ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT

FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL HOUSING DEVELOPMENT ON PLOT L.R NO. 24573 OFF QUARRY ROAD IN KATANI AREA, MAVOKO SUB-COUNTY WITHIN MACHAKOS COUNTY

NEMA/TOR/5/2/528

G.P.S COORDINATES:

LATITUDE: -1.368004°S

LONGITUDE:36.990643°E

Prepared in Accordance With:

- Environmental Management and Co-ordination Act, 1999
- Environmental (Impact Assessment and Audit) Regulations, 2003
- Legal notice 31of 2019

PREPARED BY:	PROJECT PROPONENT
GREEN BUILDERS & PLANNING CONSULTANTS LTD Consultants In: EIA/EA, Land Use Planning & Feasibility Studies Vedic House, Mama Ngina St., 6th Floor, Suite 608 **Add:** P.O Box 79170 - 00400 Nairobi **Tel:** +254 704 707 633 **Email:** greenbuildersplanningconsult@gmail.com	**SHAMJI KALYAN PINDORIA LTD** **P. O BOX 76018-00508** **NAIROBI**

SEPTEMBER 2023

DOCUMENT AUTHENTICATION

This Environmental Impact Assessment study report has been prepared by **Green Builders & Planning Consultants Limited** (NEMA Reg No. **9571**) in accordance with the Environmental Management and Coordination Act 1999 and the Environmental (Impact Assessment and Audit) regulations 2003 and legal notice 31 of 2019 which requires every proponent undertaking a project specified in legal notice 31 as high risk to undertake Environmental Impact Assessment(EIA) study report for submission to the National Environmental Management Authority (NEMA) for licensing. We the undersigned, certify that the particulars in this report are correct and righteous to the best of our knowledge.

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PROJECT PROPONENT:

SHAMJI KALYAN PINDORIA LTD

P.O BOX 76018-00508

NAIROBI

NAME:……

DESIGNATION:…….

Signature…….……Date……..……

FACT SHEET

Assignment Name	Environmental Impact Assessment Study Report		
Type of Facility	Proposed residential housing development		
County	Machakos		
Location	Plot L.R NO. 24573 measuring approximately 10.00 hectares off Quarry road in Katani area, Mavoko Sub-County		
GPS Coordinates	LATITUDE: -1.368004°S LONGITUDE:36.990643°E		
Proponent	SHAMJI KALYAN PINDORIA LTD		
Address of the Proponent	P.O BOX 76018-00508 NAIROBI		
Summary Project description	construction of additional residential housing units (Phase 3-17) comprising of 1,210 units, a kindergarten and lower primary school with supporting amenities		
Project Cost	The estimated total project cost is approximately two hundred and eighty seven million, five hundred thousand Kenya shillings only (KShs. 287,500,000.00)		
EIA firm of experts	Green Builders & Planning Consultants Limited 0704 707 633	**NEMA Firm Reg No:**	9571

ACRONYMS AND ABBREVIATIONS

EIA - Environmental Impact Assessment

EA - Environmental Audit

EHS - Environmental Health and Safety

EMCA - Environmental Management and Coordination Act

EMP - Environmental Management Plan

HA - Hectares

KM – Kilometres

KPLC - Kenya Power and Lighting Company

MOH - Ministry Of Health

NEAP - National Environmental Action Plan

NEMA - National Environment Management Authority

NPEP - National Poverty Eradication Plan

OHS - Occupational Health and Safety

PPE - Personal Protective Equipment

PRSP - Poverty Eradication Strategies Paper

SQM – Square Metres

SWM – Solid Waste Management

TOR - Terms of Reference

VAT - Value Added Tax

DEFINITION OF ANALYTICAL TERMS

Environmentally Sound Design: Is the design and implementation of activities and projects such that the environmental harm associated with a particular development objective is kept to a practicable minimum.

Positive Impact: A change which improves the quality of the environment (for example by increasing species diversity; or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities).

Neutral Impact: A change which does not affect the quality of the environment.

Negative Impact: A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem, or property or by causing nuisance.

Significant impact: An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.

Profound impact: An impact which obliterates sensitive characteristics.

Do-Nothing Impact: The environment as it would be in the future should no development of any kind be carried out.

Indeterminable Impact: When the full consequences of a change in the environment cannot be described.

Irreversible Impact: When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.

Residual Impact: The degree of environmental change that will occur after the proposed mitigation measures have taken effect.

Synergistic Impact: Where the resultant impact is of greater significance than the sum of its constituents.

Worst Case Impact: The impacts arising from a development in the case where mitigation measures substantially fail.

Cumulative impacts: Are identified as impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions.

Indirect impacts: Are defined as impacts on the environment which are not a direct result of the project, possibly produced some distance away from the project or as a result of a complex pathway.

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EXECUTIVE SUMMARY

Globalisation, urbanisation, migration and technological advancements have continued to drive cities forward right from their infant stages, the cyclic processes, growth, through to their renewal and regeneration. More and more people are moving and positioning themselves in cities for business, work, venturing forth and recreation. The demand for residential developments in Kenyan urban areas has remained under tremendous pressure. Both the government and private sector have had a role to play with the government servicing the land and leaving it to private entrepreneurs to develop. However, the provision of residential housing has not kept pace with the said phenomenon. It is laudable that housing is now a priority for Kenyan government and increasingly been considered a human right as opposed to a commodity only accessible to the wealthy.

For a long time, the world over, 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 lack of environmental conservation resulting to unsustainable development. More recently, investors and developers, spurred on by regulators world over, have recognized the need for change in order to safeguard the environment.

Reference to this, environmental concerns have now been integrated in the planning and implementation processes of any proposed projects in Kenya. The key objective is to mitigate conflicts with the environment at the vicinity during implementation and operation phases. In addition, it is now mandatory for Environmental Impact Assessment (EIA) to be undertaken on projects of such magnitude and nature; to enhance Sustainable Environmental Management as well as controlling and revitalizing the much-degraded environment. The environmental management is regulated by the National Environmental Management Environment (NEMA) in Kenya.

Pursuant to the prevailing legal requirements as envisaged in the Environmental Management and Coordination Act (EMCA), CAP 387 and to ensure sustainable environmental management, the proponent undertook this ESIA on the proposed project's site; and incorporated substantial environmental aspects as advised by NEMA. This ESIA report thus provides relevant information and environmental considerations on the project proponent's intention to seek approval from NEMA for the development of the proposed project. Environmental Experts who are registered by the Authority conducted the assessment

Shamji Kalyan Pindoria Ltd herein referred to as "the project proponent" is proposing to undertake construction of additional residential housing units (Phase 3-17) with supporting amenities comprising of 1,210 units on Plot L.R NO. 24573 measuring approximately 10.00 hectares off Quarry road in Katani area, Mavoko Sub-County within Machakos County.

The project site is currently occupied by four storey residential apartments comprising of one hundred and fifty(150) units (Phase 1) which is complete and ongoing construction of ninety residential(90) units and thirty seven (37)shops(Phase 2). The project proponent has obtained NEMA licenses for both phases (NEMA/EIA/PSL/6006 and NEMA/EIA/PSL/22922) respectively.

The proposed additional Phases will comprise of the following;

Phase 3

Phase 3 will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block E-H
ii. Block E-E
iii. Block E-G
iv. Block E-J
v. Block E-I
vi. Block D-F
vii. Block D-E
viii. Block D-H
ix. Block D-G

Summary: Phase 3 will have a total of 90 units;

- ✧ fifty (50) one bedroom units,
- ✧ thirty four(34) three bedroom units and
- ✧ eight(8), two bedroom units

Phase 4

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block E-L
ii. Block E-K
iii. Block E-N
iv. Block E-M

v. Block E-P

vi. Block D-J

vii. Block D-I

viii. Block D-L

ix. Block D-K

Summary: Phase 4 will have a total of 90 units

Phase 5

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block E-R

ii. Block E-Q

iii. Block E-T

iv. Block E-S

v. Block E-O

vi. Block D-N

vii. Block D-P

viii. Block D-O

Summary: Phase 5 will have a total 90 units

Phase 6

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block D-R

ii. Block D-T

iii. Block D-Q

iv. Block D-S

v. Block E-V

vi. Block E-U

vii. Block E-X

viii. Block E-W

ix. Block E-Z

Summary: Phase 6 will have a total of 90 units

Phase 7

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block AE-B
ii. Block E-Y
iii. Block AE-A
iv. Block AE-D
v. Block AE-C
vi. Block AE-F
vii. Block AE-E
viii. Block D-V
ix. Block D-U

Summary: Phase 7 will have a total of 90 units;

- ✧ Seventy two (72), three bedroom units and
- ✧ Eighteen (18), two bedroom units

Phase 8

Will comprise of two blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block D-X
ii. Block D-W

