Schedule) of certain kinds of developments that require EIA and thereafter, NEMA's issuance of EIA license, without which the specified developments cannot proceed.

4.4.3 THE NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY, (NEMA)

The objective and purpose for which NEMA is established is to exercise general supervision and co-ordinate over all matters relating to environment and to be the principal instrument of the government in the implementation of all policies relating to the environment. NEMA's mandate is designated to the County Environment Committees.

4.4.4 THE COUNTY ENVIRONMENT COMMITTEES, (CECS).

According to EMCA, 1999 No. 8, section 40, the following sub-sections states that:

1) Every County Environment Committee shall, within one year of the commencement of this Act and every five years thereafter, prepare a county environment action plan in respect of the county for consideration and adoption by the County Assembly.
2) Every County Environment Committee, in preparing a county environment plan, shall undertake public participation and take into consideration every other county environment action plan already adopted with a view to achieving consistency among such plans.
3) The respective County Executive Committee members of every county shall submit the county environment action plan referred to in subsection (1) to the Cabinet Secretary for incorporation into the national environment action plan referred to in section 37.
4) The Authority shall consider every county environment action plan and either recommend incorporation of such plan into the national environment action plan or specify changes to be incorporated into a respective county environmental plan.
5) The Cabinet Secretary shall, on the recommendation of the Authority, issue guidelines and prescribe measures for the preparation of environmental action plans.

4.4.5 NATIONAL ENVIRONMENTAL COMPLAINTS COMMITTEE, (NECC)

The Committee performs the following functions:

- Investigate any allegations or complaints against any person or against the Authority in relation to any environmental condition in Kenya and on its own volition, any suspected case of environmental degradation and to report findings together with its recommendations thereon to the Council.
- Prepare and submit to the Council periodic reports of its activities which shall form part of the annual report on the state of the environment under section 9 (3)
- To perform such other functions and exercise such powers as may be assigned to it by the Council.

Table 7: The Regulatory Agencies Relevant to the Project

No.	Institution	Envisioned role in the proposed project	Project phase required
1.	National Environment Management Authority	Issuance of EIA license and Monitoring for Compliance with conditions and environmental law	Construction, operation and decommissioning
2.	Kenya Civil Aviation Authority	Permit/ approval on the number of metres high above ground for the proposed construction	Pre- construction and operation
3.	Machakos County Government	Approval of plans and building inspections, issuance of licenses	Planning and pre-construction
4.	Physical Planning Department-Mavoko Sub-county	Building certifications	Planning, pre-construction and construction
5.	Directorate of Occupational Safety and Health Services	Ensure safety of workers at construction site	Construction and operation
6.	National Construction Authority	Project Registration and Certification	Planning and pre-construction
7.	Mavoko Water and Sewerage Company	Permit to connect to the sewer line in the project area	Planning and pre-construction

CHAPTER FIVE: ANALYSIS OF ALTERNATIVES TO THE PROJECT

This section outlines the main alternatives provided by the applicant, an evaluation of the impacts of each alternative with clear information on the criteria used to assign significance and an indication of the main reasons for choosing the proposed development taking into account the environmental impacts.

- No Project Alternative
- The Alternative Site
- Waste management alternatives
- Project development with mitigation measures.

5.1 NO PROJECT ALTERNATIVE

The "No development option" entailed leaving the current status of the site as it is. The environmental effects of the proposed development will be avoided making the option desirable considering the state of the environment. If this is the case, one of the main reasons for developing the site - provision of housing - will not be realized. A significant investment of investment to be spent in building material, employment etc including housing opportunities besides the potential of the project stimulating development in the area will not be realized. This option implies economic loss to the proponent, local and national economies. Already a substantial monetary commitment has been made in the procurement of the proposed site, development of building plans as well as designs. In case the project is not implemented, all the participants such as the designers, the local and national authorities, the contractors, materials suppliers and the workers in the development chain will lose economic gains that would have otherwise been realized during project life. Generally, the nil development option will be retrogressive in view of the current economic situation and the Government's efforts to achieve middle income country by year 2030 as envisaged in Vision 2030 and as per the Big Four Agenda where housing is inclusive. From the analysis, it becomes apparent that the No Project Alternative is not the appropriate alternative.

5.2 ALTERNATIVE SITE

Pursuing a change of site alternative on the other hand requires that the project be implemented at an alternative site other than the one already acquired. This would entail purchasing an alternative piece of land. 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. The project proponent however has access to only this property for the stated development. The resultant effect of changing the site would be increase in timeframe and resources required to realize the development. The unpredictability of financial resources and the lag time required in acquiring and designing the development may also mean that the project may be unable to break even once implemented. While we appreciate that 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.

5.3 WASTE MANAGEMENT ALTERNATIVES

Solid and liquid wastes will be generated from both the project construction and operational phases.

Solid Waste

Solid wastes will be collected from the site for safe disposal by a NEMA licensed waste collector after necessary contractual agreement during both construction and operational phases. For solid wastes management, an integrated solid waste management system is recommended which is as follows. a) First the proponent should give priority to reduction at source of the materials. This option will demand a solid waste management awareness programme. b) The proponent should also consider recycling and reusing of the waste as a second alternative in priority. This shall call for at source separation programme to be put in place. The recyclables may be sold to waste buyers locally or directly to any company that recycles waste such as plastic bags. c) The third priority in the hierarchy of options is landfilling of the waste that is not recyclable or reusable. It is to the interest of the proponent and the community that the waste is effectively managed so as to maintain a safe and healthy environment to the workers and the community at large through appropriate disposal mechanism.

Liquid Waste

Liquid wastes in the facility will be managed through connection to MAVWASCO sewer line during operational phase. As an alternative liquid waste management plan option, we advise the proponent to consider installing an onsite waste water management system on the complex so that in the event that the municipal sewer system would be dysfunctional or out of operations. This will ensure that the proponent manages its liquid waste in a sustainable manner.

5.4 THE COMPARISON OF ALTERNATIVES

Various alternative designs and technology have been evaluated by the proponent and various professionals involved. 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.

Under the proposed Development Alternative, the project would create more and standard housing stock and business premises 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. The layout re-design may perhaps give an optimal design and should be explored for optimization of the benefits and environmental enhancement. However, provided the proposed mitigation measures are implemented as well as adoption of sound construction management practices, the identified negative impacts will be avoided/minimized. The proponent commitments related to development alternative will ensure that potential project impacts are minimized to levels of insignificance as envisaged in the ESMP.

5.5 SELECTED SITE ALTERNATIVE

Pursuit of this alternative will entail going forward with the development but taking into account all the potential impacts on the biophysical environment by incorporating and integrating the recommended mitigation and enhancement measures into the project designs and implementation.

The proposed site provides a most suitable site for the project as it is currently owned by the proponent and is in harmony with the existing land uses; it is situated next to Mombasa Road hence ease of access as well as the ease to connect to Kenya Power and MAVWASCO lines which are essential utilities for the proposed project. With these advantages, presence of the indicated facilities and from the findings of this Impact Assessment study, the existing designs provide the optimum alternative for implementing and operating the proposed housing apartment's project subject to the effective implementation of the proposed ESMP. Prior to any development, the proponent was required to conduct public consultations and obtain feedback from the community on their views concerning the proposed project as part of the ESIA exercise.

Through the Social Impact Assessment process, the proponent got to know and learn more on the views of the residents about the proposed development and therefore shall incorporate the appropriate measures in order to be in line with the needs of the community before implementation of the project. The selected alternative will be enhanced through appropriate mitigation measures, including due diligence and best construction management practices that will help protect the physical, ecological and socio-economic environment of the project area. Commitments included in this ESIA Study report, as well as licenses and other authorizations that would be issued, are all designed or geared to avoid environmental damage in accordance with the Environmental Management and Co-ordination Act, 1999 (Amendments, 2015). The proponent undertakes to incorporate all necessary measures to ensure adverse impacts are mitigated to the maximum extent practicable during the entire project life cycle.

CHAPTER SIX: PUBLIC PARTICIPATION, CONSULTATION AND OCCUPATIONAL HEALTH & SAFETY.

6.1 CONSULTATION AND PUBLIC PARTICIPATION (CPP)

Public consultation is useful for gathering environmental data, understanding likely impacts, determining community and individual preferences, selecting project alternatives and designing viable and sustainable mitigation plans. The welfare of human societies and the quality of life is directly linked to sustainable use of our natural resources. This has been duly recognized in Agenda 21, where it is stated that: *"Special attention should be paid to the demand for natural resources generated by unsustainable consumption and to the efficient use of those resources consistent with the goal of minimizing depletion and reducing pollution."* According to International Finance Corporation (1998), Public Consultation ".is a tool for managing two-way communication between the project sponsor and the general public. Its goal is to improve decision making and build understanding by actively involving individuals, groups and organizations with a stake in the project. This involvement increases a project's long term viability and enhance its benefits to locally affected people and other stakeholders." Public consultation is also key in creating awareness of any project's anticipated impacts as well as plays a very important role in gaining agreement on the management and technical approaches in order to maximize benefits and reduce negative consequences. Consultation with members of the public ensures project ownership and reduces financial risks (that may be occasioned by delays, legal disputes or negative publicity), direct cost savings, increased market share (through good public image) in addition to enhanced social benefits to local communities.

During ESIA Studies, the Environmental Management and Co-ordination (Amended) Act, Cap 387 requirements read together with EIA/EA Guidelines of 2003 (2018) require that the general public and key stakeholders are consulted on the impacts to the environment that may be occasioned by projects either in the public or private domain. The Constitution of Kenya further provides a strong foundation for participatory governance. While the Constitution does not use the term community engagement, it is replete with provisions on public participation, and establishes public participation as a key value and principle in governance. As per EMCA regulations and NEMA requirements, there are usually two forms of public involvement in the EIA process. The first is direct involvement of the affected public or community in public consultations during the ESIA study. These consultations allow the developer to provide information to the public about the project and to determine what issues the public wishes to see addressed. Community interaction and transparency is a critical area of focus for the success of this development. The extent and results of the consultations undertaken so far have been included in this ESIA report. The second level of involvement is at the discretion of the Authority - NEMA and takes place after the ESIA Study Report, if any, has been prepared and after the applicant has provided the information needed for adequate review by NEMA and the public. Public disclosure on the other hand is important as it is critical to the effective participation of project-affected populations. An informed public is more likely to understand the trade-offs between project benefits and its demerits; be able to contribute meaningfully to project design; and have greater trust in the project proponent.

For purposes of the ESIA process, public consultation and disclosure process is conducted for any project to intimate the community about the project, its activities and associated benefits, impacts, risks etc. so that people can participate in the project activities in an informed manner and can raise their concerns to be addressed. This consultation process effectively manages public apprehensions, identifies control measures for these apprehensions in association with the public stakeholder and

also facilitates implementation of the identified measures. Public participation tries to ensure that due consideration is given to public values, concerns and preferences when decisions are made. It encompasses the public actively sharing in the decisions that government and other agencies make in their search for solutions to issues of public interest.

Public consultation in this project was carried out with the following aims:

- ✓ To inform the local people, leaders and other stakeholders about the proposed residential project and its objectives.
- ✓ Create public awareness about the proposed project
- ✓ Seek views, public opinions and concerns relating to the project and more specifically problems they anticipate and ways of overcoming them.
- ✓ Obtain professional advice from sector heads including departmental heads and local administration within the Project Area of Influence.
- ✓ Consultatively and in a participatory way identify potential positive and negative impacts of the project and seek remedial measures for adverse impacts.

6.2 IDENTIFICATION OF STAKEHOLDERS

As a developer, it is essential to know the people who may be impacted by a project and who may have an influence on its ultimate success. Communities are not homogeneous and are comprised of people with different lived realities and different interests and concerns relating to development. Multiple discussions with other stakeholder groups are critical to triangulate information collected from various tools and resources. As such, discussions with the resident communities and government agencies should be reviewed side-by-side to get the correct picture. The effectiveness of the ESIA is directly linked to the degree of continuing involvement of those affected directly or indirectly by the project. A stakeholder analysis was undertaken to identify all the potential stakeholders of the project. They included: local administration; Government Agencies; Local Residents and associations; Institutional stakeholders and the general public in the project area. The aim was to ensure that all stakeholder interests were identified and incorporated in project development: at the planning, implementation and operation phases. The stakeholder engagement process was carried out at two levels; local residents and County / National Governing bodies. Different communication methods and time were also framed.

Two main categories of stakeholders were identified, including:

1 **Primary stakeholders:** This group included those who are directly affected by the project either positively or negatively. They included the different residents within Kwambemba area in Syokimau as well as Airport 67 Hotel.

2 **Secondary stakeholders:** This group included those interested parties with no direct impact from the project. They comprise of respective government agencies, local administration, and County government among others who have different mandates as per the different regulations within the country and Machakos County that are relevant to the proposed residential project. This category was consulted as Key Informants on sectoral policy and to advise the ESIA study on mitigation measures to be put in place to minimize adverse impacts in respective sectors. This category included Kenya Airports Authority, Kenya Civil Aviation Authority, Mavoko Sub-county departments and Mavoko Water and sewerage Company, all of which were engaged.

6.3 APPROACH TO PUBLIC PARTICIPATION AND CONSULTATION

Public participation as captured in EMCA regulations is a deliberative process in which the public is involved in problem solving or decision-making in policy formulation, legislation, or project implementation. It is a process by which community concerns, needs, and values are incorporated into government and corporate decision-making. Public participation recognizes the diversity of group aspirations, needs, and values, and permits collective decision-making, thereby allowing consensus designed to achieve more policies that are legitimate. The essence of public participation is to strengthen and deepen democratic governance. Residents of a proposed project have to live with the project if implemented. They have the most to gain if the project impacts are beneficial to them. Conversely, they have the most at stake if the project goes awry. Further, stakeholder input was vital at the earliest stage possible in project development as it informed the need for KCAA permit application and the same should continue throughout the project cycle. The approach undertaken for information disclosure and consultation at the ESIA stage involved the following key processes.

- ✓ Mapping and identification of key stakeholders such as primary and secondary and prioritizing them according to their influence;
- ✓ Conducting expert consultations, informal interviews and Key Informant Interviews;
- ✓ Assessing the influence and impact of the project on these stakeholder groups and vice versa; and
- ✓ Summing up of key findings and observations from the consultations.

The overall goal of the consultation process was to disseminate project information and to incorporate the views of the residents in the design of the Environmental and Social management Plan. The specific aims of the consultation process are to:

- Inform the public and all stakeholders of the details of the proposed residential apartments;
- Provide clear and accurate information about the project to the residential neighbours;
- Obtain the main concerns and perceptions of the population and their representatives regarding the project;
- Obtain opinions and suggestions directly from the affected residents and their preferred mitigation measures;
- Collect views on the positive and negative impacts anticipated by stakeholders and how these can be overcome;
- Improve project design and thereby minimise potential impacts; and
- Reduce problems of institutional coordination;

The tools utilized for the Public Participation and Consultation included the following:

- ✓ Key Informant Interviews;
- ✓ Informal Interview sessions/discussions;
- ✓ Two Public Meetings and Consultations as per Covid -19 protocols; and
- ✓ Socio-economic/ Household questionnaire administration.

6.4 DISCLOSURE AND CONSULTATION

Public consultations and engagement forums involved disclosing information on the proposed project and the anticipated potential impacts, both negative and positive. Primary and Secondary stakeholders were engaged to establish their view on the proposed project. A number of consultations were conducted during this phase of ESIA preparation. A combination of methods of information disclosure and consultation process was adopted at this stage. The method selected for

consultation was adopted keeping in mind the profile of the stakeholders, type of information desired and level of engagement required. The methods used in the consultation process were: Key Informant Interviews; Socio-economic Questionnaires; Public Meetings and a Stakeholder Engagements Forum. The consultation and information disclosure were held in a free and fair environment with giving prior information about the same to the participants.

6.5 MODALITIES OF CONSULTATION AND PARTICIPATION

The following techniques and instruments were used for public participation and consultation;

a) Photography and direct observation

Photography was particularly useful as it captured the real situation on the ground that was relevant to the study. Direct observation involved site viewing of the proposed project location to see the extent of the residential development. Observation were used during data collection exercise and as a means of ascertaining some of the issues raised during the public meetings and household survey. Notable issues such as economic, livelihoods and production systems, land use and settlement patterns and facilities as well as natural resources were all identified, enumerated and pictures of the same taken for documentation purposes. During the consultations relevant pictures were also taken for filing purposes.

b) Key Informant oral Interviews and Questionnaires

Key Informant Interviews were undertaken to obtain qualitative data regarding the proposed project. The Mavoko Sub-county Officials, Kenya Airports Authority (KAA), Kenya Civil Aviation Authority (KCAA), Airport 67 Hotel, Sheba Village Management and Mavoko Water and Sewerage Company were engaged and questionnaires completed as annexed in this report.

c) Public Meetings

Two public meetings were held near the proposed project site at Gallas Gardens, Syokimau. Prior to public meetings the local leaders (Chief and Assistant Chief) were consulted and meeting dates set. The local leaders then invited the immediate neighbours to the proposed project site. COVID-19 prevention measures were observed during these meeting, the attendees were divided into two groups and required to have facemasks, sanitize hands and social distancing ensured. The aim of these meetings was to get the public views concerning the proposed project; how it will affect them and their environment. These meetings enabled interested and affected parties to contribute their concerns (views and opinions on the proposed residential project) which might have been overlooked by the experts.

Plate 18: Experts Presenting at the First Meeting

Plate 19: A participant asking a question at the meeting

Plate 20: Meeting two ongoing at the same venue

Plate 21: Participants asking questions at the meeting two session

d) Environmental Household Questionnaires

Structured questionnaires were used to collect information from households in the project area. Both closed and open-ended questionnaires were administered to households, and small business enterprises neighboring the site. Concerns, views and opinions from all the respondents that were received are annexed in this report.

6.6 OVERALL OUTCOME OF CONSULTATIONS

Positive Impacts

- Avail affordable housing in the area;
- Improve security of the project area;
- The project will offer employment to the residents and improve the economic status of the proponent;
- Boost local business opportunities for the local traders and materials suppliers;
- Skills transfer to the local workforce; and
- Generate revenue to the national and county government;

Negative Impacts

- The project will lead to increased emission of air and pollutants;
- Project will lead to increased crime scenes of insecurity, thefts and immoral behaviour;
- Generation of solid waste;
- Generation of surface run-off and waste water;
- The project will generate noise and vibrations;
- Traffic increase along the access roads.
- Destruction of the local roads.

Table 8: Summary of Respondents feedback

	NAME	DISTANCE	CONTACT	POSITIVE IMPACTS	NEGATIVE IMPACTS
1	Daniel Kimunyi	500 m	0723175869	• Creation of jobs • Addition in housing units	Dust pollution
2	Lawrence Murimi	100m	0114790127	• Creation of job opportunities • Employment of youths	• Dust pollution • Air pollution
3	Oscar Bobby Mlama	300m	0754438647	• Employment opportunities	• Dust pollution • Air pollution • Waste water
4	Richard Onyango	250m	0719245763	• Job opportunities • Socio economic development • Development of infrastructure	• High living standards • Noise pollution • Dust pollution • Poor waste

	NAME	DISTANCE	CONTACT	POSITIVE IMPACTS	NEGATIVE IMPACTS
					disposal
5	Stacy Odhiambo	100m	0792035065	• Creation of job opportunities • Improved living standards • Socio-economic development • Improved infrastructure	• Poor waste disposal Noise pollution • Air pollution
6	Naomi Muyantet	1km	0748420626	• Improved living standards • Job opportunities • Improved security • Improved infrastructure	• Noise pollution • Poor waste disposal
7	Beverly Angadoesma Ayoo	1km	0113390035	• Job opportunities	• Dust pollution • Noise pollution • Generation of solid and liquid waste
8	Waititu Miana	2km	38053871	• Employment opportunities • Social development • Economic development • Population growth	• Air pollution • Dust pollution • Noise Pollution • Waste generation
9	Dennis Wambua	20m	0736546171	• Job opportunities • Development of infrastructure	• Dust pollution • Increased waste generation • Noise pollution • Cutting down of trees
10	Chris Ngenzi	300m	0715353398	• Increased residents in the area equating to more customers for businesses. • Increased value of land • Development of infrastructure	• Environmental degradation • Noise pollution • Air pollution • Increased population in small area • Insecurity

	NAME	DISTANCE	CONTACT	POSITIVE IMPACTS	NEGATIVE IMPACTS
11	John Makau	20m	0706653641	• Employment opportunities • Increased land value	• Noise pollution • Vegetation clearing
12	Hamzah Abdallah	100m	0798108869	• Employment • Additional housing • Business opportunities	• Dust pollution • Noise pollution
13	Pascal Mailu	2km	0710201476	• Job opportunities • Infrastructure development	• Dust pollution • Noise pollution • Tribalism may occur
14	Franklin Nzioki	100m	0706256913	• Housing development • Employment	• Noise pollution • Damaging roads • Dumping of waste • Sewer and drainage issues are anticipated
15	Brian Katuuti	1km	0714213629	• Employment of youths • Improved roads • Improved housing	• Solid waste generation • Air pollution • Noise pollution • Degradation of roads
16	Emmanuel Muiruri	500m	0701220101	• Community development • Employment opportunities • Security improvement	• Soil pollution • Noise pollution • Poor roads due to trucks bringing materials • Health impacts due to dust pollution
17	Michael Mbauka Musau	50m	0721441426	• Improved road network • Improved security • Quality accommodation • Better and accessible social amenities	• Noise pollution • Dust/air pollution • Road damages • Vibrations

	NAME	DISTANCE	CONTACT	POSITIVE IMPACTS	NEGATIVE IMPACTS
18	Naomi Ndila Nzioki	100m	0745689245	• Creation of job opportunities • Community growth • More residential places for locals	• Dust pollution • Solid waste generation • Noise pollution • Soil contamination
19	Mary Ongeri	100m	0703846614	• Employment	• Noise pollution • Air pollution • Increased strain in water resources
20	Latasha Wambui	100m	0718150899	• Employment opportunities • Improved infrastructure • Growth of the existing community	• Environmental pollution • Noise pollution • Overcrowding • Restrained distribution of resources e.g. water
21	Caren Bwari	100m	0743971115	• Job creation • Growth of new institutions e.g. schools, hospitals	• Air pollution • Noise pollution
22	Wamwene Maureen Mueni	150m	0759680662	• Creation of employment • Community growth • More residential opportunities	• Noise pollution • Dust pollution • Sewer generation • Road damage
23	Paul Mambo Mutisya	500m	0798325896	• Employment • Growth of the area • Security improvement	• Dust pollution • Speeding construction vehicles
24	Abigael Kerubo Okinyi	1km	0713080503	• Employment • More residential houses for tenants • Increased revenue to the government • Improved infrastructure	• Environmental pollution • Increased insecurity • Damaged feeder roads

	NAME	DISTANCE	CONTACT	POSITIVE IMPACTS	NEGATIVE IMPACTS
				• Improved environmental relationship	• Waste generation • Noise pollution •
25	Joseph Mutwii Joel	1km	0724623165	• Youth employment	• Emissions from trucks • Over speeding of trucks • Double parking • Noise pollution • Waste generation
26	Denis Mumo	2km	0714662362	• Job opportunities • Environmental changes	• Road damage • Noise pollution • Waste generation
27	Christopher Mule Benson	1km	0719703704	• Employment for locals • Improved lifestyles	• Air pollution • Road damage
28	Job Kariuki	500m	0763436357	• Employment • Housing • Revenue	• Dust emissions • Noise • Pollution
29	Ismael Kiptoo	500m	0784957272	• Increase of market for our goods • Eradication of bushy areas • Availability of housing	• Noise pollution • Dust pollution
30	David Osinde	600m	0712408974	• Job opportunity • Business opportunity • Security improvement	• Noise • Dust • Water pollution • Soil pollution
31	Festus Kikuvi	300m	0704425082	• Source of income	• Noise pollution • Air pollution
32	Francis Katumo	400m	0792276984	• Increased number of customers for the local businesses • Improved infrastructure	• Air pollution • Noise pollution

	NAME	DISTANCE	CONTACT	POSITIVE IMPACTS	NEGATIVE IMPACTS
				• Development of the area • Employment opportunities	
33	Lorine Auma Oremo	500m	0797955928	• Improved security • Creating employment to the youth • Increased residential apartments	• Air pollution • Noise pollution • Dust pollution • vibration caused by vehicles and machines • Water pollution
34	Festus Mwanzia	300m	0737470734	• Employment	• Air pollution

PUBLIC PARTICIPATION MEETING MINUTES FOR THE PROPOSED INDESIGN MAKUMBI RESIDENTIAL DEVELOPMENT AT L.R. No.7149/138 IN SYOKIMAU, MACHAKOS COUNTY.

DATE: 23RD APRIL 2020.

TIME: 10:00 AM – 11:30 AM

VENUE: GALLAS RESORT

MEETING ONE (1)

MEMBERS PRESENT.

1. David K. Muthaka – Area Chief
2. ESIA Team
    - Moses Muisyo
    - Edward Kamau
    - Julius Kuya
    - Elly Ogola
    - Calvince Ochieng
3. Community Members-See Attached Attendance Sheet

Agenda

1. ESIA Project Disclosure
2. Environmental Impact Social Assessment Process.
3. Need for ESIA Public Participation,
4. Project Impacts,
5. Public concerns/comments

Opening prayers and remarks.

The meeting started with opening remarks from the Chief and followed by prayers from, Abigael Kerubo, one of the resident members present. Mr. Edward Kamau, the Team Lead for Public Participation began by sensitizing the members about the proposed residential project.

Minute 1: Project Brief.

Mr. Kamau then invited one of the Environmental Experts- Mr. Kuya who gave the finer details including the project proponent-Indesign Makumbi Limited and the project features to the members present. Mr. Kuya informed the members that the project is currently seeking relevant Government approvals and would kick off once all approvals are acquired.

Minutes 2: Environmental Social Impact Assessment (ESIA) Process

Mr Kamau then explained that all development projects like the proposed Indesign Makumbi Residential Development must be subjected to an Environmental Social Impact Assessment as stipulated in EMCA Cap 387 as well as Environmental Impact Assessment/Environmental Audit Regulations, 2003. (Rev. 2018). The team explained that they are therefore conducting the ESIA for the proposed project to determine its environmental and socio-economic impacts and identify mitigation measures for the identified negative impacts.

Minute 3: Public Participation.

Mr. Kamau explained to the community members that the Constitution of Kenya requires that the members of the public be consulted before implementation of any project in their area. The community members and various stakeholders were thus requested to give their opinions freely and accept to fill the ESIA attendance sheet as proof that they were consulted during the meeting.

Minute 4: Project Impacts.

The Environmental Social Impact Assessment team explained to the community that the proposed project will have both positive and negative impacts. Some of the positive impacts associated with the proposed residential project include;

- Creation of direct and indirect employment opportunities
- Opening up of Syokimau area to investment opportunities
- Development of local infrastructure e.g. access roads
- Revenue generation to the National Government and Mavoko Sub-county

Some of Negative impacts associated with the proposed project include;

- Air pollution from project site – dust
- Solid waste generation
- Wastewater generation
- Influx of people in the project area
- Construction induced noise pollution and traffic congestion

However, the ESIA team stated that mitigation measures would be developed for the anticipated negative impacts associated with the proposed residential project.

Minute 5: Public concerns/comments

The community members through Social Impact Assessment process are given a chance to make suggestions and recommendations regarding the proposed residential development project. The members present were then requested to give their comments or questions regarding the project which were answered later in the meeting. Key issues raised included the following:

1. Mr. Christopher Muli started by thanking the Investors for bringing employment opportunities to both the skilled and the unskilled members of the Syokimau Community. He requested if the area people could be given first priority when the project starts. Mr. Kuya responded that it was a very good concern and that it will be noted down as a recommendation to the Proponent and contractors so that they can highly consider the locals residents. The same was further emphasized by Mr. Kamau who highlighted that employment opportunities will be based on experience and not the use of the list provided in the meeting.
2. The second question was from Madam Abigael Kerubo who wanted to know how Noise and Air pollution will be controlled within the site. She was also concerned on insecurity to the people around and also if there will be fair selection during employment. Mr. Kamau responded on pollution matters that there will be use of dust nets/ arrestors and sprinkling of water to reduce on dust. The proponent will also be advised on time to ensure working hours are from 8.00am to 5.00pm to limit noise in the area. He also responded on fair selection during employment by responding that they will try to be as fair as possible and also work on first come first serve basis.
3. Mr. Michael Mbaluka and Mrs. Abigael Kerubo wanted to know the plans which the proponent had in development of the minor roads leading to the project sites. Mr. Kuya clearly highlighted that the contractors will be recommended to sprinkle water during transportation of construction

material into the site and also improve the roads which will be used by tenants after completion of the project.

4. Mr. Muli further wanted to know if the client could assist in the construction of a footbridge within the Mombasa Road. The experts informed the resident members that, this was out of control for the proponent and the need for the footbridge can only be informed by KeNHA development plans in relation to the population of the project area.
5. Mr. Michael Mbaluka also inquired if there would be a borehole construction and also if there would be a sewerage connection within the proposed site. The response from Mr. Kuya was that in conjunction with MAVWASCO, they will be able to get water from EPZA Athi River. He also responded that in the case of a borehole drilling, all permits shall be sought from WRA. However, exploratory surveys are yet to be conducted for the presence of underground water. He also indicated that, the proponent will have an onsite sewerage treatment plant as a back up to the existing sewer where the proponent has proposed to channel his sewerage in controlling liquid effluents.

Final Remarks

The area Chief, Mr David K. Muthaka thanked the members for attending the meeting and gave final remarks before closing the meeting. He stressed on the issue of employment and if the people from his area could be given first priority. He also highlighted if the payment of workers can also be up to date within the construction sites based on previous complaints of underpayments that he has handled in his office previously. The area chief also touched on insurance issue and requested that it should be clear enough to each and every worker. He finally asked the members of his area to stop on issue of theft and insecurity within the construction sites.

Closing of the meeting.

The meeting ended with a closing prayer from Calvince Ochieng, followed by closing remarks from Mr. Kamau who thanked the members present for showing up and stressed to them that the project will not only bring benefits to the people of Syokimau but also to its environs at large. Members were requested to join for a cup of tea before leaving at own pleasure.

PUBLIC PARTICIPATION MEETING MINUTES FOR THE PROPOSED INDESIGN MAKUMBI RESIDENTIAL DEVELOPMENT AT L.R. No.7149/138 IN SYOKIMAU, MACHAKOS COUNTY

DATE: 23RD APRIL 2020.

TIME: 12:00 PM – 1:30 PM

VENUE: GALLAS RESORT

MEETING II (TWO)

MEMBERS PRESENT.

1. David K. Muthaka – Area Chief
2. ESIA Team
    - Moses Muisyo
    - Edward Kamau
    - Julius Kuya
    - Elly Ogola
    - Calvince Ochieng
3. Community Members-See Attached Attendance Sheet

Agenda

1. Project Brief
2. Environmental Impact Social Assessment Process.
3. Need for ESIA Public Participation,
4. Project Impacts,
5. Public concerns/comments

Opening prayers and remarks

The meeting started with opening remarks from the Chief who thanked the members for availing themselves before asking Stacy Odhiambo, one of the area members present to open the meeting with a word of prayer. There after the team welcomed the ESIA team members and Mr. Moses Muisyo, the Team Lead introduced the rest of the team members. He then began by sensitizing the members about the proposed residential project.