Summary: Phase 8 will have a total of twenty(20) units

- ✧ sixteen (16) three bedroom units and
- ✧ four(4), two bedroom units

Phase 9

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block C-F
ii. Block C-E
iii. Block C-H
iv. Block C-G
v. Block C-I
vi. Block B-I
vii. Block B-H
viii. Block B-K

ix. Block B-J

Summary: Phase 9 will have have a total of ninety (90) units

- ✧ fifty (50) three bedroom units
- ✧ Thirty two (32), two bedroom units and
- ✧ Eight(8), one bedroom units

Phase 10

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block C-J

ii. Block C-L

iii. Block C-K

iv. Block C-N

v. Block C-M

vi. Block B-M

vii. Block B-L

viii. Block B-O

ix. Block B-N

Summary: Phase 10 will have a total of 90 units;

- ✧ forty (40), three bedroom units
- ✧ Forty two (42), two bedroom units and
- ✧ Eight(8), one bedroom units

Phase 11

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block C-P

ii. Block C-O

iii. Block C-Q

iv. Block B-Q

v. Block B-P

vi. Block B-S

vii. Block B-R

viii. Block B-U

ix. Block B-T

Summary: Phase 11 will have a total of 90 units

Phase 12

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block C-R
ii. Block C-T
iii. Block C-S
iv. Block B-W
v. Block B-V
vi. Block B-Y
vii. Block B-X
viii. Block AB-A
ix. Block B-Z

Summary: Phase 12 will have a total of 90 units

Phase 13

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block C-V
ii. Block C-U
iii. BlockC-X
iv. Block C-W
v. Block C-Z
vi. Block C-Y
vii. Block AB-C
viii. Block AB-B
ix. Block AB-D

Summary: Phase 13 will have a total of 90 units

Phase 14

Will comprise of five blocks of ground plus 4 floors each with ten (10) units as follows

i. Block AB-E
ii. Block AB-I
iii. Block AB-H
iv. Block AB-G
v. Block AB-F

Summary: Phase 14 will have a total of 50 units

Phase 15

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block A-E
ii. BlockA-F
iii. Block A-G
iv. Block A-H
v. BlockA-I
vi. Block A-J
vii. Block A-K
viii. Block A-L
ix. Block A-N

Summary: Phase 15 will have a total of 90 units

Phase 16

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block A-V
ii. Block A-U
iii. Block A-T
iv. Block A-S
v. Block A-R
vi. Block A-Q
vii. Block A-P
viii. Block A-O
ix. Block A-M

Summary: Phase 16 will have a total of 90 units

Phase 17

Will comprise of six blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block A-W
ii. Block A-X
iii. BlockA-Y
iv. BlockA-Z
v. Block AA-A
vi. Block AA-B

Summary: Phase 17 will have a total of 60 units

School block

This block will comprise of a kindergarten and lower primary school

Other amenities include; a gatehouses, adequate parking spaces, playground, a shopping centre and garbage section/solid waste disposal areas, KPLC room (switch room), septic tank, existing borehole and storm water drains

The main project components include the following:

a. Clearing and preparation of the project site.
b. Actual construction activities
c. Development of driveways, walkways and parking areas
d. Development of utilities services i.e. drainage systems, wastewater and electricity supply
e. Site landscaping especially tree planting and landscaped gardens

Socio-Economic (Positive) Impacts of the Project

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

(a) Provision of residential housing to the growing urban population

(b) The optimal use of land i.e. increased utility of the parcel of land, which is currently underutilised.

(c) Boost local investment; to both government and the proponent.

(d) Creation of market for goods and services. Many secondary businesses are also likely to spring up during the construction phase especially those providing foods and beverages to the construction workers.

(e) Provision of employment during both construction and occupational phases.

Issues of concern associated with project implementation

Against the background of the above positive impacts, there are a few issues of concern anticipated from the implementation of the subject project. These shall be experienced during implementation/construction phase, operation/occupation phase and decommissioning phase. They include soil degradation; air quality; noise; oil wastes; water resources; solid and liquid waste

management; drainage, terrestrial ecology, visual and landscape; traffic; public comfort; occupation, health and safety (OHS); and energy.

The impacts have been elaborated as follows:

(a) Impact to soil (including soil erosion) especially when laying the foundation

(b) Increased noise and vibration mostly during construction phase.

(c) Impact (constraints/pressure) to the existing infrastructure i.e. water, power, roads among others.

(d) Increased waste generation (both solid and liquid) during construction and operational/occupation.

(e) Increased storm water/ runoff resulting from the roof catchments and as a result of decreased recharge areas, after pavement of most areas.

(f) Air pollution as a result of dust particles emanating from cement, excavation and construction activities. Exhausts from the involved machinery will lead to increased levels of noxious gases.

(g) The health and safety of workers and immediate neighbours may be compromised in case of occurrence of incidences, pollution and disturbance

Proposed potential mitigation measures

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

i. During Construction Phase

(a) Minimising air pollution (suppressing dust) and erosion by the agents of soil erosion through soil compaction and utilisation of water sprays (on loose soils on all unpaved access paths/roads, cleared surfaces), utilisation of covered trucks, and netting of construction site.

(b) Erection of warning / informative signs at the site during the implementation phase, and traffic control along the connecting road.

(c) Minimising strain on water supply (surface and groundwater sources) by, employing water conservation measures such as water reuse, rainwater harvesting, use of runoff, and reduction or avoidance on misuse of water.

(d) Reducing noise pollution through:

i) installation of portable barriers to shield compressors and other small stationary equipment (where necessary);

ii) sensitising workers on the need to switch off engines whenever possible;

iii) Ensuring machinery are well maintained through regular tuning and maintenance to minimise or avoid noise emanating from friction of rubbing metal parts;

iv) Installation of silencers whenever possible;

v) Ensuring work is carried out between specified time i.e. 7a.m. to 6p.m.

(e) Minimising emission of noxious fumes through:

i) proper and regular tuning and maintenance of construction machinery/equipment;

ii) ii) reduction/control of vehicle/machinery idling.

(f) Construction machinery and vehicles maintenance should be conducted in appropriate and designated service bays to reduce chances of contaminating the environment by resulting oils and greases. Any of such oils should be collected and disposed appropriately.

(g) Workers should be provided with full personal protective gear (PPE) to safeguard their health and safety; and, they should be sensitised on health, safety and environmental conservation aspects.

(h) The site should be fenced off during construction to keep off animals and the general public, so as to safeguard their health and safety.

(i) Provision of sound waste management systems and procedures. During implementation phase, the contractor should put in place effective and efficient waste management systems in compliance with the legal framework of Kenya. This includes providing acceptable sanitary conveniences to the workers during the construction.

(j) Developer will work with the immediate neighbours to ensure air, noise and land pollution levels are either avoided or kept to the minimal, and the overall health and safety of the immediate environment is safeguarded.

ii. During Operation Phase

(a) Minimising strain/pressure on the water supply infrastructure by promoting water efficiency through rainwater harvesting, minimising water consumption/ misuse and using recycled water.

(b) Managing surface drainage by developing and implementing a storm water management design that closely emulates the existing natural "pre-development" hydrological systems, as well as applies the principal of managing (the quantity and quality of) storm water at the source. With respect, emphasis should be on:

i. Storm water drainage, on-site infiltration, and ground water recharge by making use of methods, which closely emulate natural system by incorporating revegetation of the site and porous paving in the design.

ii. Maximising recycling and reuse of water. This includes designing a storm water management system which, excludes discharge into the designed sewerage system so as not to put extra burden on this system; but harvests, stores and reuses the rainwater falling within the site. This would greatly enhance efficient use of portable water within the site, as well as contribute to the project's compliance with the Country's provision on climate change adaptation and mitigation measures.

Lastly, where drain channels are considered in the design, they should be well-designed and installed to harmonise management of the resulting storm water within the site. During operation phase, they should be regularly maintained and covered with gratings to avoid accidents and dirt entry.

(c) Comprehensive landscaping on completion of the proposed development to prevent soil erosion and upgrade the site to its appropriate environmental standard.

(d) There no public sewerage infrastructure around the proposed construction site. In compliance with the applicable legal framework of Kenya, the sewage generated from the completed development shall be managed by connecting to the Waste water Treatment Plant. This system shall be regularly maintained and closely monitored and evaluated to ensure its efficiency.

iii. During both construction and operation phases

(a) Careful siting, planning and implementation processes- to ensure that it is sympathetic to its surroundings and is in line with County Government's Physical Planning and Construction standards.

(b) To safeguard against environmental and human health and safety risks, effective emergency response plans should be adapted during both construction and operation phases. There should be a specific area for hazardous material storage, machinery maintenance activities and refuelling; and, these should be clearly indicated and adhered to.

(c) Adapt the proposed Environmental Management and Monitoring Plans involving all relevant stakeholders during implementation phase and inhabitants, during operation phase.

Project Cost Estimate

The proponent has undertaken a preliminary estimate of the total project cost using experienced consultants. The estimated total project cost is approximately two hundred and eighty seven million, five hundred thousand Kenya shillings only (KShs. 287,500,000.00).

Conclusion and Recommendations

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

In relation to the proposed mitigation measures that will be incorporated during implementation and occupation phases; the project's input to the Kenya's housing sector; and cognizance of the fact that the project proponent is environmentally conscious**,** the subject project is beneficial and important for a developing country (like Kenya). It is our recommendation that the proponent be granted EIA license to implement the project. Major concerns should nevertheless be geared

towards minimising the occurrence of impacts that would degrade the general environment. This will however be overcome through close following and implementation of the outlined Environmental Management and Monitoring Plans (EMPs); which have been strategically packaged with key environmental sustainability elements, tailored toward enhancing the adoption of *Integrated Ecosystem Management (IEM)*. This will form the (now) widely accepted keystone of the environmental action agenda.

CHAPTER ONE: INTRODUCTION

1.1 Background and Rationale of Environmental Impact Assessment

Currently the rates of urbanization and population growth worldwide are increasing fast and with it come the need for improvement in service provision especially in our urban areas. Kenya's rates of urbanization are escalating and being a developing country; most of its urban population is forced to live in slums. Increased population due to rural-urban migration in search of job opportunities and or higher education in major towns of Kenya has increased demand for buildings, especially residential houses.

The principle measure of sustainable development is that all activities which are carried out to achieve development must take into account the needs of environmental conservation. The sustainability of the ecosystem requires the balance between human settlement development and the natural ecosystem, which is a symbiotic relationship. This can be achieved through careful planning and the establishment of appropriate management systems. In modern times, the need to plan activities has become an essential component of the development process. Consequently, a number of planning mechanisms have been put in place to ensure that minimum damage is caused to the environment. Environmental planning is also integrated with other planning processes such as physical planning, economic planning, and development planning. Environmental Impact Assessment (EIA) is considered part of environmental planning. EIAs are undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority. In Kenya, the competent authority is the National Environment Management Authority (NEMA).

As part of the EIA process, it is necessary to devise alternatives to avoid undesirable impacts. Besides the alternative, identification of impacts may also lead to the development of mitigation measures i.e. means of reducing the impacts. As a tool of environmental planning, E.I.A is therefore precautionary in nature. E.I.A is neither anti-development nor does it stop actions which impact the environment. It only requires that those impacts be considered. Most development activities impact the environment hence a "no impact" interpretation of environmental impact assessment could lead to no development. But a "considerable impact" interpretation of E.I.A will lead to better development. If environmental impacts are ignored, the project may not be sustainable in the long-run, in which case the money invested in it will have been wasted.

Pursuant to the prevailing legal requirements as envisaged in the EMCA 1999 and to ensure sustainable environmental management, the proponent contracted the services of Registered NEMA consultants to carry out an environmental impact assessment study for the proposed

development. This EIA study report thus provides relevant information and environmental considerations on the project proponent's intention to seek approval from NEMA.

1.2 Objectives of the EIA

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

(a) To determine environmental compatibility of the project

(b) To identify and evaluate the significant environmental impacts of the project

(c) To evaluate and select the best project alternative from the options available

(d) To incorporate environmental management plans and monitoring mechanisms

(e) To assess the environmental costs and benefits of the project to the society

This objective are based on ensuring that the environmental concerns are integrated in the proposed project activities in order to contribute to the overall sustainable development .Other objectives include;

- To identify potential environmental impacts of proposed project; both positive and negative
- To assess the significance of these impacts to the environment and other stakeholders
- To assess the relative importance of the impacts of alternative plans to the proposed project.
- To propose mitigation measures for the significant negative impacts of the proposed project on the environment and all involved stakeholders.
- To propose measures that will enhance the positive impacts of the proposed project to the environment and all involved stake holders
- To generate baseline data for monitoring and evaluation of how well the mitigation measures are being implemented during the proposed project cycle;
- To present information on the impact of alternatives;
- To present results of the EIA in such a way that they can guide informed decision

1.3 Terms of Reference (TOR)

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

(a) To hold appropriate meetings with the project proponent to establish the procedures, define requirements, responsibilities and a time frame.

(b) To produce an EIA study report that contains among other issues potential negative and positive impacts and recommendations of appropriate mitigation measures to minimize or prevent adverse impacts

(c) To carry out a systematic environmental assessment study at the proposed project site and the surrounding area.

(d) To provide a description of the proposed activities throughout the entire implementation process of the project with a special focus on potential impacts to the surrounding environment and facilities.

(e) To develop an Environmental Management Plan for the proposed project.

1.4 Scope of EIA Study

The study was conducted to evaluate the potential and foreseeable impacts of the proposed development. The physical scope is limited to the proposed site and the neighbouring areas/environment as they may be affected by or may affect the proposed project. Any potential impacts (localized or delocalized), are also evaluated as guided by EMCA 1999 and the Environmental (*Impact Assessment and Audit*) Regulations 2003.This study report includes an assessment of impacts of the proposed sites and its environs with reference to the following;

(a) Description of the proposed project

(b) Baseline information (Biophysical and Socio-Economic environment, land use and zoning approval, etc.).

(c) Assessment of the potential environmental impacts on the project area.

(d) A review of the policy, legal and administrative framework.

(e) Development of the mitigation measures and future monitoring plans.

(f) Proposition of alternatives.

(g) Occupational Health and Safety -OHS

1.5 Methodology

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

(a) Screening of the project, a process that identified the project as being high risk as per Legal Notice 31 of 2019.

(b) A scoping exercise that identified the key issues to be addressed.

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

(d) Public participation and consultation-detailed discussions with the project affected persons,stakeholders, proponent and architects.

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

(f) Reviewing the proposed project designs and implementation plan/schedules with a view to suggesting suitable alternatives,

(g) Developing an environmental management plan outline with responsibilities, schedules, monitorable indicators and time frames among other aspects,

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

1.6 Need for the Project

Increase in population and urbanization within and around Nairobi City has led to rapid increase in demand for residential houses which has led to people moving out of city centre and staying in the satellite towns within the vicinity of the city or staying in shanties. The satellite areas like Syokimau, Mlolongo, Athiriver, Machakos and specifically Mavoko sub-county where the proposed project falls are currently experiencing enormous housing demand as dormitory areas of Nairobi City County population.

Mavoko area, where the project falls is also home to a number of education, industrial, commercial, administrative and health institutions that require accommodation for their staff members. The housing needs of these people can only be taken care of through construction of facilities like the proposed Residential apartments. The scheme is planned to cater for housing demand for middle class. More importantly, it is vital to optimally utilize the land that has been undeveloped. The neighbourhood comprises of residential developments i.e. Swara Court, Metta Road Residences, Kattani Villas, Twiga Court Katani which have been operational without significant negative impacts to the environment and the neighbouring populations. Other notable land use practices include stone quarrying for aggregate and stone/block cutting.This land use is in harmony with the land use class of the area. The project will lead to economic

empowerment not only to the project proponent but also to a host of other people who will both directly and indirectly benefit from jobs and business opportunities resulting from the presence of the project within the neighbourhood. Revenue generation to the central government through land rates and taxes as a result of the implementation of this project will lead to the much needed economic development.

In terms of environmental degradation, the project is likely to lead to very minimal negative impacts, which shall be easily taken care of in the design and the proposed mitigation measures as suggested in Chapter 8 of this project study report.

1.7 National Housing Policy and Housing Needs in Kenya

In August 2003, the government of Kenya through a Sessional Paper spelt out a Housing Policy whose overall goal was to facilitate the provision of adequate shelter and healthy living environment at an affordable cost to all socio-economic groups in Kenya in order to foster sustainable human settlements. The aim is to minimize the number of citizens living in shelters that are below the habitable living conditions.

Among other things, the policy aims at facilitating increased investment by the formal and informal private sector, in the provision of housing units for low and middle-income dwellers. The estimated current urban needs are 150,000 units per year, which can be achieved if the existing resources are fully utilized by the private sector with the enabling hand of the government. It is estimated that the current production of new housing in urban areas is only 20,000-30,000 units annually, giving a short fall of over 120,000 units per annum. The shortfall in housing has been met through the proliferation of squatter and informal settlements and overcrowding.