Minute 1: Project Brief

Mr. Kuya, one of the environmentalists present gave details in regard to the proposed project and features including disclosing the project proponent to the members. Mr. Kuya further informed the members that apart from the NEMA approval, the project was also seeking other Government approvals and would kick off once all approvals are acquired.

Minutes 2: Environmental Social Impact Assessment (ESIA) Process

Mr Kamau explained the need for the public participation as well as further explained that all development projects like the proposed Indesign Makumbi Residential Development must be subjected to an Environmental Social Impact Assessment as stipulated in EMCA Cap 387 as well as Environmental Impact Assessment/Environmental Audit Regulations, 2003. (Rev. 2018). He noted that the team was therefore conducting the ESIA for the proposed residential project to determine its

environmental and socio-economic impacts and hence the need to involve local residents to help identify potential negative impacts and help develop mitigation measures.

Minute 3: Public Participation

Mr. Edward Kamau as the Team Lead explained to the community members that the Constitution of Kenya requires that the members of the public be consulted before implementation of any project in their area. The community members and various stakeholders were requested to give their opinions freely and accept to fill the ESIA attendance sheet as proof that they were consulted during the meeting. The community members were also given a chance to give suggestions and recommendations regarding the proposed Indesign Makumbi residential development project. Mr Ogola had to ensure that all the Covid-19 rules were followed which included everyone having mask on and social distance is observed.

Minute 4: Project Impacts

The Environmental and Social Impact Assessment team explained to the community that the proposed residential project will have both positive and negative impacts. Some of the positive impacts associated with the proposed residential project include;

- Creation of direct and indirect employment opportunities.
- Opening up of Syokimau area to investment opportunities.
- Development of local infrastructure e.g. access roads used
- Revenue generation to the National Government and Mavoko Sub-county.

Some of Negative impacts associated with the proposed project include;

- Noise and Air pollution from project site
- Solid waste generation
- Wastewater generation
- Influx of people in the project area
- Construction induced noise pollution and traffic congestion

However, the ESIA team stated that mitigation measures would be developed for the anticipated negative impacts associated with the proposed residential project.

Minute 5: Public concerns/comments

The members present were requested to give their comments or questions regarding the project which were to be answered later.

1. The first question was from Hamza Abdalla who was concerned about the environmental air pollution caused by dust in the atmosphere and how it can be controlled. Response from Mr. Kuya was that a recommendation will be tabled to the contractors on the various mitigation measures that will be effective in curbing air pollution during construction. The mitigation measures included use of dust arrestors and sprinkling of water to reduce on dust during working times.
2. Stacy Odhiambo was positive about the project for she expressed it as an opportunity that will help in reducing unemployment in the area. She wanted to know if the opportunity will be given to the youths coming within the area or from people outside the area. Mr Edward clearly outlined that employment opportunity will be as fair as possible based on experience, both skilled and unskilled, vetting using good conduct and on first come first serve basis.

3. The third response was from John Makau who envisaged the project as a project that will lead to growth in development within the area. The project will lead to increase in housing units for residents in the area and roads leading to the apartment will be improved as compared to their present states.
4. Mr Pascal Mailu was concerned about noise pollution from the site during construction and inquired on some of the mitigation measures that the client will put in place to reduce the pollution. Mr. Julius Kuya clearly stated that the contractors will be advised to strictly observe the time of working hours from 8.00am to 5.00pm to limit noise in the area. The machines will be serviced regularly to ensure that they don't produce irritating noise during working hours.
5. Stacy Odhiambo also saw the project as it will affect the lifestyle of the area people by raising the living standard. She explained that with the more developed residential apartments, people of high income will come to the area thus forcing the living standard within the neighborhood to go high something that not everyone will be able to keep up with.
6. John Makau asked how the solid wastes from the site will be taken care of since there are usually waste from cement bags, used timber and also from packaging bags during construction period. Mr Kuya explained to the members present that in order to keep our environment clean and safe, the client will be advised to contract a NEMA registered company to assist in the collection and handling of solid waste within the site.
7. Richard Onyango raised a concern that an increase in population will lead to an increase in demand of the scarce social amenities within the area which included water. It was well elaborated by Mr. Kamau that that in conjunction with conjunction with MAVWASCO, they will be able to get water from the EPZA Athi River. He also responded that in the case of a borehole drilling, all permits shall be sought from WRA and construction of a borehole will be very key in the near future.

Final Remarks

Mr. Edward Kamau welcomed the area Chief, Mr David K. Muthaka to give final remarks before closing the meeting. The area chief thanked all the members who sacrificed their time to come out and share their views on the upcoming residential project within his area of jurisdiction. He was excited about the upcoming project and was inquiring if it would start sooner so as to help in curbing the problem of unemployment within the area. The area chief finalized by asking the members present to stay safe during this time of Covid 19 pandemic and that they should always have their mask on in public places while maintaining social distance.

Closing of the meeting

The meeting ended with a closing prayer from Elly Ogola, followed by closing remarks from Mr. Moses Muisyo who thanked the members present for showing up and stressed to them that the project will not only bring benefits to the people of Syokimau but also to its environs at large.

6.7 ENVIRONMENTAL OCCUPATIONAL, HEALTH AND SAFETY IMPACTS

It is a requirement that Indesign Makumbi Ltd must develop adequate and responsive HSE policies and integrate them into the project lifecycle. The construction workers must also ensure that they adhere, at all times, to all national and local health and safety standards applicable. The Main Contractor should be compliant with the findings of this ESIA report and the NEMA licensing conditions. All personnel should be issued with necessary personal protection equipment (PPE) and trained by their supervisors to complete their assigned tasks in a safe and secure manner. The key to achieving healthy and safe working conditions is to ensure that health and safety issues are planned, organized, controlled, monitored and reviewed. Everyone controlling site work has health and safety responsibilities. Checking that working conditions are healthy and safe before work begins and ensuring that the proposed work is not going to put others at risk and this requires planning and organization.

Environmental, Occupational Health and Safety (EOHS) is an important aspect of an environmental assessment and evaluation exercise since most of the activities which will be carried out within the project area should comply with specific standards as set by the local authorities, NEMA, DOSHs and other recognized institutions. Health, Safety and Environmental protection and responsibility are among the most important aspects of modern construction industry activities. The health and safety of all personnel and the impact of operations on third parties and on the environment are of paramount importance. It is the responsibility of proponent and the contractor to ensure that safety standards are maintained and all members at the construction site adhere to safe working practices. Some of the safety issues include, but are not limited to, the following factors: Risk of personal injury at work, especially during excavation; Noise generation from the machines; Solid and liquid waste management, including wastewater and effluent discharges; Oil and chemical spills; dust emissions, Fire; and material handling. The proponent is required to assess risks and take practical measures in advance to protect the health and safety of the workers, keep accident records, provide information and training, consult employees, cooperate as well as coordinate mitigation measures with the contractors. Some of the key aspects to be implemented on the site include:

- Standard HSE Management procedures for the site;
- Strategically place safety signage and postage at the project site; and
- Provide fit for use PPE for workers such as, coveralls, gloves, hard helmets, safety shoes etc.

To achieve the above key approaches include planning and organization, documentation, enforcement and good housekeeping.

6.2.1 Planning the work

This will involve gathering as much health and safety information about the project and the proposed site before work begins, this is important. Sources of information include.

- The client and the design team;
- The main contractors on the sit and contract documents;
- Specialist contractors and sub- contractors;
- Equipment and material suppliers; and
- HSE relevant laws regulations and guidelines.

The contractor shall identify site hazards as well as see if there are any unusual features which might affect the work, or how the work will affect others in close proximity to the project site.

6.2.2 Organizing the work

- The project proponent shall make sure that the Main Contractor and sub-contractors on site provide adequate supervision for their workers.
- The contractor shall decide who will supervise the work – check that they are adequately trained and experienced.
- The Contractors management on the project will oversee that work methods and safety precautions agreed before work is started are put into practice.
- The Contractor shall make sure that people working for subcontractors also get the information they require and provide training, supervision etc as needed.

6.2.3 Notifying DOSHS

According to the Factories and Other Places of Work (Safety and Health Committees) Rules, 2004, a project site should be registered as a work place with DOSHs if it regularly employs twenty or more employees and hence shall establish a Safety and Health Committee in the manner provided in these Rules.

6.2.3 Setting up the site

Site access

There should be safe access onto and around the site for people and vehicles. There shall be a plan how vehicles will be kept clear of pedestrians, especially at site entrances. The plan should include how vehicles can be kept clear of pedestrians at vehicle loading/ unloading areas, parking areas and areas where drivers' vision may be obstructed.

Site boundaries

The construction worksite should be fenced off and suitably signed. This will protect people from site dangers and the site from vandalism and theft. For some jobs the workplace will have to be shared. A plan on who has to control each area shall be agreed, what fences, barriers, means of separation or permits to work are required to keep both construction workers away from hazards created by others and other people away from hazards created by the construction work. Site rules might be needed to make sure there is a system to ensure necessary precautions are kept in place during working hours and that night-time and weekend protection is put in place as required before the site closes.

Welfare facilities

- Everyone who works on project site must have access to adequate toilet and washing facilities, a place for consuming refreshments and somewhere for storing and drying clothing and
- The project contractor and others who have control over construction sites are responsible for providing or making available site welfare facilities. Employers are also responsible for ensuring that welfare facilities are adequate for their employees.
- The welfare facilities should be sufficient for everybody who is working on the project site. If facilities such as toilets and canteens provided by someone else are to be used, check that they are suitable and properly maintained. They should be kept clean, warm and properly ventilated and lit.
- Welfare facilities shall be easily available to people working on the site. Toilets need to be easily accessible from where the work is being done. Washing facilities should be as close as

possible to the toilets. Washing facilities also need to be rest rooms so that people can wash before eating.

Sanitary conveniences

- The numbers of toilets required will depend on the number of people working on the project site.
- Wherever possible toilets should be flushed by water and connected to a mains drainage system. If this is not possible, toilets with a built-in water supply and drainage tank may be provided. If neither option is possible, chemical toilets may be provided.
- Men and women may use the same toilet, provided it is in a separate room with a door that can be locked from the inside.
- A washbasin with water, soap and towels or dryers should be located close to the toilets.

Washing facilities

- On all sites sections, provide basins large enough to allow people to wash their faces, hands and forearms. All basins should have a supply of clean hot and cold, or warm, running water. Because the mains water is not available in the project area, this water will be supplied from a tank.
- Where the work is particularly dirty or workers are exposed to toxic or corrosive substances (e.g. during excavations and demolitions), showers will be provided.
- Men and women can share basins used for washing their faces, hands and arms

Rest facilities

- Facilities should be available for taking breaks and meal breaks facilities should provide shelter from the wind and rain and be heated as necessary.
- It should be possible for non-smokers to use the facilities without suffering discomfort from tobacco smoke. This can be achieved by providing separate facilities for smokers and non-smokers, or by prohibiting smoking in the rest facilities.
- Rest facilities may be provided within the site office or site hut.

Storing and drying clothing and personal protective equipment

1. The contractor shall make sure there are proper arrangements for storing:
   - Clothing not worn on site (e.g. hats and coats);
   - Protective clothing needed for site work (e.g. wellington boots, overalls, gloves etc.);
   - Personnel should be issued with equipment (e.g. ear defenders, goggles, harnesses etc.).
2. The site office may be a suitable storage area, provided it is kept secure. Where there is a risk of protective site clothing contaminating everyday clothing, store items separately.
3. Where necessary for propriety, men and women should be able to change separately.

Drinking water

1. The proponent shall make sure there is a supply of drinking water.
2. The drinking water tank should be clearly marked if it is possible not to confuse the drinking water supply with other water supplies or other liquids such as:

a. those not fit for consumption (e.g. water from storage tanks used for wheel washers); or
b. certain toxic materials

3. Cups or other drinking vessels should be available at the water point, unless the water is supplied as an upward jet that can be drunk from easily (e.g. a drinking fountain).

Good order, storage areas and waste materials

1. Plans should be made on how the site will be kept tidy and how housekeeping will be actively managed:
   - Keep walkways and stairways free of tripping hazards such as trailing cables, building materials and waste. This is especially important for emergency routes. Make sure that all flammable waste materials (such as packaging and timber offcuts) are cleared away regularly to reduce fire risks;
   - Keep inside floor areas clean and dry;
   - Outdoor footpaths should be level and firm and should not be used for storing materials.
2. Designate storage areas for plant, materials, waste, flammable substances (e.g. foam plastics, flammable liquids and gases such as propane) and hazardous substances (e.g. pesticides and timber treatment chemicals). Flammable materials will usually need to be stored away from other materials and protected from accidental ignition. Care must be taken not to store materials where they obstruct access routes or where they could interfere with emergency escape.
3. If materials are stored at height (e.g. on top of a container or on a scaffold gantry), make sure necessary guard rails are in place if people could fall when stacking or collecting materials or equipment.
4. All storage areas shall be kept tidy, whether in the main compound or on the site itself. Try to plan deliveries to keep the amount of materials on site to a minimum.
5. A decision must be made on how the waste stream will be managed to ensure it is timely and effective. The contractor should consider whether to be responsible for collecting their own waste or whether you will provide someone to do this for the site. Don't forget that waste materials also need storing safely before their removal from the site and make sure that to make allowance for sufficient space for waste skips and bins. If you are collecting waste in skips you will need to decide where the skips can be positioned and how often they will need to be collected. Consider waste generated inside and whether you need to provide wheeled bins to enable it to be brought out of the building safely.

Emergency procedures

1. At most sites, the most obvious emergency is fire. The general principles for dealing with fire risks can be applied to planning for other emergencies. Plan emergency procedures before work begins and put general precautions in place from the start of work.
2. Some emergencies may require evacuation of the site or part of the site, while others might involve the rescue of an injured person. For example, it may be necessary to plan how someone injured in a fall can be attended to by first aiders and the emergency services before being taken to a place of safety.

a) Planning for an emergency

1. When planning emergency procedures, routes and exits, the following should be into account:
   - The type of work being done on site (e.g. extra precautions may be required to maintain routes down stairs during demolition);

- The characteristics and size of the site and the number and location of workplaces on the site. A large site with people working at many locations will probably need bells or sirens at a number of places to raise the alarm. On small sites with only two or three people working, an air horn may be adequate;
- The plant and equipment being used (e.g. consider tower crane drivers, people working on suspended access equipment or where the exit may be obstructed by equipment);
- The number of people likely to be present on the site at any one time. On sites where many people work, escape routes need to be wide enough to allow everyone to get through doorways or down stairs easily without them becoming overcrowded; and
- The physical and chemical properties of substances or materials on or likely to be on the site (e.g. work at petrochemical installations or at sites where flammable paints or glues are in use may require an increased standard of ventilation).