To alleviate the huge shortfall of urban housing mentioned above and to curb the mushrooming of informal settlements/slums, various interventions and strategies have to be adopted. In the Policy Paper, the government correctly accepts the fact that it cannot meet the housing shortfall on its own and that the best policy is to encourage the private sector (like the proponent) to chip in while the government provides an enabling environment for development. The government will provide an enabling environment by doing the following:

- Facilitating the supply of serviced land at affordable prices in suitable locations
- Expanding and improving infrastructure facilities and services
- Using research findings as well as innovative but cheap conventional building materials and technologies to improve production of housing units.

- Harmonizing the Banking Act, the Building Society Act, the Insurance Act and the various Acts that have so far proved to be a hindrance to the sourcing of housing finance.
- Generally easing the path of funds from the private investor/government to the development project.
- Issuing workable guidelines on Estate Management and maintenance.

The promotion of this development is therefore well within the government current and long-term policies of ensuring decent housing for all by 2030 (Vision 2030).

1.8 Methodology

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

(h) Screening of the project, a process that identified the project as being among high risk projects as per Legal Notice 31 of 2019

(i) A scoping exercise that identified the key issues to be addressed in the assessment.

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

(k) Public participation and consultation-detailed discussions with the immediate neighbours, proponent and architects.

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

(m) Reviewing the proposed project designs and implementation plan/schedules with a view to suggesting suitable alternatives,

(n) Developing an environmental management plan outline with responsibilities, schedules, monitorable indicators and time frames among other aspects,

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

CHAPTER TWO: PROJECT DESCRIPTION

2.1 Project Proponent

The project proponent is Shamji Kalyan Pindoria Limited of P.O. Box P.O. BOX 76018-00508 Nairobi, Kenya.

2.2 The location of the project and Site description

The proposed project is situated on Plot L.R NO. 24573 off Quarry road in Katani area, Mavoko Sub-County Within Machakos County. The site is currently occupied by four storey residential apartments comprising of one hundred and fifty units (Phase 1)which is complete and ongoing construction of ninety residential units and thirty seven shops(Phase 2). The project proponent has obtained NEMA licenses for both phases (NEMA/EIA/PSL/6006 and NEMA/EIA/PSL/22922) respectively. The project site lies within geographical coordinates; -1.368004°S, 36.990643°E at an altitude of 1577.994M.

It falls within Mavoko Sub-county which shares the vegetation of Athi Kapiti plains that is constituted of grasslands, shrub vegetation with sections of rocky ridges.

The neighbourhood character comprises of ;

a) Quarries; the project neighbourhood comprises of various stone and concrete quarries such as Silver Stone Quarry Mlolongo, cementers quarry(concrete), cementers quarry(Bitumen), Kingstone concrete quarry limited, Blue stone Limited, cavestone quarry among others. The project proponent has been obtaining the construction materials from the nearby quarries .

b) Residential Developments; the area has been growing over the years with pockets of undeveloped land slowly fading away to pave way for development of single dwelling residential units such as maisonettes and bungalows such as;

- ✧ Viraj Village
- ✧ Swara Court
- ✧ Metta Road Residences
- ✧ Katani Villas
- ✧ Twiga Court Katani

Other notable residential developments includes few residential apartments such as Phase 1&2 of Viraj Oasis Apartments. These are modern residential apartments comprising of ground plus

four floors situated on the proposed project site.

c) Undeveloped pieces of land; the proposed project site is surrounded by rows of undeveloped pieces of land. Some of the pieces are fenced with barbed wire to show plot demarcation as well as prevent trespassing.

d) Social amenities: the area has various social amenities to serve the population. These includes; Viraj International Academy-Katani, Danana Girls Secondary School, City of refuge Assembly church, Katani Primary and Secondary schools among others.

2.3 Site ownership, size, zoning and land use

2.3.1 Site Ownership and Size

The proposed site falls within Land Reference Number 24573 measuring approximately 10.00 Ha situated off Quarry Road in Katani area, Mavoko Sub-County within Machakos County. The project site lies within geographical coordinates -1.368004°S, 36.99063°E. The land ownership documents provided are registered under **SHAMJI KALYAN PINDORIA LTD.**

The copies of land ownership documents are annexed.

Image 1: proposed project site

Image 2: ongoing construction of Phase II within the proposed site

Image 3: A section of the completed houses (Phase 1)

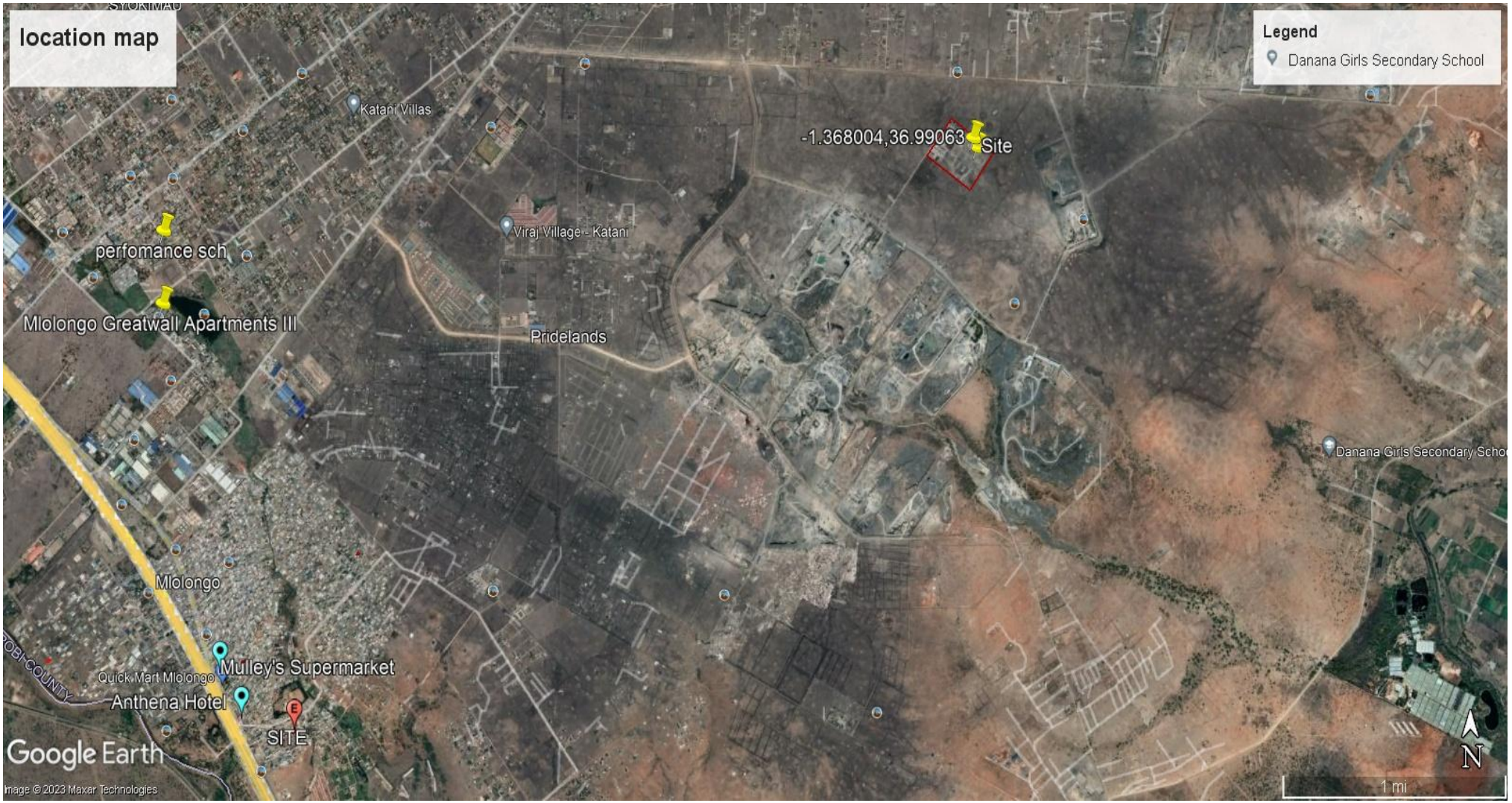
Image 4: cabro pavement ,landscaping and parking on Phase 1

Image 5: Rows of undeveloped pieces of land

Image 6: scattered shrubs(vegetation cover) and single dwelling units

Image 7: Twiga Court comprising of single dwelling units

Image 8: controlled single dwelling units within the neighbourhood



Google earth photo showing the location of the proposed project. *Source (Goggle Earth Map Imagery Extract, 2023)*

2.4 Nature and Design Components of the Project

2.4.1 Project description

The project proponent intents to undertake construction of additional residential housing units (Phase 3-17) with supporting amenities comprising of 1210 units on Plot L.R NO. 24573 measuring approximately 10.00 hectares off Quarry road in Katani area, Mavoko Sub-County within Machakos County.