2. Take precautions to ensure:
    - The likelihood of emergencies arising is as low as possible;
    - Everyone on site can be alerted in an emergency;
    - Everyone working on site (including contractors who may only be at the site for a few hours) knows what signal will be given if there is an emergency and knows what to do;
    - Someone who has been trained in what to do is on site while work is in progress and will take responsibility for coordinating procedures;
    - Emergency routes are available, kept clear, signed and adequately lit. When the site is not adequately lit by daylight for all periods when people are at work, provide lighting that will come on automatically in an emergency;
    - There are arrangements for calling the emergency services. It is good practice to let the Fire Brigade know about any work in tunnels, confined spaces or above 18 m (above this height they may require specialist access equipment) and anywhere else where specialized rescue equipment may be needed;
    - There is adequate access to the site for the emergency services and that access does not become blocked by plant or material building up;
    - Arrangements for treating and recovering injured people are available;
    - If an emergency does arise, someone is posted at the site entrance, or in another prominent position, so that they can direct the emergency services.

b) Precautions to prevent fires

The following precautions should be taken to prevent fires:

- Use less-easily ignited and fewer flammable materials, e.g. use water-based or low-solvent adhesives and paint;
- Keep the quantity of flammables at the workplace to a minimum;
- Always keep and carry flammable liquids in suitable closed containers;
- If work involving the use of flammable materials is being carried out, stop people smoking and don't allow other work activities involving potential ignition sources to take place nearby. For example, if floor coverings are being laid using solvent-based adhesives, don't allow soldering of pipes at the same time;
- Ensure that pipes, barrels, tanks etc. which may have contained flammable gases or liquids are purged or otherwise made safe before using hot cutting equipment, such as a cutting torch or angle grinder. A pipe or container may appear to be empty, but can contain enough material on its sides, or within rust or other sediments, to produce a flammable or explosive atmosphere within it when heated or disturbed. Specialist advice may be required;
- To minimize the risk of gas leaks and fires involving gas-fired plant:
    - Close valves on gas cylinders when not in use;

- Regularly check hoses for wear and leaks;
- Prevent oil or grease coming into contact with oxygen cylinder valves;
- Do not leave bitumen boilers unattended when alight;

- Store flammable solids, liquids and gases safely. Separate them from each other and from oxygen cylinders or oxidizing materials. Keep them in ventilated secure stores or an outdoor storage area.
- Do not store them in or under occupied work areas or where they could obstruct or endanger escape routes;
- Have an extinguisher to hand when doing hot work such as welding or using a disc cutter that produces sparks;
- Check the site at lunch time and at the end of the day to see that all plant and equipment that could cause a fire is turned off.
- Stop hot working an hour before people go home, as this will allow more time for smoldering fires to be identified; and
- Provide closed metal containers to collect rubbish and remove them from the site regularly. Collect highly flammable waste such as solvent-soaked rags separately in closed fire-resisting containers.

c) Precautions in case of fire

If a fire should break out, people must be able to escape from it. To achieve this consider the following procedures;

1. Means of giving warning

Set up a system to alert people on site; this could be a temporary or permanent mains operated fire alarm (which should be tested regularly, e.g. weekly), a klaxon, an air horn or a whistle, depending on the size and complexity of the site. Any warning needs to be distinctive, audible above other noise and recognizable by everyone.

2. Means of escape.

Plan escape routes and ensure they remain available and unobstructed. For work areas above or below ground, provide well separated alternative ways to ground level where possible. Protect routes by installing the permanent fire separation and fire doors as soon as possible. It is important that escape routes give access to a safe place where people can assemble and be accounted for. Signs will be needed if people are not familiar with the escape routes Make sure that adequate lighting is provided for enclosed escape routes – emergency lighting may be required.

3. Means of fighting fire

a) As well as providing fire extinguishers for hot work, fire extinguishers should be located at identified fire points around the site. The extinguishers should be appropriate to the nature of the potential fire:
   - Wood, paper and cloth – water extinguisher;
   - Flammable liquids – dry powder or foam extinguisher;
   - Electrical – carbon dioxide (CO_2) extinguisher.

b) Nominated people should be trained in how to use extinguishers.

d) First Aid

Factories (First-Aid) Order required by section 50 (1) of the Act require the occupier to provide. The first-aid boxes or cupboards at a work place which are adequate and appropriate equipment, facilities

and personnel to enable first aid to be given to your employees if they are injured or become ill at work. The minimum provision for all sites is:

- A first aid box with enough equipment to cope with the number of workers on site as per the order;
- An appointed person to take charge of first-aid arrangements;
- Information telling workers the name of the appointed person or first aider and where to find them. A notice in the site hut is a good way of doing this.
- The first-aid arrangements should cover shift working, night and weekend working where this is carried out. This may mean appointing or training several people to ensure adequate cover.

e) Reporting injuries, diseases and dangerous occurrences

Employers have a duty under the law (OSHA, 2007) to report to DOSHs certain types of accidents that happen to their employees. Whoever is in control of the site also has a legal obligation to report certain accidents which involve a self-employed worker or member of the public and certain dangerous occurrences. Generally, you have to report deaths, serious injuries and dangerous occurrences immediately and less serious injuries within seven days. Certain occupational ill-health issues and diseases also have to be reported. Further details of when you must report an accident, disease or dangerous occurrence are given in Factories and other places of work (Safety and health committees) Rules.

f) Site rules

It is recommended to enact certain safety precautions while construction work is in progress. It may assist everyone if site rules are applied. Site rules might cover, for example, the use of personal protective equipment, traffic management systems, pedestrian routes, site tidiness, fire prevention, emergency procedures or permit-to-work systems. It should be very clear where site rules apply. Make sure everybody knows and follows the rules relevant to them.

Site management and supervision

This should entail making provision of either all or some of the following.

1. Safety while working at height.
2. Selecting the right means of access and work equipment.
3. Safe working platforms.
4. Inspections and reports.
5. General access scaffolds.
6. Guard rails, toe boards and brick guards.
7. Tower scaffolds.
8. Mobile access equipment.
9. Suspended access equipment.
10. Safety nets and soft landing systems.
11. Rope access techniques.
12. Safety harnesses.
13. Ladders and stepladders.
14. Roof work and fragile surfaces.
15. Roof truss installation.
16. Management of site traffic and mobile plant.
17. Moving goods safely.

18. Hazardous substances and processes.
19. Personal protective equipment.
20. Electricity safety.
21. Prevention of slips and trips.
22. General Public Safety

6.8 COVID 19 PREVENTION AT THE WORKPLACE

The proponent shall develop and implement Covid-19 Policies and Workplace Readiness. These shall be communicated to all employees, a COVID-19 Preparedness Policy Statement that address all aspects of COVID-19 readiness including but not limited to Policy, Planning and Organizing activities for COVID-19; Occupational Safety and Health Risk Assessment, Management and Communication; Prevention and Mitigation Measures against COVID-19 and arrangements for dealing with suspected and confirmed COVID-19 cases and clear guidelines and specific requirements when sick or ill staff may be absent to attend hospital and to staff who are not sick or ill but need to be absent to care for others, especially family members. The prevention and mitigation measures shall include but not limited to infection control plans, ensuring social distancing of not less two (2) meters between employees in all directions, suitable hand sanitizing facility or handwashing soap and water and the strict proper use of facemasks throughout all working hours and public places. A summary of the Policy Statement and level of COVID-19 Readiness and preparedness shall be submitted to the Director of Occupational Safety and Health Services within thirty (30) days from the date of opening the work workplace.

CHAPTER SEVEN: ASSESSMENT OF POTENTIAL IMPACTS AND PROPOSED MITIGATION MEASURES

7.1 INTRODUCTION

This chapter presents the relevant environmental and social issues that may occur (potential impacts) throughout the project cycle. The purpose of this ESIA for the project is to ensure the project progresses in a sustainable approach. The assessment is based on identified potential impacts through fieldwork and public participation. The proposed project is expected to have both positive and negative impacts. Specifically, the chapter covers the main environmental and social impacts that are likely to occur during construction, operation and decommissioning phases of the proposed residential project. The anticipated impacts are then discussed in three phases namely: construction, operational and decommissioning phases. The initial identification of activities with a potential to have a significant impact on the local physical, human and ecological environment was performed using a screening matrix. In this process several criteria were used to allow the significance of each impact to be assessed, including but not limited to: extent, frequency, duration, reversibility, repairability and scale. The impacts identified during the initial screening were then subjected to an extended evaluation. This evaluation included establishment of a rating, on a scale, for each impact in terms of the level of its significance and the probability of its occurrence. The individual rating of each criterion was then followed by a matrix-based assessment where they were weighed against each other to retrieve a final estimation based on local conditions as per the Magnitude-Sensitivity Matrix. The assessment of the impacts from each activity was then followed by initial recommendations on mitigation efforts, adapted to local conditions, which were considered necessary to reduce the estimated impact from each activity to an acceptable level. In order to alleviate negative impacts emanating from the implementation of the project, relevant mitigation measures have also been proposed in this chapter.

7.2 CLASSIFICATION OF ENVIRONMENTAL IMPACTS

Impacts may be categorized into the following:

- Positive (beneficial) or negative (adverse);
- Direct or indirect, long-term or short-term in duration;
- Localized or widespread in the extent of their effect;
- Cumulative or non-cumulative.

The aim of this assessment exercise was to identify the significant impacts related to the project. Significant impacts were defined as being those which:

- Are subject to legislative control;
- Are of public concern and importance;
- Are determined as such by technically competent specialists;
- Trigger subsequent secondary impacts;
- Elevate the risk to life threatening circumstances; and
- Affect sensitive environmental factors and parameter in the project area.

7.3 IMPACT SIGNIFICANCE AND SEVERITY

Proposed project activities and their impact severity /significance was determined by evaluating the intensity of the impact and the sensitivity of the environmental and social receptors, which is largely subjective but based on the professional judgements of the ESIA team. This methodology required assigning of numerical descriptors to the impact intensity, as well as the environmental and social receptors, for each potential impact. The numerical descriptors are 1, 2, 3, or 4; which are equivalent to very low, low, medium or high. The impact severity was then calculated as the product of the two numerical descriptors, which was equivalent to negligible, minor, moderate or major, as indicated in the table below. This approach is a semi-qualitative method designed to provide a broad ranking of the different potential impacts of the proposed residential project as presented in the summary of impacts table.

Table 9: Magnitude Intensity-Sensitivity receptor Matrix

MAGNITUDE - SENSITIVITY MATRIX			SENSITIVITY OF RECEPTOR			
			Very low	Low	Medium	High
			1	2	3	4
INTENSITY OF IMPACT	Very Low	1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low	2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium	3	3 Minor	6 Moderate	9 Moderate	12 High
	High	4	4 Minor	8 Moderate	12 High	16 High

7.4 IMPACT IDENTIFICATION, DESCRIPTION AND MITIGATION

An impact matrix is a simple but effective tool for identifying the possible impacts of the project activities on the environment and this was done for the proposed residential project. The project activities of the proposed project were arrayed against a selection of environmental factors that were deemed to be relevant to the project or which may be affected indirectly as a result of project activities. In order to ensure sound development and effective implementation of the proposed Environmental and Social Management Plan, it is necessary to identify and define the responsibilities and authority of the various persons and organizations that will be involved in the project. The following entities are key for the success of the proposed project and should be involved as adequate in the in the implementation of this ESMP: Indesign Makumbi Project Manager, the Project Contractor, Mavoko Sub-county, DOSHs and NEMA. The Project Manager will oversee the

construction program and construction activities which shall be compliant with the developed ESMP. The contractor is required to comply with all other requirements of the ESIA license and other relevant legislations. The relevant department within the Mavoko Sub-county shall be called upon where necessary during the project implementation to provide the required permits and advisory services to the proponent while NEMA will exercise general supervision and coordination over all matters relating to the environment as the principal instrument of the government for implementation of all environmental policies.

7.4.1 POSITIVE IMPACTS

Provision of standard 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 reducing the deficit. The proposed project shall also increase cash flows to the proponent by renting of the units. This is in line with the government policy of providing standard and affordable housing infrastructure to the society through the Big Four Agenda. The proposed development will give an opportunity for people to acquire shelter easing housing problems. The project will form a well-planned project and shall include key services, infrastructure and amenities. The project will also include provision of infrastructure including driveway and parking, storm water drainage, outdoor lighting, sewerage and water to local authority's adoptive standards. The proposed project shall inject approximately 378 No. residential units to the national stock.

Optimal utilization of the land

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. The proposed site was at the time of study vacant but the proposed project shall accommodate at least 378 households raising the utility of the land. The proposed use also conforms to the area's planning policy and is not unique in the neighbourhood. Currently there are other high-rise developments adjacent to the site.

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 enhancing livelihoods. Those doing commercial activities in the neighbourhood shall also have their market widened by the occupants and workers. Many secondary businesses are also likely to spring up during the construction phase especially those providing foods and beverages to the construction workers. Other businesses will also come up in the in the neighbourhood when the project is complete that will be serving the estate residents.

Promotion of social cohesion

The development will bring together people with diverse traditions and culture. It will lead to promotion of cultural interaction. The proposed project shall bring at least 378 households to live on the same plot. This may help the households in saving some of the overheads such as security, waste disposal etc since if they were to live on individual plot, and some of these costs would have to be borne individually without any economies of scale which are otherwise shared.

Creation of employment opportunities

This project will create job opportunities in the project area. This include direct and indirect job opportunities to a significant number of the population during construction, occupational and decommissioning phases thus reducing the unemployment and in the process provide livelihood. Direct job opportunities are available for high calibre professionals including architects, engineers, civil works contractors and consultants. The project will also offer direct or indirect employment opportunities to semi-skilled and unskilled labourers such as foremen, security guards, housekeepers, shopkeepers, clerks and drivers.

During the Social Impact Assessment process, locals raised the question regarding more job opportunities and the following recommendations were proposed:

- Ensure compliance with the Employment Act, 2007 and Regulation of Wages (General) (Amendment)order, 2009.
- During employment of semi-skilled and unskilled labour, priority should be given to the local residents and immediate community;
- Gender Equity should be considered when employing labours so as to ensure a balance between the two sexes is almost equal and there should be no bias towards the male; and
- The contractor should inform workers that the employment opportunity is short term so as to prepare them in case employment comes to an end due to reduction in work.

Enhancement of local economic growth and Additional Revenues

This project will increase the economic activities around the area, creating avenues for direct/ indirect employment in the post project period. There would be a wider economic impact in terms of generating opportunities for other business like workshops, marketing, repair and maintenance tasks etc. Income generated from employment during construction and from the informal and formal business around the project area is expected to improve the economic status of the local populous. Increased income would lead to increased saving and investment on the household level for example in housing, education and assets. The development of land for any purpose creates both an immediate demand for services and a flow of revenues to the community from a variety of sources, for example property tax, licenses and permits fee etc. The proposed project shall generate tax revenue for the government directly and indirectly. Specifically, the Machakos County Government will raise extra revenue from both the enhanced Land Rates and approval fees.

Provision of market for building materials

The project will require supply of large quantities of building materials most of which will be sourced locally within Mlolongo town. This provides ready market for building material suppliers such as quarrying companies and hardware shops hence will be a source of income for owner which enable further investment in their business and create employment opportunities for labourers. Proposed mitigation measures shall include:

- Construction contract should stipulate that the Contractor sources materials from an approved site and sources e.g. hard stones for building should be obtained from bonafide commercial quarries;

- Adherence to the NEMA national sand harvesting guidelines by sand harvester supplying sand for building. This is to mitigate the degradation of riverbed and acceleration of erosion;
- Quarry providing aggregates for construction should be licensed and in line with the various regulatory guidelines such as the Mining Act, EIA guidelines and local authority bylaws;
- The Project Manager should ensure that source of timber used during construction should be obtained from approved sources;
- Materials such as steel and cement should be from accredited companies within Kenya Bureau of Standards marks of highest quality as well as Ministry of Public Works Material testing section. This is to ensure high building standards are upheld and not compromised by low quality materials;
- The tender documents should specify required standards and certification for procurement of all materials and appliances.

7.4.2 NEGATIVE IMPACTS DURING CONSTRUCTION AND OPERATIONAL PHASE

a) Vegetation clearing and restriction of movement

Construction Phase:

The entire land surface has been cleared to create space for construction of structures and the needed supporting services and facilities. Further, the site will be enhanced through landscaping leading to establishment of new vegetation. The overburden shall be removed from the construction site. This process of vegetation clearing is associated with loss of biodiversity, soil erosion and increased run off. The loss of vegetation also has a great effect on the general and localized environment and normally can modify microclimate. There will be some temporary and permanent disturbances to small animals / bird life especially those that inhabit the project area. With regards to flora, there are no known red data species or significant indigenous vegetation on-site or within the project area. The only areas of concern with regards to biodiversity are the shrub and grass vegetation that were cleared on the site.

Site handing over to the contractor after signing of civil contract will be the beginning of the site preparation. The contractor will have to fence the site to restrict the movement of people through the site.

Enhancement of the current ecology at the proposed site will entail landscaping. Landscaping of the project site will help to improve the terrestrial habitat for birds, effectively serve as pollutant absorbent, act as recreation place for the residents and add to overall aesthetics of the area.

Mitigation measures

- 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.
- Fence the site to restrict movement.
- Modifications to the design of the development to ensure spaces are left to allow for regeneration of vegetation.

- Restriction of construction activities to defined project areas.
- After completion of soil work, grasses are to be planted to minimize soil erosion.
- No vehicle shall be allowed access onto the stockpiles after they have been placed.
- Stockpiles shall not be allowed to become contaminated with oil, diesel, petrol, garbage or any other material, which may inhibit the later growth of vegetation.
- Soil conservation measures would be taken to the stockpiles to prevent erosion. This can include the use of erosion control fabric.
- Soil stockpiles shall not be higher than 2.5 m or stored for a period longer than 2 months.

b) Land Degradation

Construction Phase:

Most of the building materials such as stones, aggregates, and sand required for construction of the proposed project will be obtained from nearby quarry sites, concrete block sites and borrow pits. Since substantial quantities of these materials will be required for construction of the residential development, the availability and sustainability of land resources at the extraction sites will be negatively affected as they are not renewable in the short term. Similarly, during construction of the proposed housing project a lot of construction solid wastes will be generated. These include papers used for packing cement, plastics, timber remains, landscape and land clearing debris, asphalt pavement, gravel and aggregate products, concrete, masonry scrap and rubble (concrete masonry, stone) among others. These will have a negative impact on the receiving environment. It is expected that the contractor will obtain these materials for construction purposes from licensed suppliers or from authorized areas. Likewise, disposal of construction waste will be on designated sites. The extent of this impact is localized with a low intensity. The impact will be highly reduced /eliminated with mitigation. Therefore, the impact is negative and of low significance. Movement of this material could have an impact on the environment and settlements. How and where the material is sourced from is also a key determinant on the magnitude of the impact these activity may cause.

Mitigation measures

- Strictly source material from NEMA authorised dealers or quarries
- Backfilling of opened up borrow pits, borrow pits and quarries should be undertaken at the end of the construction process; and
- All wastes should be segregated and appropriately stored on site before final disposal.

Operation Phase:

No negative impact on land quality degradation of the study area is expected due to the project activities.

c) Excavations and Soil erosion

Construction Phase:

Excavations would result to loosened soil and highly susceptible to soil erosion. Soil erosion is the 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. In this case soil erosion will not be a major environmental impact especially when the project is over since there will hardly be open areas. However, during site excavations and construction phases, there will be massive movement of soil materials from the site. Other impacts on soil owing to the project construction activity includes soil compaction, physical and chemical desegregations and pollution of soil.

Other factors contributing to soil erosion include increased runoff and decrease in permeability of the soil. Use of heavy machinery and storage of material results into compaction of soil. Compaction of soil as well as mixing of construction material with soil would also lead to reduced infiltration of water, decrease in permeability and increased runoff. Both physical and chemical desegregations of soil would occur during the construction phase. Physical desegregations would occur due to excavation of different layers of soil and subsequent mixing of different layers and would lead to disruption of soil structure. Chemical desegregations and pollution of soil would be on account of spillage of oil from vehicles used for transportation of construction material and from the building material used for construction purposes.

Potential Mitigation Measures

- Schedule earth moving activities during the dry season. This is to reduce acceleration of soil erosion by run off when it rains.
- Avoid unnecessary movement of soil materials from the site.
- Provide soil conservation structures on the areas prone to soil erosion.
- Control construction activities during rainy / wet conditions to mitigate erosion effects to the soil.
- 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.

Operation Phase:

During the operation phase, carefully designed landscaped areas will be maintained. No significant impact is expected on the soil on and around the site, due to the following management measures:

- All solid wastes from the residential complex will be properly collected and recycled.
- The entire site area will be well paved and thus there will be no leaching of any substances in case of spills.

Hence, no negative impact on soil quality in the study area is expected due to the project activities.

d) Water Resource, supply and use

Construction activities for the proposed development can have minor impact on hydrology and ground water quality of the area if the construction waste leaches into ground. In the short term, surface and ground water may be impacted by construction activities, such as the contamination from fuels, cement, oils and other liquid waste. A potential impact on water quality may also arise from the risk of soil erosion and poor surface drainage management during the construction phase. Any surface water contamination may enter the area drainage water resources and negatively impact on the aquatic ecology of the system. Good environmental management practices must be followed to prevent potential contamination of the water resources. Potential sources of impacts on the hydrology and ground water quality during the construction phase are as follows:

- Soil runoff from the site leading to off-site contamination (particularly during rainy season).
- Improper disposal of construction debris leading to off-site contamination of water resources.

- Spillage of oil and grease from the vehicles and wastewater generated on site activities such as vehicles washing, workshop etc.

Water source for the proposed project will be met by Water tankers/ MAVWASCO water supply. The development will cause strain to the existing water supply since construction activities are known to be heavy water consumers. The project occupation will also bring in very large population which will have direct impact to the water supply (hence high water demand). This section describes the potential impacts on the water resource during the construction and operation phase of the project.

Mitigation measures

The following measures should be adhered to in order to limit the impact of the construction phase on the quality of water in the area:

- No mixing of concrete to occur on bare ground. Concrete mixing should be done on bunded surface to avoid soil pollution and contaminating the ground and surface water.
- Appropriate containment structures should be provided to store contaminated water from the construction site. The contractor should ensure these waters are properly disposed.
- No concrete batching to occur directly on the ground. Concrete batching area should be bunded to prevent contamination of soils and surface water features.
- All fuel storage to be appropriately bunded and provided with a canopy.
- Project site should have drip trays to contain any potential leakages of fuels and oils.
- Ablutions for construction workers to enable proper disposal of faecal matter and avoid contamination of surface water features which could be a cause of waterborne diseases.
- Concrete batching and mixing should occur at one particular point and the site should be bunded or paved and drains provided to ensure polluted water is drained at a particular suitable point.
- Construction of storm water diversion channels to divert storm runoff from flowing over the construction areas.
- Avoid excessive use of the water supplied by the MAVWASCO. Water supply and use should follow approvals by the service provider and as per the extraction permits.
- Roof catchments should be provided with gutters to facilitate collection of the run-off. This water should be stored for general use i.e. cleaning, fire-fighting etc.
- Installing oil and grease traps in construction workshop and vehicle parking areas.

Operation Phase

No significant adverse impacts on surface and ground water quality are expected during the operation phase as no major pollutants would be released. Wastewater will be first treated using the sewage treatment plant as proposed as well as through connection to the sewer line in the project area. Hence, no negative impacts are expected due to the operation phase of the project.

Mitigation measures

- Ensure (consistently) good water quality through regular water analysis to ascertain compliance to public health standards.

- Use hydro pneumatic system with variable frequency drive for the water supply system, in which the pumps will start only when there is a pressure drop in the plumbing line than the set limits.

e) Air Pollution Control and Management

Construction Phase:

The construction activities on the site will result to increased dust and gas emissions. Construction machinery and trucks (including small vehicles) generate hazardous exhaust fumes such as Carbon Oxides (COx), Sulphur Oxides (SOx) and Nitrogen Oxides (NOx). Dust particles caused by vibrations of machines and vehicle movement suspends them in the air mostly during dry spells. Diesel engines emit black carbon, which absorbs sunlight and warms the atmosphere and micro-particles. 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. The level of air pollution originating from the above mentioned sources are expected to be low, localized and short term. Air emissions from construction sites can pose health risks to workers and sensitive receptors surrounding the site. No serious impacts are expected on people and the environment.

To mitigate the impact of PM (dust), the following measures are recommended for implementation.

a) Dust Control Plan

The most cost-effective dust suppressant is water, because a source of water tends to be readily available on a construction site. Water can be applied using water trucks, handheld sprays and automatic sprinkler systems. Furthermore, incoming loads should be covered to avoid loss of material in transport.

b) Use electrically operated machinery

Using electrically operated construction machinery is the best way to avoid all externalities produced by diesel engines. This procedural change reduces problems related to emission, idling and maintenance.

Operation Phase

The major sources of pollutant in the proposed project are line sources due to vehicular exhausts and the DG sets (point sources) planned to be installed in the operation phase of the project and the fugitive dusts in the project area. To mitigate the impact of pollutants from diesel generator sets and vehicular traffic during operational phase, the following measures are recommended for implementation.

Vehicle Emission Controls and Alternatives

Anti-idling: The underground parking provided in the building blocks should carry signs warning the vehicle driver against idling within the parking lot.

Smooth flow of traffic: Sudden acceleration or de-acceleration of vehicles produces more pollution than a vehicle maintaining a constant speed. Smoother flow of traffic within the building premises would ensure lesser pollution from the vehicles.

Entry and exit of vehicles: The proposed project site will have frequent movement of vehicles. To ensure least interference from incoming and outgoing vehicles, it is suggested that the entrance and exit points of the vehicles should be different.

General proposed mitigation measures

- Regular and prompt maintenance of construction machinery and equipment. This will minimize generation of noxious gases and other suspended particulate matter.
- Control over areas generating dust particles. Such areas should be regularly cleaned or sprinkled with water to reduce dust. The areas can be enclosed to mitigate effects of wind on them.
- Ensure strict enforcement of on-site speed limit regulations.
- Avoid excavation works in extremely dry weather when soil is pulverized.
- Sprinkle water on access routes each day to reduce dust generation during heavy machines usage.
- Workers should be encouraged to go for regular health check-ups to ascertain their health standards.
- Provide dust nets to prevent the spread of dust to neighbouring buildings and residential houses.
- Ensure all trucks delivering construction materials such as sand are properly covered to prevent the spread of dust.
- Ensure all transportation trucks are covered while carrying away excavated soils and construction debris for final disposal.
- Minimize dust generation and implement a dust control program.
- Protect exposed soil and material stockpiles against wind-blown erosion.
- Provide Personal protective Equipment (PPE) such as nose masks to the workers on site.

f) Noise Control and Management

Construction Phase:

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 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, Air Compressor, Back Hoe / Loader, Concrete Mixer Truck, Concrete Pumper, Concrete Vibrators, Cranes – Mobile, Dump Truck, Hammering & Jack hammer, trucks and other vehicles accessing the site. It will also affect small animals and bird life.

The project site is currently adjacent to low level flats and therefore the construction of the development will disturb the residents. Noise levels are expected to rise during the construction phase of the development. Construction activities that cause noise include vehicle trafficking, generator noise, pressure hammers and construction worker's voices, etc. These noise levels are assessed to be a nuisance to adjacent residents. The following measures are recommended for implementation.

Noise Shields

Construction equipment producing the most amount of noise should be fitted with noise shields.

Time of Operation

Noisy construction equipment should not be permitted during night hours.

Job Rotation and Hearing Protection

Workers employed in high noise areas will be rotated. Earplugs/muffs, or other hearing protective wear will be provided to those working very close to the noise generating machinery.

Operation Phase:

During occupation noise will come from vehicles, air conditioning systems and other operations within the site. Production machines generate/ produce a lot of noise. The D.G. sets will only be used in case of emergency. Proper acoustic enclosures will be provided for avoiding any noise problem. Hearing protection is thus essential when noise exposures cannot be controlled at their source.

To mitigate the impact of noise from vehicle movement and operation of air conditioning systems during the operational phase the following measures are recommended for implementation.

Maintenance

Air conditioning system will be serviced and maintained regularly as per manufacturer's guidance, to ensure that noise emissions are low.

Sign Boards

Anti-honking sign boards will be placed in the parking areas and on entry and exit points.

Other Potential Mitigation Measures

- Schedule noisy activities during the normal working hours of between 8am to 5pm. No work should be undertaken at night or very early in the morning.
- Put off machines and equipment when not in use. Apart from fuel cost saving.
- Ensure machinery is well maintained to reduce noise emitted.
- The Contractor should adhere to the provision in the Environmental Management and Coordination (Noise and Excessive Vibration pollution) (control) regulations,2009.
- Provide worker with appropriate PPEs when working under noisy environment e.g. ear plugs.
- Use suppressors or silencers on equipment or noise shields.
- There should be no unnecessary horning of the involved machinery and vehicles.

g) Oil Leaks and Spills

Construction Phase:

During construction phase, some of the site's construction equipment will require diesel and/or oil. It is also important to note that oil/grease spills are prevalent in construction sites and in most areas that make use of petroleum products. Such products contain detrimental elements to the environment. Though this may not be common at the site, it is wise to control and observe the little

that could occur especially during maintenance of the involved machinery. There is therefore the risk of leaks or spills and the potential for contaminating the site's soil. The impacts of improperly stored fuel and other chemicals could prove detrimental if these fluids infiltrate the surface waters or groundwater systems. Management guidelines should be implemented in order to regulate and document the use of explosives, chemicals and fuels within the project site. Operators should express due caution when it comes to the re-fuelling of equipment on site, as an accidental oil spill is more likely to occur during these activities. Spillage of hazardous materials shall be managed by implementing the following measures;

- Train personnel on the risks of oil spills and leakages.
- Refuelling and maintenance of large vehicles will only take place at a designated garages.
- All hazardous materials will be stored in appropriately bunded containers and placed on concrete floor as where applicable.
- Maintaining spill response kits at the construction site at all times.
- Prepare and display on site spill response procedures and training of workers on spill response and management.
- The site design should incorporate oil sumps at the parking areas to isolate oil spills from parked vehicles that might spill to the storm drains.
- No solid waste, fuels or oils shall be discharged on land surface or into drains.
- All oil products and materials should be stored in site stores.
- Any wash off from the oil/grease handling area or workshop shall be drained through impervious drains.
- Regularly check for leaks from paint containers.
- Unwanted paint will not be disposed by pouring it on soil or storm water drains.
- All machinery must be keenly observed not to leak oils on the ground. This can be affected through regular maintenance of the machinery. Maintenance must be carried out in a designated area (protected service bays) and where oils are completely restrained from reaching the ground. Such areas should be covered to avoid storm from carrying away oils into the soil or water systems.

Operation Phase:

There are no significant impacts envisaged from the project operations as they relate to oil spill and leakages.

Visual Impacts

Construction Phase:

Visual impacts occur during earthworks for the foundation of projects. However, the proposed project will not by far be out of scale with the existing projects or developments (within the area). The visual impact will not be significant and will have very little effects on neighbouring activities and the general public. There are already completed similar projects in the immediate neighbourhood, which is thought to have psychologically prepared the general environment. However, the project location being within in a designated flight path, the proponent is hereby advised to make formal application and seeks approval from Kenya Civil Aviation Authority respectively as herein advised.

Potential Mitigation Measures

- On completing the earthworks, the worked area should be restored through backfilling, levelling and planting of vegetation.
- All solid waste and debris from construction site must be cleared on completion.
- Landscaping and planting of vegetation especially trees shall go a long way in mitigating the visual intrusion.

Operation Phase:

There are potential no further visual impacts at the operation phase.

h) Storm Water Management

Construction Phase:

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 with a myriad of consequences to human health and safety and buildings. Damp (as influenced by poor drainage), in the presence of warmth and darkness, breeds germs and mosquitoes and may cause acute and Chronic Rheumatism. Poor drainage may also lead to property damage due to flooding. 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 buildings are built close together, the space of land (left open) which is useful in absorbing the surface water would be small.

Potential Mitigation Measures

- During construction, the designs should ensure that surface flow is drained suitably into the public drains. There should be no flooding within the site at all.
- Drainage channels should be provided within the site and should be covered with gratings or other suitable and approved materials. They must be installed as provided for in the approved plans and designs.
- The channels should be designed with regards to the peak volumes i.e. periods or seasons when there is high intensity of rainfall. They should never at any time be full; say due to the resulting heavy downpours.
- The drainage channels must ensure the safe final disposal of run-off surface water and must be self-cleaning i.e. should have suitable gradient.