The project site is currently occupied by four storey residential apartments comprising of one hundred and fifty(150) units (Phase 1) which is complete and ongoing construction of ninety residential(90) units and thirty seven (37)shops(Phase 2). The project proponent has obtained NEMA licenses for both phases (NEMA/EIA/PSL/6006 and NEMA/EIA/PSL/22922) respectively.

The proposed additional Phases are discussed below;

Phase 3

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block E-H
ii. Block E-E
iii. Block E-G
iv. Block E-J
v. Block E-I
vi. Block D-F
vii. Block D-E
viii. Block D-H
ix. Block D-G

Summary: Phase 3 will have a total of 90 units;

- ✧ fifty (50) one bedroom units,
- ✧ thirty four(34) three bedroom units and
- ✧ eight(8), two bedroom units

Phase 4

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block E-L
ii. Block E-K
iii. Block E-N

iv. Block E-M

v. Block E-P

vi. Block D-J

vii. Block D-I

viii. Block D-L

ix. Block D-K

Summary: Phase 4 will have a total of 90 units

Phase 5

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block E-R

ii. Block E-Q

iii. Block E-T

iv. Block E-S

v. Block E-O

vi. Block D-N

vii. Block D-P

viii. Block D-O

Summary: Phase 5 will have a total 90 units

Phase 6

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block D-R

ii. Block D-T

iii. Block D-Q

iv. Block D-S

v. Block E-V

vi. Block E-U

vii. Block E-X

viii. Block E-W

ix. Block E-Z

Summary: Phase 6 will have a total of 90 units

Phase 7

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block AE-B
ii. Block E-Y
iii. Block AE-A
iv. Block AE-D
v. Block AE-C
vi. Block AE-F
vii. Block AE-E
viii. Block D-V
ix. Block D-U

Summary: Phase 7 will have a total of 90 units;

- ✧ Seventy two (72), three bedroom units and
- ✧ Eighteen (18), two bedroom units

Phase 8

Will comprise of two blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block D-X
ii. Block D-W

Summary: Phase 8 will have a total of twenty(20) units

- ✧ sixteen (16) three bedroom units and
- ✧ four(4), two bedroom units

Phase 9

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block C-F
ii. Block C-E
iii. Block C-H
iv. Block C-G
v. Block C-I
vi. Block B-I
vii. Block B-H
viii. Block B-K
ix. Block B-J

Summary: Phase 9 will have have a total of ninety (90) units

- ✧ fifty (50) three bedroom units
- ✧ Thirty two (32), two bedroom units and
- ✧ Eight(8), one bedroom units

Phase 10

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block C-J
ii. Block C-L
iii. Block C-K
iv. Block C-N
v. Block C-M
vi. Block B-M
vii. Block B-L
viii. Block B-O
ix. Block B-N

Summary: Phase 10 will have a total of 90 units;

- ✧ forty (40), three bedroom units
- ✧ Forty two (42), two bedroom units and
- ✧ Eight(8), one bedroom units

Phase 11

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block C-P
ii. Block C-O
iii. Block C-Q
iv. Block B-Q
v. Block B-P
vi. Block B-S
vii. Block B-R
viii. Block B-U
ix. Block B-T

Summary: Phase 11 will have a total of 90 units

Phase 12

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block C-R
ii. Block C-T
iii. Block C-S
iv. Block B-W
v. Block B-V
vi. Block B-Y
vii. Block B-X
viii. Block AB-A
ix. Block B-Z

Summary: Phase 12 will have a total of 90 units

Phase 13

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block C-V
ii. Block C-U
iii. BlockC-X
iv. Block C-W
v. Block C-Z
vi. Block C-Y
vii. Block AB-C
viii. Block AB-B
ix. Block AB-D

Summary: Phase 13 will have a total of 90 units

Phase 14

Will comprise of five blocks of ground plus 4 floors each with ten (10) units as follows

i. Block AB-E
ii. Block AB-I
iii. Block AB-H
iv. Block AB-G
v. Block AB-F

Summary: Phase 14 will have a total of 50 units

Phase 15

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block A-E
ii. BlockA-F
iii. Block A-G
iv. Block A-H
v. BlockA-I
vi. Block A-J
vii. Block A-K
viii. Block A-L
ix. Block A-N

Summary: Phase 15 will have a total of 90 units

Phase 16

Will comprise of nine(9) blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block A-V
ii. Block A-U
iii. Block A-T
iv. Block A-S
v. Block A-R
vi. Block A-Q
vii. Block A-P
viii. Block A-O
ix. Block A-M

Summary: Phase 16 will have a total of 90 units

Phase 17

Will comprise of six blocks of ground plus 4 floors each with ten(10) units as follows;

i. Block A-W
ii. Block A-X
iii. BlockA-Y
iv. BlockA-Z
v. Block AA-A
vi. Block AA-B

Summary: Phase 17 will have a total of 60 units

School block

This block will comprise of a kindergarten and lower primary school

Other amenities include; a gatehouses, adequate parking spaces, playground, a shopping centre and garbage section/solid waste disposal areas, KPLC room (switch room), septic tank, existing borehole and storm water drains

The main project components include the following:

a. Clearing and preparation of the project site.
b. Actual construction activities
c. Development of driveways, walkways and parking areas
d. Development of utilities services i.e. drainage systems, waste water and electricity supply
e. Site landscaping especially tree planting and landscaped gardens

2.4.2 Clearing and Preparation of the Project Site

The existing ground situation will be altered through clearing of existing vegetation and other barriers to pave way for implementation of the proposed development projects on the site. The proponent plans to plant trees and flower gardens to create a green cool environment

2.4.3 Residential apartments development

The proposed project will include construction of 121 blocks of ground plus four floors, which will conform to existing developments in the area. The housing development will provide accommodation for the increasing population.

2.4.4 Community Facilities

The proposed development will share the community facilities with Phase 1 & 2. These includes;, shopping Centre, Playground, School and a medical clinic.

2.4.5 Local Access Roads, Parking and Walkways

The proposed housing estate development has provision for adequate width access roads. A 6 metre main road has been provided to access both sides of the proposed estate. The walkways will be at least 2.5 m wide. Car parking spaces will also be provided at the communal facility areas.

2.4.6 Trunk Infrastructure and Utilities

Water Supply: The proposed development will be served water by on-site Borehole, water storage tanks, harvesting rain water and recycling of waste water.

Foul Water Drainage: The proposed development will generate substantive amount of waste water per day. The waste water generated will be discharged into the waste water Treatment Plant within the site.

Storm Water Drainage: The proposed development will generate enormous surface water. It is therefore recommended that adequate and well drainage channels be provided to accommodate the increased discharge. The flow of the storm water has been well captured in the plans and the proponent plans to develop a storage tank for storage and use in irrigation of flowers.

Solid Waste Disposal: The proposed development will generate enormous solid waste. It is recommended that NEMA & County licensed private waste handlers be contracted to collect the waste. It is further recommended to have one common point on the plot to store the waste before final collection.

Electricity Supply: The proposed development will be connected to the Kenya Power and Lighting Company power supply line. The KPLC electricity supply lines are already available within the neighbourhood of the proposed project site. There will be a backup generator in case of Power blackout.

2.4.7 Landscaping and Tree Planting

The project will involve clearing of few vegetation and excavation of soil material. The site development involves cut and fill arrangement, whereby excavated material is used for backfilling. Any excess material will be disposed off-site.

The project site will be landscaped according to scheme plan. This will entail establishment of flower gardens, planting of trees, grass and related ground cover to compensate for any cleared vegetation and to improve general aesthetics of the estate.

2.5 Construction Activities and Inputs

All the construction inputs shall be obtained from licensed dealers. The following will be required for successful implementation of construction activities. Construction tools and equipment including machinery mainly transportation vehicles will be used for the transportation of materials and in the execution of the proposed works.

2.5.1 Inputs during Construction

Typical inputs which will be used in construction phase are land and water which will be readily available. The materials that shall be used include building sand, aggregates, natural stones, either hand or machine cut construction stones, steel and timber for making structural formwork and interior design, tiles for roofing and floor tiles. Others include concrete block for constructing selected internal and external pavements, precast units for drains, PVC pipes for sewer and water reticulation, paints, electrical wiring and fitting, barbed wires, wire mesh, water tanks and gutters. Window casement and glasses, spades, pick axes, and other hand held tools will also be needed.

2.5.2 Construction Activities

The construction activities shall begin once the proponent obtains all relevant approvals such as NEMA license. Site clearing, setting out and excavations for laying of various housing units and ancillary facilities will then proceed. Materials from the excavations of the ground and foundation work will be reused for earth works and landscaping.

2.5.3 Project implementation sequencing/Phasing

i. Pre-construction stage

a) Plan preparation and seeking of the appropriate approvals from the relevant authorities which has been done

b) Appraisal of baseline condition to determine supply and demand for required infrastructural utility services.

c) EIA study Report preparation including the necessary approvals.

ii. Construction stage

a) ***Establishment of related works and all support infrastructure that are significant for the construction work:*** This would involve the transportation of machinery and deployment of the workers to the construction site. The machinery would be used for ground breaking and transportation of materials from the sources to the site. The major machineries that will be used include mixers, welding machines and transmission machines. The contractor will also mobilize human workforce at casual, permanent, skilled and unskilled levels.

b) ***Acquisition and transportation of building materials:*** The contractor shall source for materials for construction from the various available suppliers. Supply of materials will be a continuous activity throughout the project life since different materials will be

needed at different phases of the construction. The materials that shall be used in the construction include among others building stones, sand, ballast, cement, timber, reinforced concrete frame, steel, bars, G.I pipes, PVC pipes, pavement blocks, concrete slabs, murram, hardcore, insulated electrical cables and timber among others.

c) ***Excavation and land filling works:*** Excavation will be carried out to prepare the site for construction of foundations to lay the residential houses and all other proposed facilities and utilities. This will involve the use of heavy earthmoving machinery such as tractors, tippers and bulldozers

d) ***Masonry, Concrete Work and Related Activities:*** The construction of the perimeter walls, building walls, foundations, floors, pavements, drainage systems 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 will be supplemented by machinery such as concrete mix

e) ***Structural Steel Works:*** The buildings will be reinforced with structural steel for stability. Structural steel works will involve steel cutting, welding and erection.

f) ***Roofing and Sheet Metal Works:*** Roofing activities will include slab roofing

g) ***Transportation of the construction wastes from the site:*** Construction waste that cannot be used for either back filling or landscaping work at the site will be deposited in approved dumpsites by a contracted licensed waste handler.

h) ***Electrical Work:*** Electrical work during construction of the premises will include installation of electrical gadgets and appliances including electrical cables, lighting apparatus, sockets etc. in addition, there will be other activities involving the use of electricity such as welding and metal cutting.

i) ***Power distribution:*** The position for location of power transformer to serve the proposed estate will be determined by experts from KPLC. The project will increase power demand in the area and it is proposed that the proponent should consider other power sources like solar to reduce on the power demand. The proposals include solar power especially for water heating purposes and to supplement power supply when experiencing power outage problems.

j) ***Plumbing:*** Installation of pipe work for water supply and distribution will be carried out within the proposed residential houses and associated facilities. In addition, pipe work

will be done to connect sewage from the premises to the main waste water disposal lines, and for drainage of storm water. Plumbing activities will include metal and plastic cutting, the use of adhesives, metal grinding and wall drilling among others.

k) ***Fire protection:*** Self-contained fire detection and alarm system complete with manual call points, optical smoke detectors, heat detectors and electronic sounders will be proposed especially in the kitchen areas. Hose reel fire protection system will be provided to cover the buildings. The system will comprise of a water storage tank, distribution of pipe work and fire hose reels and portable fire extinguishers will be provided at convenient spots. Additional provision will be made for special hazards and high risk areas.

m) **Landscaping and tree planting:** To improve the environmental and aesthetic value or visual quality of the site once construction ceases, the proponent will carry out landscaping and tree planting. This will include establishment of flower gardens and lush grass lawns and will involve replenishment of the top soil. It is noteworthy that the proponent will use plant species that are available locally preferably indigenous ones for landscaping. The proponent has already established a tree nursery in preparation of the trees to be used for landscaping and tree planting.

2.5.4 Occupation/Operational stage

This stage shall involve running and managing the facility as per the laid down rules and procedures.

a) ***Residential activities:*** Once construction is complete, the houses will be ready for occupied by respective owners/tenants.

b) ***Solid waste and waste water management:*** The proponent will provide facilities for handling solid waste generated within the facility. These will include dust bins/skips for temporarily holding waste within the premises before final disposal by the contracted licensed waste handler at the designated dumping site. Sewage generated from the residential buildings will be discharged into the main trunk sewer line, while the storm water drainage system will also consist of a network of Inverted Block Drains, manholes and road gullies which will discharge to the proposed artificial water reservoir.

c) ***Compound Cleaning:*** The management will be responsible for regular washing and cleaning of the paved and non-paved areas. Cleaning operations will involve the use of substantial amounts of water, disinfectants and detergents, blooms, rakes, wheelbarrows among others.

d) ***General Repairs and Maintenance:*** The residential and other facilities buildings will be repaired and maintained regularly during the operational phase of the project. Such activities will include repair of building walls and floors, repairs and maintenance of electrical gadgets and equipment, repairs of leaking water pipes, painting, maintenance of the gardens and grass lawns and replacement of worn out materials among others.

2.6 Decommissioning Phase

Decommissioning of operations is here taken to mean that the buildings cease to operate and the premises are closed down or reverted to another use. Under such circumstance, the house owners will be expected to adhere to the legislation applicable to such undertaking in the laws of Kenya but in general the decommissioning shall be staggered through a number of steps and measures to rehabilitate the site to its status before the commencement of the buildings occupancy or to a suitable state for its next use. This will involve looking for alternative uses for the site that is compatible to the surrounding and to the former use. An environmental impact assessment shall be commissioned to advice on the environmental aspects with respect to the identified new use if found necessary. If no other use(s) are found for the site, rehabilitation measures to revert it to its former use a state shall be implemented that include:-

i. Building stones, paving slabs, and other installations of economic use can be sold-off in the market through a biding or auction sale.
ii. Dug up areas should be backfilled with uncontaminated earth.
iii. All solid wastes including debris shall be disposed in a designated dumpsite.
iv. The site shall be re-vegetated with vegetation capable of protecting the soil from erosion

The owners will then, deregister its operations and legal requirements such as the certificates of operations will be surrendered to the relevant issuing bodies.

2.7 Air Emissions

Relative air emission is expected during construction when dust from construction activities and smoke from construction machinery will be emitted. It is recommended that watering the site especially during dry periods be enforced to keep dust at minimal levels. The employees at the site especially during construction activities shall be provided with dust masks to protect them from dust and fumes associated with construction activities.

2.8 Waste Management

The principle objective of waste management program is to minimize the pollution of the

environment as well as to utilize the waste as a resource. This goal should be achieved in a way that is environmentally and financially sustainable.

2.8.1 Solid Waste Management

The technologies for the management of the solid wastes will incorporate the collection of the waste from the source, transportation of the waste to the place of storage and final disposal through a contracted waste handler. The following waste management techniques shall be used in the different stages of the project.

a) ***During construction:*** The main wastes from the construction site will consist of material residues of the construction materials. These include pieces of concrete, heaps of sand and aggregate, bits and pieces of various pipe types, cans of paint, polythene sheets, paper packaging materials, pieces of timber, and off cuts of metals among others. They shall be managed as follows:

   Express condition shall be put in the contract that before the contractor is issued with a completion certificate; he will clear the site of all debris and restore it to a state acceptable by the supervising architect and environmental consultant.

   Materials from excavation of the ground and foundation works shall be reused for earth works and landscaping.

b) ***During operation:*** During operation phase, residents will contract a licensed waste handler who will collect their household waste at agreed intervals and dump them at licensed waste dumping sites.