Operational Phase

In this particular project some of the surface water/run-off will mainly be absorbed within the site i.e. open areas. However, these (open) areas shall be limited since much land will be covered by building structures, driveway, parking 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 channel will be high. As discussed earlier, most of the storm water produced on site will be harvested for ground water recharge, thus proper management of this resource is a must to ensure that it is free of contamination. A detailed "Storm Water Management Plan" will be developed which

will consider the above sources. The plan will incorporate best management practices, which will include the following.

- Regular inspection and cleaning of storm drains.
- Storm water generated from roof catchments should be harvested, stored and made use in various household activities i.e. general cleaning.

i) Wastewater Treatment and Management

Construction Phase:

Water will be consumed in various processes like drinking, flushing, floor washing etc. and gardening. After this consumption, wastewater will be generated in significant amount. Wastewater disposal and management shall be undertaken through the following: onsite sewage treatment plant till tertiary level or connection to the MAVWASCO sewer line in the area. Water demand for proposed project during construction phase is estimated to be high. Wastewater generated during construction is negligible. There will be no labour camps on the site and the workers shall use of a common public toilet to be constructed on site. The site manager shall ensure that in no circumstances, there are no open defecation in and around the site.

Mitigation Measures

- A temporary pit latrine/ mobile toilet shall be provided on the site during construction phase for use
- The proponent must connect the sewerage effluent to the MAVWASCO 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 system (sewer) line connection should be made of hard, strong, durable, smooth, impervious, and non-corrodible materials. The sewerage lines require to be upgraded in order to adequately service the increased levels of sewage discharge due to rising levels of development.
- The gradient should be sufficient to ensure and maintain maximum depth of flow.
- Branches should be streamlined in the direction of flow and there should be no right-angled junctions that would affect the flow of the effluent.
- All drain pipes passing under building, driveway or parking should be of heavy duty PVC 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.

Operation Phase:

Sewage is the used water or liquid waste of a community, which includes human and household wastes together. Effluent/sewage resulting from sanitary facilities and wastewater from washrooms is of significant importance to the environment. It must never come into contact with the surrounding i.e. water, soil, air etc. It must always drain effectively into the existing sewer systems via 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.

The project area where the proposed complex will be constructed has MAVWASCO sewer line as waste water disposal infrastructure. The proponent should seek approval and connect to the sewer line. Other water conservation and development measures need to be taken shall include the construction of an onsite Wastewater Treatment Plant. This will be used as a back-up to the existing sewer line in the project area.

j) Solid Waste Generation

Construction Phase:

During the construction phase, a considerable quantum of waste generated at the project site would be inert waste, which largely comprises of sand, construction debris and biomass from land clearing, gravel, untreated wood, concrete, asphalt, pipes, conduits, light steel material, stone, bricks, plastic, paper, metal and glass. Impact from construction waste may arise owing to the shortage of dumping sites, increase in transportation and disposal cost and environmental deterioration. Potential pollution problems during construction activities include dumping of construction debris into or near watercourses or surface water drains. Proposed mitigation plan suggest maximum reuse of construction waste on site or removal of waste from the site and proper disposal, which would reduce the impact significantly (details in ESMP Section).

Potential Mitigation Measures

- Prudent use of materials to reduce solid waste volumes.
- The wastes should be properly segregated and separated to encourage recycling of some useful waste materials; i.e. some excavated stone materials can be used as backfills. (Use of an integrated solid waste management system; through a hierarchy of options: source reduction, recycling, 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.
- The contractor or proponent should work hand in hand with private refuse handlers, NEMA and the Mavoko sub-county to facilitate sound waste management as per the prevailing regulatory provisions.
- The contractor should prepare a waste management plan for management of solid waste management. The waste management plan should contain the waste streams, management procedures, responsibilities and monitoring frequency.
- Disposal of solid waste that accumulate at the construction site should be properly disposed in NEMA licensed landfill in accordance with NEMA solid waste disposal Guidelines and regulations;
- No burning, on-site burying or dumping of waste shall occur.
- Provision of waste collection bins and cubicles for collection and temporal holding of the generated waste within the site before disposal.
- Purchase construction materials in quotas to avoid wastage.
- Ensure separation at source of the solid waste generated on site is done to enhance reusing of any material recovery.

Operation Phase:

When all the structures are operational and occupied, it is expected that solid wastes will be generated in large volumes. These will be primarily household waste from the kitchens. Impacts may also result from improper sitting, inadequate design and poor operation. However, for the proposed project, impacts from waste disposal would not be significant, since waste would be disposed as per the EMC (Waste Management) Regulations, 2006. Environmental impact from solid waste disposal can typically include contamination of soil, ground water, surface water and air quality.

The philosophy of solid waste management at proposed project will be to encourage the four R's of waste i.e. waste reduction, reuse, recycling, and recovery (materials & energy). A good deal depends upon the mutual cooperation between the local authorities 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. However, the problem of dealing with house refuse resolves itself into four parts: storage, collection, transportation and disposal. Therefore bins come in handy during storage and collection; both in the house and on foot paths for the throwing of whatever rubbish such as paper wrappings, cigarette ends etc., into them instead of scattering them all over. Transportation of the collected waste need to be simplified and finally, the use of sound method of waste disposal. The proponent has provided for dustbin cubicle at the project site as given in the project designs approved by Mavoko Sub-county. The Environmental and Social Management Plan for the solid waste focuses on three major components during the life cycle of the waste management system, i.e. collection & transportation, treatment or disposal and closure.

Potential Mitigation Measures

- Provision of waste collecting bins to households which will then be collected for proper disposal.
- Waste separation to encourage reuse and recycling e.g. plastic and glass bottle.
- Domestic refuse should be collected and removed from all facilities at least twice per week and transported to the approved refuse disposal site in covered containers or trucks.

k) Occupational Health and Safety

Construction Phase:

Risks of accidents and incidents will be heightened during the construction activities. Construction workers will be in direct contact with heavy machinery and equipment. Construction work can be particularly hazardous. Personal protective equipment, fire safety, electrical safety, and other precautions are essential for safe construction work.

During the project constructions, it is expected that workers are likely to have accidental injuries and hazards as a result of manual handling and exposure to hazards. There are three main types of occupational health and safety hazards that may be of concern. These are physical, chemical and biological. Potential physical hazards will include noise and accidents. Chemical hazards will involve exposure to harmful gases and chemicals by inhalation, ingestion and skin contact. Biological hazards involve exposure to pathogenic organisms which may cause diseases. Specific areas of concern include: (a) Fire hazards (b) Noise and vibrations (c) Congestion (d) Poor sanitation resulting from presence of potential environmental pollutants at the site including waste water, decomposing solid wastes, dust and exhaust emissions and used chemicals and equipment which could result into waterborne diseases such as typhoid. (e) Accidents including cuts, pricks and bruises; electrocution from naked electrical cables and falling in uncovered manholes. Accidents could result from lack of

supervision and job training, improper handling of machinery and hand tools and inappropriate carrying out of tasks.

Potential Mitigation Measures

- Providing information, instruction and training enabling employees to work without hazards.
- Contractor should contract a qualified Health and Safety Advisor to conduct training and monitoring of construction works.
- The contractor should construct a temporary clinic on site to be run by a qualified nurse/ paramedics who will treat opportunistic ailments and injuries such as cold, malaria etc.
- Contractor should provide a standard First Aid Kit on site.
- Dangerous works should be protected, fenced, demarcated or cordoned off.
- Induction policy to all visitors and new employees shall be developed.
- Providing adequate personal protective clothing and equipment where needed.
- Ensuring chemicals are stored in a designated enclosed area, and material safety data sheets (MSDS) that provide advice on storage, emergency and first aid of these chemicals are within easy reach.
- Training shall be provided for all staff to ensure adequate knowledge of safe manual handling and correct use of equipment and vehicles by covering all safety procedures to ensure that general work safety exists at the site.
- The contractor should provide and install fire-fighting equipment such as fire extinguishers to fight different classes of fire (Class A, B, C D).
- The contractor should develop site Health and Safety guidelines which are to be adhered to by construction workers and visitors to the construction site.
- Maintain an incident/ accident register, in accordance with the Occupational Safety and Health Act, 2007, and report incidences to DOSHS.
- Adequate respiratory protection including properly fitted masks equipped with filters especially designed to capture dust and micro-organisms shall be provided.

l) Fire Risks, Accident prevention and Emergency Response Plan (ERP)

Construction Phase:

Fire risks during construction arise due to hot works, and use of inflammable chemicals. 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. Potential causes of fire are many and varied including electrical faults, smoking, gas leaks, carelessness etc. It is therefore always important to consider the issue of fire by bringing in the element of preparedness. In this regard, the design has provided and recommended for implementation of fundamental fire-fighting measures and control facilities.

Stakeholders must therefore need to be sensitized and prepared on how to react during all the phases (the construction, occupational and decommissioning). Absence of such plans 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 herein. For further management of any

foreseeable accidents, the proponent shall develop an ERP which shall be documented and all the residents provided with the requisite training. 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. The ERP shall also provide for basic First aid training. Such plans among others must be properly documented and made available to all.

Mitigation measures include:

- Combustible materials used during construction should be stored away from source of ignition.
- Smoking on site or burning of waste should be prohibited so as to reduce the source of ignition at the workplace.
- Electrical works such as electrical wiring should be done by qualified technicians or engineers to ensure shoddy work which could pose a danger to the development does not occur.
- Train and induct workers on the use of fire extinguishers.
- Train all staff on fire safety and procedures.
- Allocate a fire assembly point.
- Ensure fire safety warnings are prominently displayed at appropriate locations where fires are likely to occur.
- Develop a Fire Safety Plan through a qualified specialist and implement the provision of the plan at the workplace.
- Install fire-fighting equipment, Fire Hydrant Ring main, hose reel, heat and smoke detectors on each floor.
- Install manual electric break-glass fire alarm system with secondary power
- 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 firefighting equipment are strategically positioned, regularly maintained and serviced.
- Provide fire hazard signs such as 'No Smoking' signs, Direction to exit in case of any fire incidence and emergence contact numbers should be provided as well as the assembly points.
- Provide and enforce the use of Personal Protective Equipment (PPE).
- Conduct regular fire-fighting drills within the site and adapt an emergency response plan for the project (during construction and implementation stages)
- Provide fire hazard signs such as 'No Smoking' sign, direction to exit in case of any fire incidence and emergency numbers and display strategically contact/emergence numbers.

Operation Phase:

Fire risks are expected to occur during operation of the project through electrical fault caused by power upsurges and accidents occurring mainly from the kitchens. The proponent and residents should not burn waste on site. However, electrical faults during electrical repairs and due to power brown outs may cause risk of fire. Safety measures should therefore be applied to control and prevent fire risks.

Mitigation measures

- Install an automatic fire alarm system for the project.
- Provide appropriate Fire Hydrant Ring main with suitable outlet points.
- Place portable fire extinguishers at suitable locations where they could be easily accessed and visible from a distance.
- Burning of waste within the complex should be prohibited as this could cause fire in cases where the fire is left to burn without monitoring.
- Electrical faulty equipment should be repaired or not put to use. This is to eliminate the risk of fire caused by electrical faults.
- Electrical wires and socket which are broken or open should be repaired immediately by qualified electrician.

m) Energy Conservation

The project construction will consume large amount of electricity due to the number of the commercial residential housing development units being proposed and the activities that will take place during the construction process. Since electric energy in Kenya is generated mainly through natural resources, namely water and geothermal resources, increased use of electricity have adverse impacts on this natural resource base and its sustainability.

Proposed mitigation measures

- Architectural Design: Maximize the use of natural lighting through design.
- The proponent should install an energy-efficient lighting system for the development. This will contribute immensely to energy saving.
- The proponent should make provision for installation of solar system for public room lighting, water heating and street lighting.
- Use of clean fuels e.g. unleaded and de-sulphurized fuels in vehicles.
- Paving should only be carried out where necessary to reduce the reflection of the solar radiations.
- Using sustainable drainage systems that mimic the natural percolation of water into the soil, and green roofs where possible.

Operation Phase:

The project will consume large amount of electricity due to the magnitude 0f the project being proposed and the activities that will take place once the project is complete. Energy conservation program will be implemented through measures taken both on energy demand and supply. It will be one of the focuses during the complex planning and operation stages.

Proper selection of light fittings can greatly bring down the energy consumption on lighting. Some of the measures taken to have better energy efficiency are as follows:

- Promoting resident awareness on energy conservation.
- Training staff on methods of energy conservation and to be vigilant to such opportunities.
- Tenants will be sensitized to ensure and promote energy efficiency in their domestic operations.
- Energy use monitoring during the operation of the proposed estate and setting targets for efficient energy use or use efficient equipment that emit little or no waste heat are important.
- It is proposed to control all Common area lighting with photocell controllers which will switch on / off and dim the lights according to the ambient light conditions.
- Solar heating and lighting system is proposed in the complex
- The use of fluorescent lights instead of incandescent ones and the use of high quality reflectors etc., would lead to lower energy consumption.
- Exterior lighting like façade, common area etc are controlled by astronomical / timer switches to select the time and fittings there by required fittings are switched on at required time to save the power.

n) Traffic and pedestrian safety

The project location is likely to result to increased traffic, and changed traffic patterns during construction which might cause localized traffic jams and can potentially cause health and safety impacts, as well as economic impacts. The use of heavy moving construction vehicles and machineries on the project site will however be short lived. The other implications for increased traffic on the access roads will include damage to roads and surface drainage. Additional traffic in the area is a matter of concern to the local residents. This effect would be prominent during construction as well as at the operation phase. The probability of inconvenience faced due to the frequency of truck movement during construction phase would be minimized by better control of traffic movement in the area. Road entry and exit may also be a risk if not properly designed and controlled and more so the heavy trucks during construction. Traffic congestion is also a problem during occupation because the proposed project may add more than 350 cars.

Mitigation measures

- Properly design to allow for deceleration and acceleration to the site. Clearly indicate direction of traffic throughout the project cycle. There should be careful design and layout of the site entrance, providing adequate visibility.
- As far as possible, transport of construction materials should be scheduled for off—peak
- Internal driveways should also be erected with bumps to control speed and thus reduce potential accidents.
- Develop and implement a traffic management plan; and adhere to the Traffic Act/ Rules.
- Speed bumps and limit should be set at 5 KMs per hour and signs put up to that effect.
- Ensure proper planning of transportation of materials to ensure that vehicle fills are increased in order to reduce the number of trips done per vehicle or the number of vehicles on the access road.

o) Sexually Transmitted Infections and HIV / AIDS

Construction Phase:

Laborers from the surrounding areas will come and work at the site. Though majority of population would be recruited locally, limited labour with specific skills will be recruited from outside the project area. Therefore, there is chance for increased disease risk to occur due to social interaction between immigrant workers working on the project and the local population. Therefore necessary measures to make workers and the local population aware of the risk of transmitting and contracting HIV/AIDs and STIs need to be implemented by the contractor.

Potential Mitigation Measures

- Voluntary Counselling and Testing to be undertaken monthly for construction workers so as to establish their HIV status.
- The contractor has to institute HIV/AIDS awareness and prevention campaign amongst workers for the duration of the contract e.g. erect and maintain HIV/AIDS information posters at prominent locations within the construction site, provision of condoms and monthly Educational Video presentation and discussions.

p) Security

Security is a prerequisite for any development. During construction, security is very important on the site. This will ensure that materials are in order and minimal cases of material loss are reported on the site. It would also control movement within the site especially for the intruders who might be injured by the materials and other hazardous features available within the site.