CHAPTER THREE: BASELINE INFORMATION FOR THE STUDY AREA

3.1 Introduction

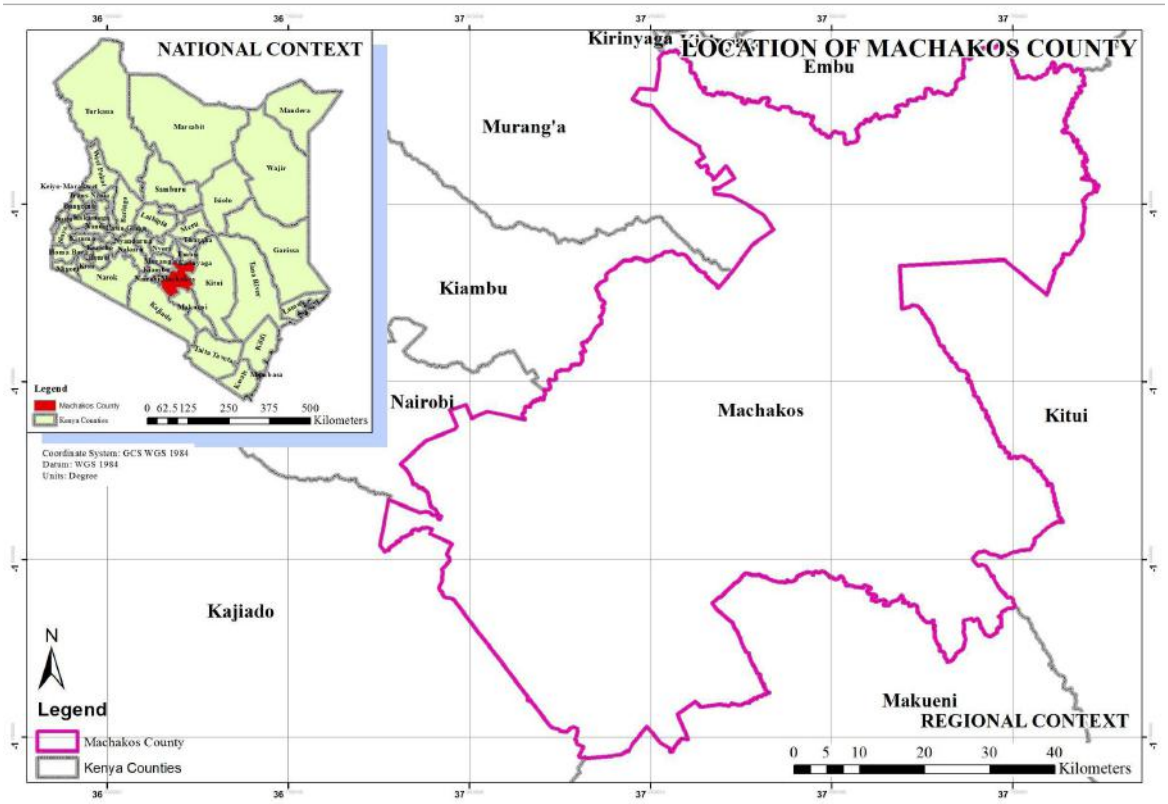
This chapter has information on the location, bio- physical, socio and economic aspects of the project area. These are elaborately discussed in order to identify areas likely to be affected as a result of project activities. This study therefore considered the physical location, climatic data, geology, drainage, infrastructure, demography and socio-economic information.

3.2 Machakos County

Located between 0° 45´ S and 1° 31´ S and 36° 45´ East and 37° 45’ , the County borders Nairobi and Kiambu counties to the West; Embu to the North; Kitui to the East; Makueni to the South; Kajiado to the South West and Muranga and Kirinyaga to the North West. It covers a total area of 6,208.2 km² .

The proposed site falls within Land Reference Number The proposed project is located on Plot L.R NO. 24573 measuring approximately 10.00 Ha) off Quarry Road in Katani area, Mavoko Sub-County within Machakos County. The project site lies within geographical coordinates -1.368004°S, 36.99063°E.

Map of Kenya showing location of Machakos County



Adopted from CUIDS (2018-2018) Machakos County

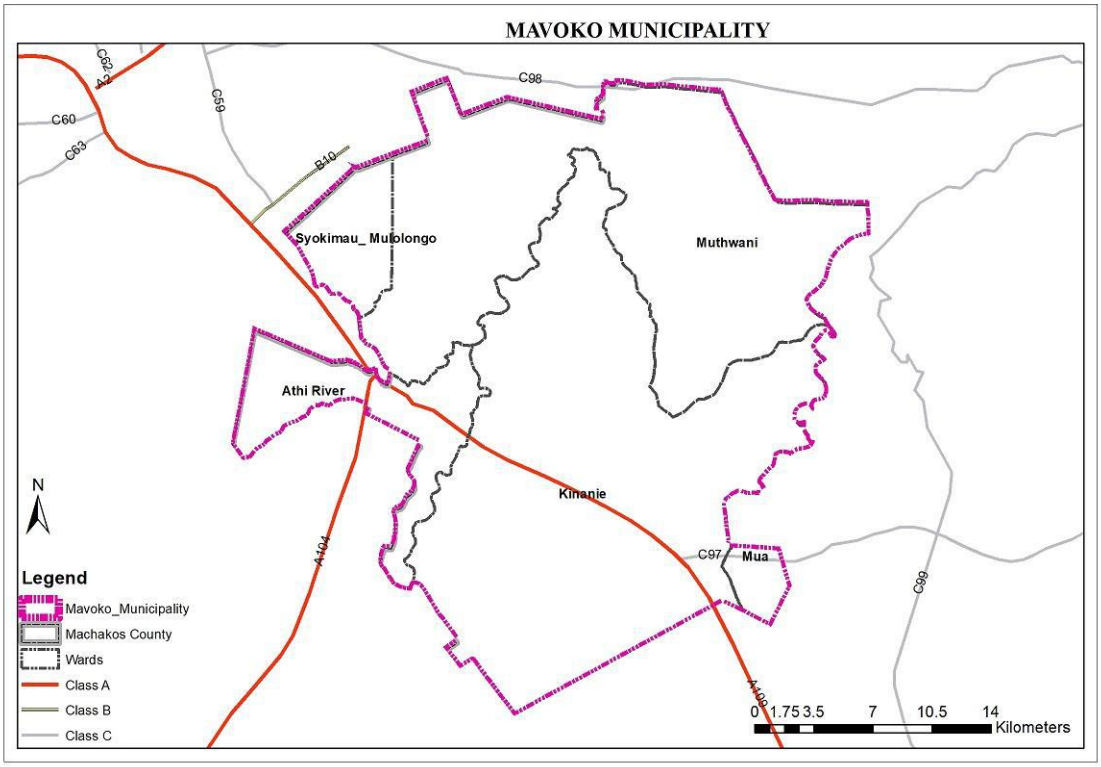
3.3 Administrative units and demographics

Machakos County is subdivided into nine sub-counties; Mavoko, Kathiani, Machakos, Matungulu, Yatta, Masinga, Mwala, Kalama and Kangundo. These sub counties are further divided into twenty-two (22 no.) divisions, two hundred and seventy (275 no.) locations and two hundred thirty-nine (239 no.) sub locations.

3.4 Mavoko Municipality

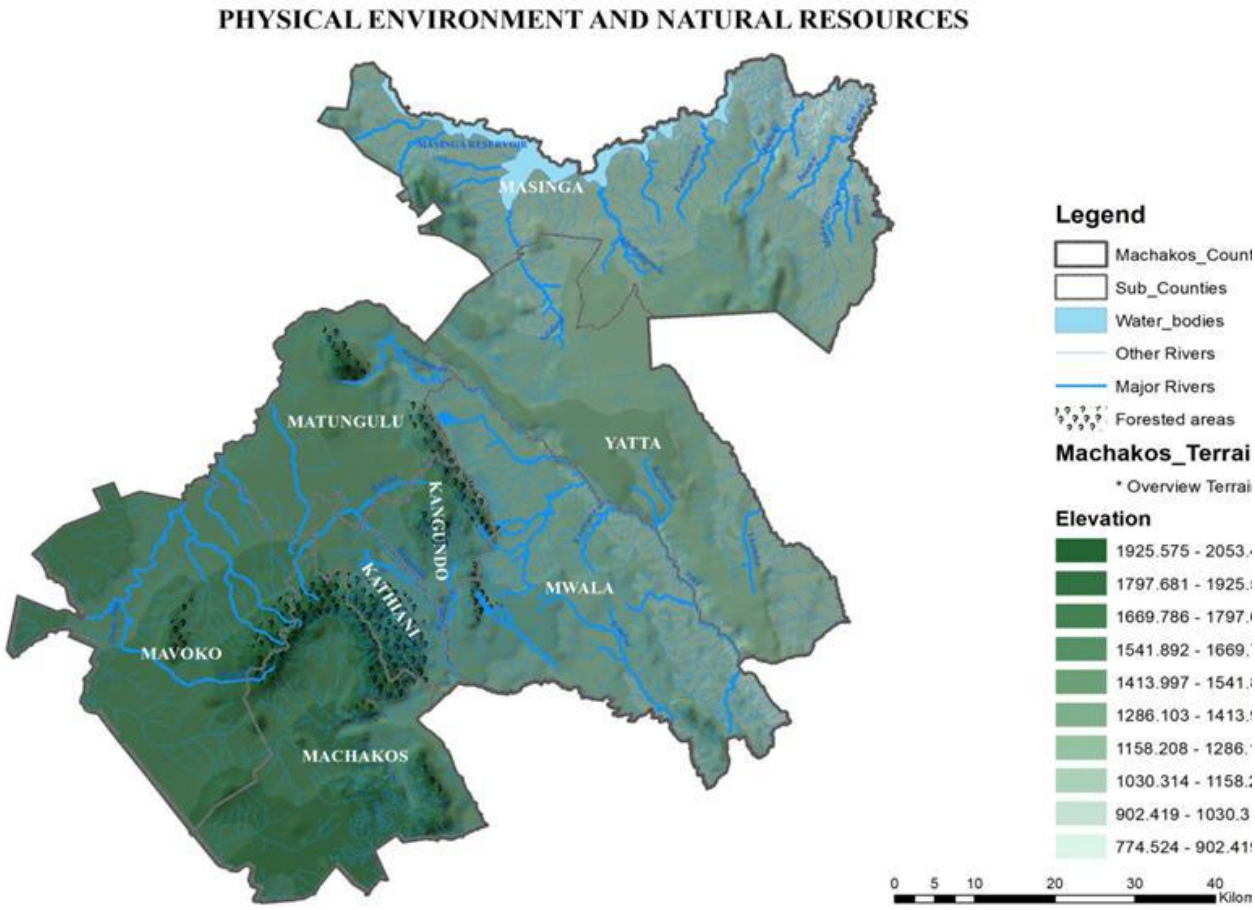
Mavoko is the commercial and industrial hub of Machakos County covering an estimated area of 852 km2. Its population was 322,499 in the 2019 census. Its proximity to Nairobi (28 km) ensures it enjoys the trickle-down effects of Nairobi's city status. A substantial number of its population, mostly the middle-income group, works in the City. Industries within the municipality include cement factories, steel mills, export processing zone companies and transport/ logistics companies. Key social amenities within close proximity include a university, shopping malls, hospitals, the standard gauge railway (SGR) and the Jomo Kenyatta International Airport (JKIA).