The project area is well covered with communication facilities, which can facilitate security communication to a large extent. After the project is over, security guards and facilities should be provided. The issue has been catered for in the drawings.

Mitigation Measures

- Fence the site to restrict movement.
- Security guards must always guard the gate to the site to keep away intruders and to control movement within the site.
- Lighting as well as security alarms should be installed in strategic positions all over the site during construction and after the completion of the project.
- The Contractor should provide adequate security during the construction period when there are no works on the site.
- The guards stationed at the gate should document movements in and out of the site.

q) 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 or drug users and this may pose a risk to the local residents during the implementation and occupational phases of the project.

Mitigation Measures

Adopt strict hiring guidelines to lock out the bad elements. The contractor has a responsibly of sensitizing the workers on social issues such as drug abuse, robbery and other social issues through regular training and social gatherings and strict monitoring. Workers should not be housed on site.

r) Community Facilities and Social Infrastructure Services

The proposed residential development will result to increased pressure on existing utilities such as roads and service lines such as sewerage, water, electricity etc. due to the increased number of people who will be using these facilities. The increased population accommodated in the proposed residential development has not been adequately provided with a commensurate increase in the community facilities and services. The proponent should thus make sure that he engage all the relevant departments to ensure that the adequacy of the existing facilities are able to cater for the increased number including electricity needs, water, road and sewer management of the project area.

Mitigation Measures

- Installation of solar panels on each structure to provide alternative source of power for household use as well as enhancing natural lighting in the designs.
- Pursue options for drilling a borehole on the site to supplement MAVWASCO water supply.
- Install water automatic taps that have the capacity to enhance water saving.
- Install an onsite waste water management plant as a back-up to the sewer line.

7.5 DECOMMISSIONING PHASES IMPACTS DISCUSSION

Environmental Emergency and Response

In the event of an environmental emergency during the decommissioning activity, the proponent should establish a procedure for handling the emergency. For example, if a spill of fluid occurred during project decommissioning, the proponent should be able to activate the emergency response protocol, which should include spill response, contingency and urgency communications.

Fire hazards and Management

The proponent should implement the fire procedures, assignment and guidance information on the project site to help in the prevention and management of fire. This will help highlight fire hazards, precautions and suppression facilities necessary to prevent fires from occurring or spreading to prevent loss of life, serious injuries and damage to plant, equipment and structures. The same should also provide the authority and channel of command in the event of fire.

Recycling and Reuse

During decommissioning, there is need to identify the materials that will be of economic value if reused or can be recycled for use gain. In this regard, there is need to identify suitable recycling and disposal options for the equipment and materials that are dismantled, in line with best management principles of the waste hierarchy. Recycling and reuse of materials is to be maximized to the greatest extent possible, subject to safety and pollution considerations. Where practicable, and subject to considerations about safety and pollution, provide local people with first choice concerning acquisition of recyclables or reusable infrastructure.

Reinstatement and Rehabilitation

After demolition of the building and associated infrastructure, site access roads with no beneficial re-use potential by deep ripping, shaping and levelling after the removal and disposal of construction debris. Natural drainage patterns should be reinstated as closely as possible. Also shape, level and de-compact the final landscape, dress with topsoil and, where necessary, vegetate with indigenous species.

7.5.1 POSITIVE IMPACTS DURING DECOMMISSIONING

Rehabilitation of the site

Upon decommissioning of the residential development project, the site will be rehabilitated and reinstated to its original state. This will include replacement of topsoil and re-vegetation of the site, which will lead to improved visual quality of the area.

Employment opportunities

The decommissioning process will be in need of both skilled and semi-skilled labour. The required labour can easily be sourced locally. This will help in reducing social vulnerability and increase household income. However, the job will be short term with the workers soon thereafter being unemployed. It is therefore concluded that the provision of employment opportunities during decommissioning shall therefore provide a positive socio-economic impact but on a short term basis.

Informal Business Growth

During decommissioning period the informal sector will benefit from the operations. This will involve different local entrepreneurs such as local food vending operators who will be selling their food stuffs to the site workers while local business people will salvage construction materials for resale. Such a move for instance, shall promote these local entrepreneurs in the project area.

7.5.2 NEGATIVE IMPACTS DURING DECOMMISSIONING

Noise and vibration

Demolition of structures and removal of the supporting facilities such as water and electricity lines will involve the use of heavy machinery which will generate noise and excess vibration which will impact on the surrounding receptors. The excessive noise and vibrations impact receptors will be general and casual workers on site, adjacent property personnel. The decommissioning process is a temporary nature and it is anticipated that the noise generated will be short lived. However, the proponent is advised to undertake a combination of the following mitigation measures so as to reduce the residual impacts.

Mitigation measure will include:

- Scheduling all the decommissioning works within the normal working hours of between 8am and 5pm.
- Provision of screening around the site when the demotion works is on-going to reduces the impact of noise by cordoning the area.
- Adherence to the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

Air pollution

Dust generated from the demolition of the concrete structure, excavation works and rehabilitation of the area will pollute the air within and around the project area. Increase in particulates in the air will possess a respiratory health risk to the surrounding community near the project as well as other sensitive receptors located in close proximity to the project.

Mitigation measures include:

- Water spraying to suppress dust especially where dust activities are taking place.
- Cordoning the site using meshed cloth to capture particulates during demolition of the structures.
- Providing workers involved with appropriate PPE such as dust masks or respirators.

Solid Waste

Demolition activities will lead to solid waste generation mainly from building materials used and other materials used in finishing, cement blocks, steel, power and water connection as well as other building materials removed from the foundations. Plastic and metal materials, concrete surfaces and foundations, metal cuttings, reinforcing bars and piping materials all need to be removed. Other waste types will be composed of degradable and non-toxic wastes generated from food wastes, office papers, cardboard and used timber remain. These types of waste need to be adequately separated and appropriate transportation to approved dumping site be undertaken in compliant to EMCA 1999 (Waste Management) Regulation, 2006.

All options will be considered in avoiding or minimizing transporting any unsuitable excavated materials from site, as this is undesirable from both an ecological and economic perspective. Where practicable, materials should be reused or recycled appropriately. Excess materials generated at the facility are also required to be tested for potential environmental concerns. The test will allow for proper classification and characterization of excess materials. The results of the test help determine if excess materials can be reused onsite or if they are considered waste. If it is deemed acceptable for reuse onsite, the excess materials may be reused during site reclamation landscaping or visual and sound barrier purposes or it will be shipped offsite to an approved disposal facility. If determined to be waste, the excess materials will be managed in accordance with set waste management requirements on site.

Mitigation Measures:

- The contractor shall put in place a Waste Management Plan aimed at minimising the production of all wastes and maximize on resource recovery.
- Where possible measures will be put in place to recycle materials such as metal off-cuts, some plastics and clean paper/ cardboard utilizing existing specialist recycling firms in Nairobi.
- A suitable location within site for placing concrete and foundations removal and washing down equipment will be undertaken with no discernable impact.
- Other non-recyclable materials should be segregated and stored in plastic bins, collected and disposed of through the Mavoko sub-county disposal site.
- Disposal bins should be provided at designated areas at the project site to help in waste segregation to encourage recycling.

- Prepare a contaminated land assessment which identifies all areas of contaminated land, the nature of the contamination and the necessary measures to contain and rehabilitate these site.
- Enforce regular collection and disposal of garbage by the project contractor through licensed NEMA waste handler in the entire decommissioning process.
- Prepare an inventory of all hazardous materials and wastes to be disposed of and specify the method of disposal in accordance with the MSDS and current NEMA's legislation.

Table 10: Impact Analysis matrix

IMPACT MATRIX	DIRECTION		DURATION		LOCATION		MAGNITUDE			EXTENT			SIGNIFICANCE		
ACTIVITY /IMPACT	**Pos.**	**Neg.**	**Long**	**Short**	**Direct**	**Indirect**	**High**	**Moderate**	**Low**	**National**	**Regional**	**Local**	**High**	**Moderate**	**Minor**
Site Clearance and Construction															
1. Biological Impacts															
Vegetation clearance		X	X		X			X				X		X	
Soil erosion due to vegetation removal		X	X		X		X					X		X	
Effect of dust on vegetation		X		X		X			X			X			X
2. Physical Impacts															
Increased pollutants in the air		X	X		X			X				X	X		
Increased noise pollution		X	X		X		X					X	X		
Excavation works (soil removal and rock blasting)		X		X	X				X			X			X
Increased water pollution		X		X		X		X				X		X	
Soil erosion and siltation		X		X		X			X			X			X
Increased runoff and flooding hazard		X	X			X		X				X		X	
Vibration		X		X	X		X					X	X		
3. Construction															

IMPACT MATRIX	DIRECTION		DURATION		LOCATION		MAGNITUDE			EXTENT			SIGNIFICANCE		
ACTIVITY /IMPACT	**Pos.**	**Neg.**	**Long**	**Short**	**Direct**	**Indirect**	**High**	**Moderate**	**Low**	**National**	**Regional**	**Local**	**High**	**Moderate**	**Minor**
Works															
Water demand and supply		X		X	X			X				X			
Energy demand		X		X		X			X			X			X
Refueling of vehicles and fuel storage onsite		X	X		X				X			X		X	
Increased accident potentials		X	X		X			X				X		X	
Repair of vehicles/ machinery onsite		X		X		X			X			X			X
4. **Material Storage and Transport**															
Traffic congestion		X	X		X				X			X		X	
Dusting and Spillage		X	X		X			X			X			X	
Suspended solid runoff		X	X		X				X			X			X
Effect on vegetation		X		X	X				X			X			X
5. **Construction Crew**															
Increased potential for oil spills		X		X	X				X			X			X
Water demand and supply		X		X	X				X			X			X
Sewage/wastewater generation		X	X		X				X			X		X	
Improper solid waste disposal		X	X		X				X			X		X	
Increased potential for accidents		X	X		X			X				X	X		
6. **Socioeconomics**															

IMPACT MATRIX	**DIRECTION**		**DURATION**		**LOCATION**		**MAGNITUDE**			**EXTENT**			**SIGNIFICANCE**		
ACTIVITY /IMPACT	**Pos.**	**Neg.**	**Long**	**Short**	**Direct**	**Indirect**	**High**	**Moderate**	**Low**	**National**	**Regional**	**Local**	**High**	**Moderate**	**Minor**
Employment	X		X		X			X				X		X	
Traffic flow and access	X		X		X			X				X			X
Visual Impacts		X	X		X		X					X		X	
Increased commercial activity	X		X			X		X				X		X	

CHAPTER EIGHT: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The Environmental and Social Management Plan (ESMP) is a site specific plan developed to ensure that the project is implemented in an environmentally sustainable manner where all stakeholders including the project proponents, contractors and subcontractors, including consultants, understand the potential environmental risks arising from the proposed residential project and take appropriate actions to properly manage the risks. Adequate environmental management measures need to be incorporated during the entire planning, construction and operation stages of the project to minimize any adverse environmental impact and assure sustainable development of the area. The ESMP is proactive in nature and should be upgraded if new facilities or modification of existing facilities, with environmental concerns, come up at a later stage. The ESMP includes four major elements:

a. **Commitment & Policy:** Project will strive to provide and implement the Environmental and Social Management Plan that incorporates all issues.

b. **Planning:** This includes identification of environmental impacts, legal requirements and setting environmental objectives.

c. **Implementation:** This comprises of resources available to the developers, accountability of contractors, training of operational staff associated with environmental control facilities and documentation of measures to be taken. The Environmental and Social Management Plan will be properly executed if the estimates of all environmental protecting and monitoring plan is thoroughly studied and estimated properly. For that feasibility of each plan is worked out on the basis of budgetary provision and efficiency of each plan and last but not least, long term survival of the project. Based on that after due discussion with environmental consultant and project proponent the funding are allotted on each planning and following table shows the budgetary requirement for the same. To ensure that the negative environmental impacts can be controlled and mitigated effectively, a stringent and scientific management plan has been prepared. The proposed ESMP is to be utilized by the contractor together with the proponent to ensure that the environmental responsibilities and obligations of the ESIA are satisfied during the life of the project. Annual audits should be conducted to ensure that the system for implementation of the ESMP is operating effectively.

d. **Measurement & Evaluation:** This includes monitoring, corrective actions, and record keeping. The ESMP will be planned for construction and operating stages of the project and includes the following elements:

- Air pollution control and management.
- Water pollution control and management
- Noise control and management
- Storm water management
- Solid waste management
- Plantation, landscaping and land management
- Management of Social Issues
- Energy conservation

Table 11: Environmental and Social Management Plan

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and monitoring during design, construction and defects liability period	Responsibility for mitigation, monitoring and/or maintenance after defects liability period	Estimated Cost (Kshs)	Monitoring means	Recommended frequency of monitoring and indicators
Vegetation clearing	**Construction Phase** • Incorporation of natural vegetation into site landscape design. • Stockpiles shall not be allowed to become contaminated with hazardous materials. • Soil stockpiles shall not be higher than 2.5 m or stored for a period longer than 2 months • The proponent should fence the site. **Operation Phase** • No vegetation clearance impacts hence no mitigation. Clear all the soil debris cleared at the site.	Contractor Indesign Makumbi Ltd & Project Manager	Indesign Makumbi Ltd & Project Manager Indesign Makumbi Ltd & Project Manager	250,000 30,000 Monthly	Inspection & Routine maintenance Observation Routine maintenance	One off, before Construction works Continuous
Land degradation	**Construction Phase** • Strictly source material from NEMA authorised dealers or quarries • Backfilling of opened up borrow pits, borrow pits and quarries	Contractor	Indesign Makumbi Ltd & Project Manager	50,000	Observation	Weekly

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and monitoring during design, construction and defects liability period	Responsibility for mitigation, monitoring and/or maintenance after defects liability period	Estimated Cost (Kshs)	Monitoring means	Recommended frequency of monitoring and indicators
	• All wastes should be segregated and appropriately stored on site before final disposal. **Operation Phase** • No negative impact on land quality.					
Excavations and Soil erosion	**Construction Phase** • Schedule earth moving activities during the dry season. • Avoid unnecessary movement of soil materials from the site. • Provide soil conservation structures on the areas prone to soil erosion. • Introduce suitable and well-managed vegetation to generate surface covers on the open areas. **Operation Phase** • All solid wastes from the residential complex will be properly collected and recycled. • The entire site area will be well paved and thus there will be no leaching of any substances in case of spills.	Contractor Indesign Makumbi Ltd & Project Manager	Indesign Makumbi Ltd & Project Manager Indesign Makumbi Ltd & Project Manager	500,000 100,000 Monthly	Inspection & Routine maintenance Observation Routine maintenance	Weekly Continuous

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and monitoring during design, construction and defects liability period	Responsibility for mitigation, monitoring and/or maintenance after defects liability period	Estimated Cost (Kshs)	Monitoring means	Recommended frequency of monitoring and indicators
Solid waste management	**Construction Phase** • Efficient use, re-use and re-cycling of materials to minimise on solid waste. • Good housekeeping to ensure no littering from packaging materials. • Segregation of waste before appropriate disposal • The contractor should prepare a Waste Management Plan for management of solid waste management. • Disposal of solid waste that accumulate at the construction site should be properly disposed in NEMA licensed landfill in accordance with NEMA regulations. **Operation Phase** • Adopt sound waste management system to ensure proper solid waste disposal and collection facilities as per the prevailing NEMA regulations • Provision of waste collecting bins.	Contractor Indesign Makumbi Ltd & Project Manager	Indesign Makumbi Ltd & Project Manager Indesign Makumbi Ltd & Project Manager	400,000 100,000 Monthly	Inspection & Routine maintenance Observation Routine maintenance	Weekly Continuous

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and monitoring during design, construction and defects liability period	Responsibility for mitigation, monitoring and/or maintenance after defects liability period	Estimated Cost (Kshs)	Monitoring means	Recommended frequency of monitoring and indicators
Water Resource, supply and use	**Construction Phase** • Appropriate containment structures should be provided to store contaminated water from the construction site. • Disposal of construction debris in approved areas. • Avoid excessive use of the water supplied by the MAVWASCO. • Roof catchments should be provided with gutters to facilitate collection of the run-off.	Contractor	Indesign Makumbi Ltd & Project Manager	200,000	Inspection & Routine maintenance Observation	Daily
	Operation Phase • Management of water usage and avoid unnecessary wastage. • Use hydro pneumatic system with variable frequency drive for the water supply system. • Ensure (consistently) good water quality through regular water analysis to ascertain compliance to public health standards. • Supplement MAVWASCO water supply with water from other sources with necessary approvals	Indesign Makumbi Ltd & Project Manager	Indesign Makumbi Ltd & Project Manager	100,000 Monthly	Routine maintenance	Continuous

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and monitoring during design, construction and defects liability period	Responsibility for mitigation, monitoring and/or maintenance after defects liability period	Estimated Cost (Kshs)	Monitoring means	Recommended frequency of monitoring and indicators
Wastewater Management	**Construction Phase** • A temporary pit latrine shall be constructed on the site during construction phase for use • The proponent shall connect the sewerage effluent to the MAVWASCO sewer in the area. **Operation Phase** • Connect sewerage effluent to the MAVWASCO sewer system and have an onsite sewer treatment plant	Contractor	Indesign Makumbi Ltd & Project Manager	300,000	Inspection & Routine maintenance Observation	Monthly
		Indesign Makumbi Ltd & Project Manager	Indesign Makumbi Ltd & Project Manager	200,000 Monthly	Routine maintenance	Monthly
Air Pollution Control and Management	**Construction Phase** • Regularly sprinkle water to reduce dust on site and access roads. • Ensure strict enforcement of on-site speed limit regulations. • Avoid excavation works in extremely dry weather. • Provide dust nets to prevent the spread of dust. • Ensure all trucks delivering construction materials are properly covered.	Contractor	Indesign Makumbi Ltd & Project Manager	100,000	Inspection & Routine maintenance Observation	Weekly
		Indesign Makumbi Ltd & Project	Indesign Makumbi Ltd & Project Manager	50,000 Monthly	Routine maintenance	Quarterly

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and monitoring during design, construction and defects liability period	Responsibility for mitigation, monitoring and/or maintenance after defects liability period	Estimated Cost (Kshs)	Monitoring means	Recommended frequency of monitoring and indicators
	• Implement a dust control program. • Provide PPE such as nose masks to the workers. **Operation Phase** • Erect engine anti-idling warning signs in the parking lots • Encourage use of clean fuels	Manager				
Noise Control and Management	**Construction Phase** • Schedule noisy activities during the normal working hours of between 8am to 5pm. • Put off machines and equipment when not in use. • Ensure machinery is well maintained to reduce noise emitted. • Provide workers with appropriate PPEs. • There should be no unnecessary horning of the involved machinery and vehicles. **Operation Phase** • Air conditioning system will be serviced and maintained regularly.	Contractor Indesign Makumbi Ltd & Project Manager	Indesign Makumbi Ltd & Project Manager Indesign Makumbi Ltd & Project Manager	100,000 50,000 Monthly	Inspection & Routine maintenance Observation Routine maintenance	Weekly weekly

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and monitoring during design, construction and defects liability period	Responsibility for mitigation, monitoring and/or maintenance after defects liability period	Estimated Cost (Kshs)	Monitoring means	Recommended frequency of monitoring and indicators
	• Anti-honking sign boards will be placed in the parking areas and on entry and exit points • Install silencers in generators.					
Storm water management	**Construction Phase** • Installation of proper drainage structures • Install cascades to break the impact of water flowing in the drains • Install oil/grease interceptors on the drainage channels. **Operation Phase** • Ensure efficiency through sound maintenance of drainage channels.	Contractor Indesign Makumbi Ltd & Project Manager	Indesign Makumbi Ltd & Project Manager Indesign Makumbi Ltd & Project Manager	500,000 50,000 Monthly	Inspection & Routine maintenance Observation Routine maintenance	During construction and on completion of the structure Daily

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and monitoring during design, construction and defects liability period	Responsibility for mitigation, monitoring and/or maintenance after defects liability period	Estimated Cost (Kshs)	Monitoring means	Recommended frequency of monitoring and indicators
Oil Leaks and Spills	**Construction Phase** • Refuelling and maintenance of large vehicles will be done offsite. • All hazardous materials will be stored in appropriately bunded containers. • Maintaining spill response kits at the site at all times. • The site design should incorporate oil sumps at the parking areas to isolate oil spills from parked vehicles that might spill to the storm drains. • All oil products and materials should be stored in site stores. • Regularly check for leaks from paint containers.	Contractor	Indesign Makumbi Ltd	100,000	Observation & Inspections	Daily
	Operation Phase • There are no significant impacts • Ensure sound working of oil interceptors along the drains leading from car wash and parking bays.	Indesign Makumbi Ltd and Project Manager	Indesign Makumbi Ltd and Project Manager	50,000	Notices and inspections Inspection/ observation	Weekly

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and monitoring during design, construction and defects liability period	Responsibility for mitigation, monitoring and/or maintenance after defects liability period	Estimated Cost (Kshs)	Monitoring means	Recommended frequency of monitoring and indicators
Traffic and pedestrian safety	**Construction Phase** • Speed bumps with signage should be put in place to give warning and direction. • Protect walkways with temporary barriers. • Adhere to Kenya traffic laws. **Operation Phase** • Erect suitable bumps along internal driveway • Erect speed limit notices especially within the complex	Contractor	Indesign Makumbi Ltd	100,000	Observation & Inspections	Daily
		Indesign Makumbi Ltd and Project Manager	Indesign Makumbi Ltd and Project Manager	100,000	Notices and inspections	Weekly
Visual Impacts	**Construction Phase** • Erect a suitable perimeter wall • Clear all solid waste and debris from the site • Landscaping and planting of vegetation on the site. **Operation Phase** • There are potential no further visual impacts at the operation phase.	Contractor	Indesign Makumbi Ltd	500,000	Inspection & Routine maintenance Observation	Monthly
		Indesign Makumbi Ltd and Project Manager	Indesign Makumbi Ltd and Project Manager	Nil	None	None

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and monitoring during design, construction and defects liability period	Responsibility for mitigation, monitoring and/or maintenance after defects liability period	Estimated Cost (Kshs)	Monitoring means	Recommended frequency of monitoring and indicators
Occupational Health and Safety	**Construction Phase** • Register the workplace with DOSHs. • Contract a qualified Health and Safety Advisor to conduct training • Provide a standard First Aid Kit and train workers on the same. • Workers should be inducted with training on health and safety. • Provide and enforce the use of PPE. • Erect safety and informative signage for hazardous conditions. • Maintain an incident/ accident register, in accordance with the Occupational Safety and Health Act, 2007, and report incidences to DOSHS. **Operation Phase** • Maintain an incident/ accident register, in accordance with the OSHA, 2007, and undertake audits as appropriate.	Contractor Indesign Makumbi Ltd and Project Manager	Indesign Makumbi Ltd Indesign Makumbi Ltd and Project Manager	200,000 500,000 monthly	Reports Number of OHS related illnesses Reports produced	Continuous Random Weekly reporting

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and monitoring during design, construction and defects liability period	Responsibility for mitigation, monitoring and/or maintenance after defects liability period	Estimated Cost (Kshs)	Monitoring means	Recommended frequency of monitoring and indicators
Fire safety and preparedness	**Construction Phase** • Install fire-fighting equipment as approved in the designs. • Conduct training on fire-fighting, evacuation and emergency response to workers. • Maintain/ service fire-fighting machinery regularly and conduct drill for preparations. **Operation Phase** • Provide appropriate firefighting equipment i.e. fire hydrants and extinguishers within the complex.	Contractor Indesign Makumbi Ltd and Project Manager	Indesign Makumbi Ltd Indesign Makumbi Ltd and Project Manager	2,000,000 100,000 monthly	Installed equipment Number of extinguishers Audits of the fire equipment Observation	On completion Random Quarterly reporting
Energy resources	**Construction Phase** • Maximize the use of natural lighting through design. • Install an energy-efficient lighting system for the development. • Use of clean fuels e.g. unleaded and de-sulphurized fuels in vehicles. **Operation Phase**	Contractor	Indesign Makumbi Ltd	Energy costs	Inspection/ observation/re cords	Monthly

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and monitoring during design, construction and defects liability period	Responsibility for mitigation, monitoring and/or maintenance after defects liability period	Estimated Cost (Kshs)	Monitoring means	Recommended frequency of monitoring and indicators
	• Ensure electrical equipment, appliances and lights are switched off when not being used • Design to provide for adequate natural lighting. • Install energy saving bulbs at all lighting points. • Install solar systems to complement heating and lighting • Encourage use of natural lighting during the day.	Indesign Makumbi Ltd/ Project Manager	Indesign Makumbi Ltd/ Project Manager	500,000	Inspection/ observation/re cords	weekly
Materials management to minimise the impact of material delivery and waste disposal	**Construction Phase** • Develop materials delivery and waste disposal handling plan. • Develop safety measures to avoid loss of load from trucks. • Implement methods to reduce dust emission from the loads e.g. covering of trucks.	Contractor	Indesign Makumbi Ltd	1000,000 monthly	Inspections	Daily
Security	**Construction & Operation Phase** • Provide security guards and facilities during the entire project lifecycle.	Contractor	Indesign Makumbi Ltd	100,000 monthly	Inspections	Daily

Environmental/ Social Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and monitoring during design, construction and defects liability period	Responsibility for mitigation, monitoring and/or maintenance after defects liability period	Estimated Cost (Kshs)	Monitoring means	Recommended frequency of monitoring and indicators
Socio-economic impacts	**Construction & Operation Phase** • Employ workers from the immediate area • Establish a code of conduct for the workers. • All communications with the community should be documented. • Display communicative posters within site on HIV/AIDS related messages. • Avail literature on HIV/AIDS awareness to staff.	Contractor & Indesign Makumbi Ltd	Indesign Makumbi Ltd	To be determined	Employment Contract	Weekly
Covid -19 Prevention and Mitigation	**Construction & Operation Phase** • The Workplace shall develop and implement action plans to prevent and mitigate COVID-19. • The action plan and preventive measures should be regularly monitored and updated. • Observe preventive measures at the workplace including Thermal screening of workers, sensitization of the need to wear facemasks, regular hand washing with soap or sanitizing and social distancing as	Contractor & Indesign Makumbi Ltd	Indesign Makumbi Ltd	200,000	Reported cases on site	Daily screening of project workers

Environmental/ Social Impact	**Proposed Mitigation and Aspects for Monitoring**	**Responsibility for intervention and monitoring during design, construction and defects liability period**	**Responsibility for mitigation, monitoring and/or maintenance after defects liability period**	**Estimated Cost (Kshs)**	**Monitoring means**	**Recommended frequency of monitoring and indicators**
	per Ministry of Health and World Health Organization Protocols					

Table 12: Environmental and Social Management Plan during decommissioning

Expected Negative Impacts	Recommended Mitigation Measures	Responsibility Party	Time Frame	Cost (Ksh)
Scraps and construction debris	• The contractor shall put in place a waste management plan aimed at minimising the production of all wastes and maximize on resource recovery. • Where possible measures will be put in place to recycle materials such as metal off-cuts, concrete blocks, some plastics and clean paper/ cardboard utilizing existing specialist recycling firms in Kenya. • A suitable location within site for placing concrete and foundations removal and washing down equipment will be undertaken with no discernable impact. • Other non-recyclable materials should be segregated and stored in plastic bins, collected and disposed of. • Disposal bins should be provided at designated areas at the project site to help in waste segregation to encourage recycling. • Enforce regular collection and disposal of garbage by the project contractor through licensed NEMA waste handler in the entire decommissioning process. • Prepare an inventory of all hazardous materials and wastes to be disposed of and specify the method of disposal in accordance with the MSDS and NEMA's legislations. • Remove and dispose of all demolition waste at an appropriate authorized waste disposal site.	Contractor, Indesign Makumbi Project Manager	One-off	1,500,000

Expected Negative Impacts	Recommended Mitigation Measures	Responsibility Party	Time Frame	Cost (Ksh)
Air Pollution	• Water spraying to suppress dust especially where dusty activities are taking place. • Providing workers involved with appropriate PPEs such as dust masks or respirators.	Contractor, Indesign Makumbi Project Manager	One-off	500,000
Occupational Hazards	• Ensure that safety measures have been effectively integrated and positioned in respective areas of the project to control and manage health and safety hazards.	Contractor, Indesign Makumbi Project Manager	One-off	250,000
Noise and vibrations	• Scheduling all the decommissioning works within the normal working hours of between 8am and 5pm. • Provision of screening around the site when the demotion works is on-going to reduces the impact of noise by cordoning the area. • Adherence to the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.	Contractor, Indesign Makumbi Project Manager	One-off	300,000

CHAPTER NINE: CONCLUSIONS AND RECOMMENDATIONS

This ESIA Study report has been prepared to provide sufficient and relevant information on the proposed Indesign Makumbi Limited Residential Development project located in Syokimau to enable the Authority-NEMA to establish the sustainability and compliant of the project and whether activities of the project are likely to have significant or adverse environmental or social impacts. Mitigation measures have been proposed for the identified impacts in this report and an ESMP for the implementation of the proposed measures presented. The ESMP presented in this report is a tool to be used by the project team, contractor and Indesign Makumbi Limited during the entire life cycle of the project. Based on the findings of this study, the ESIA study team concludes that the project and subsequent operational activities will generate significant socio-economic benefits to the public, the proponent, local government and the nation at large. This study has also established a number of negative environmental consequences that the project activities are likely to induce if mitigation measures are not implemented effectively as they have been presented in Chapter 7 of this report.

This study indicates that the construction and occupation/operation of the proposed (apartments) project will have positive impacts, which include employment, increase in the national/local housing stock and quality, increase in Government revenue, and improvement of standards of living. However, despite the outlined positive impacts, the proposed development will come up with some negative impacts such as increased pressure on existing infrastructure, potential pollution (to air, water, soil) mostly during construction phase, enhanced security risks and social crimes, occupational and safety hazards and increased waste (solid and liquid) generation among others. The proponent shall in liaison with the local administration respond appropriately to conserve the environment by avoiding activities that may negatively affect the environment. The proposed project design has integrated mitigation measures with a view to ensuring compliance with all the applicable laws and procedures as well as the legislation and regulatory framework that govern environmental management. The structures should be built to the required planning/architectural/structural standards of Mavoko Sub-county. 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 at the project site, 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 beneficial and important. It is our considerable opinion that the proposed residential development is a timely venture with a positive and significant contribution to the government housing policy as well as a key contributor to Governments of Kenya Big Agenda Four that incorporates affordable housing. 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 so far. 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. We further note that wastes should be reduced to the minimum as this will save on costs and at the same time preventing environmental pollution. The waste contractors during both the construction and operational phases should exercise diligence in all activities to ensure environmental sustainability. During project implementation and occupation, sustainable environmental management (SEM) shall be ensured. The ESIA study team hereby recommends the approval of the project subject to the proponent's commitment and adherence to all applicable Kenyan laws, project mitigation measures as presented in the ESMP section of this report and the implementation of all recommendation put forward as well as other best industry practices.

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APPENDICES

Appendix I: Copy of EIA Lead Expert NEMA License
Appendix II: Copy of Certificate of Incorporation
Appendix III: PIN Certificate
Appendix IV: The Proposed Site Title Deed
Appendix V: Change of User
Appendix VI: Copies of Consultation List and Public Participation Questionnaires
Appendix VII: Sample Laboratory Results
Appendix VIII: Copies of the Proposed Project Approved Architectural Drawings