It is among the urban areas having the fastest urban growth rates in the Nairobi Metropolitan Region (NMR). Its population is projected to grow to 593,182 by 2030. The Mavoko Municipality Catchment Basin is drained by Athi River and Mto wa Mawe rivers. This watershed experiences tropical savannah climate with an average annual rainfall of 712.89 mm with maximum and minimum temperatures ranging between 11 °C and 28 °C. Mavoko Municipality has a high prevalence of clay soils formed on Pliocene and Miocene rock types and which comprise 60% of clayey soil.



3.5 Physical and Topographic Features

The County has unique physical and topographical features. These include hills rising between 1800 – 2100m above sea level and Yatta plateau, which is elevated to about 1700m above sea level and slopes to the South East. There are isolated hills in the North West. In the plains, the soils are well-drained, shallow, dark and red clay soils. In addition, the vegetation across the entire County varies according to the altitude. The plains receive less rainfall and are characterized by open grassland with scattered trees as compared to high altitude areas, which receive high rainfall and have dense vegetation. Figure below refers.



3.6 Climatic Conditions

The County receives bimodal rainfall with short rains in October and December while the long rains from March to May. The rainfall range is between 500mm and 1250mm, which is unevenly distributed and unreliable. The altitude mainly influences rainfall distribution in the county. The high areas such as Mua, Iveti and Kangundo receive an average rainfall of 1000mm while the lowland areas receive about 500mm. Temperatures vary between 18°C and 29°C throughout the year. The dry spells mainly occur from January to March and August to October.

In terms of temperature, July is the coldest month while October and March are the warmest. Temperature varies between 180C and 29°C throughout the year. The Table below represents the major Agro-ecological zones across the County.

Agro-ecological zones in the County.

Major AEZ	Ward (s)	Precipitation amounts & adequacy	Score
Lower Highlands (LH) 2-3	Upper Kaewa, Kathiani Central, Mua,	Moderate (1000 -1250mm)	3
Upper midland (UM) 2-3	Machakos Central, Upper Kaewa, Kathiani Central, Kangundo Central, Kangundo East, Kangundo West, Kangundo North, Tala, Matungulu East, Mutituni, Mumbuni North	Moderate (1000 -1250mm)	3
Upper midland (UM) 4	Kalama, Kola, Muvuti-Kiima kimwe, Lower Kaewa, Mitaboni, Kangundo East, Matungulu West, Matungulu East, Matungulu North, Kyeleni,	Low (500-750mm)	4
Upper midland (UM) 5-6	Athi river North, Kinanie, Muthwani, Syokimau-Mlolongo	Low (500-750mm)	4
Lower Midland (LM) 3	Kangundo East, Masii	Very low (<500mm)	5
Lower Midland (LM) 4	Kangundo East, Masii, Mbiuni, Muthetheni, Mwala-Makutani	Very low (<500mm)	5
Lower midland (LM) 5	Wamunyu, Kibauni, Ikombe, Katangi, Matuu, Ndalani, Kithimani, Kivaa, Ekalakala, Masinga central, Muthesyia, Ndithini	Very low (<500mm)	5

3.6.1 Temperatures

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

3.6.2 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.

3.6.3 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.

3.6.4 Sunshine

Early mornings in Machakos in general are often blue sky, but the sun peeks through by mid-morning. Solar radiation and sunshine are considered together since they are so closely connected. The area experiences a total of about 2,500 hours of bright sunshine per annum, which is equivalent to annual mean of approximately 6.8 hours of sunshine per day. July and August are characterized by cloudiness and during these months the average daily sunshine in the area is about 4 hours. Frequently there are several days in succession when the sun fails to penetrate the thick stratocumulus cover, although on other days the cloud does break to a greater or lesser extent for a short period. There is about 30% more sunshine in the afternoon than in the morning and it follows that westerly exposures receive more isolation than easterly one.

3.6.5 Evaporation

The annual variation of evaporation is as expected from consideration of temperature and sunshine factors. The mean annual evaporation as measured by the pan is seen slightly to exceed the mean rainfall at the altitude of area but it would be expected that at higher altitudes this position would be reversed. The peak evaporation values are during March, followed by January, February and October. The average annual evaporation ranges between 1550 to 2200mm per year.

3.6.6 Water resource

The surface water and sub-surface water resources in the county are a bit scarce. Most natural rivers and wells in the area and its neighbourhood are seasonal in nature. Therefore, the only most reliable source of water in the area are boreholes. This underground water resources are greatly exploited and boreholes drilled in most major developments within the area. A substantial percentage of households in the area also harness rain water through roof catchment. Mavoko water supply in the area is unreliable hence it is received averagely two days per week and sometimes disappear for a whole week.

3.6.7 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 upto Kilimambogo area. The crystalline rocks are rarely exposed but occasionally fragments are found as agglomerates derived from former Ngong volcano. The soils of this area are products of weathering of mainly volcanic rocks. Weathering has produced red 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.

3.7 Land Use Zoning in the Area

3.7.1 Current Physical Development Planning Policy

There is not current physical development plan for the area. There is no current local physical development plan and no regional physical development plan for the area.

3.7.2 Land Uses Adjacent to the Site

The neighbourhood, where the proposed development is located is characterized by the following:

i. Quarries; the project neighbourhood comprises of various stone and concrete quarries such as Silver Stone Quarry Mlolongo, cementers quarry(concrete), cementers quarry(Bitumen), Kingstone concrete quarry limited, Blue stone Limited, cavestone quarry among others. The project proponent has been obtaining the construction materials from the nearby quarries .

ii. Residential Developments; the area has been growing over the years with pockets of undeveloped land slowly fading away to pave way for development of single dwelling residential units such as maisonettes and bungalows such as;

- ✧ Viraj Village
- ✧ Swara Court
- ✧ Metta Road Residences
- ✧ Katani Villas
- ✧ Twiga Court Katani

Other notable residential developments includes few residential apartments such as Phase 1&2 of Viraj Oasis Apartments. These are modern residential apartments comprising of ground plus

four floors situated on the proposed project site.

iii. Undeveloped pieces of land; the proposed project site is surrounded by rows of undeveloped pieces of land. Some of the pieces are fenced with barbed wire to show plot demarcation as well as prevent trespassing.

iv. Social amenities: the area has various social amenities to serve the population. These includes; Viraj International Academy -Katani, Danana Girls Secondary School, City of refuge Assembly church, Katani Primary and Secondary schools among others.

3.8 Socio-Economic Profile

Development of the proposed residential apartments project will be influenced by two important socio-economic aspects, i.e. population/demography and economic trends in the neighbourhood, Mavoko area, Machakos County, and Nairobi City County.

3.8.1 Population Demography

The City County of Nairobi and Machakos County at large are among the key county areas in Metropolitan region that have continued to experience high rates of demographic transition over time. This is mainly due to the urban rural migration as well as natural population increase. The increased population in these areas has led to sprawl of increased housing demand into Katani , Syokimau , Athi River/Mavoko area, which acts as a dormitory zone for these adjoining counties.

3.8.2 Housing Demand in Machakos and Nairobi City Counties

In 2019, the demand for Middle Income Housing in Nairobi was estimated to reach 18,000 units. This is expected to grow at a 5.4% Compound Annual Growth Rate to reach 23,400 units by 2024. Averagely, 11,500 households will join the middle income housing segment each year until 2024, driving the demand for housing in this segment. Therefore, the proposed residential housing development will significantly contribute towards meeting this increasing housing demand for the rapidly growing population within Nairobi and Machakos counties.

3.8.3 Employment Trends in the Area

Currently numerous educational facilities, recreational facilities, industrial establishment and commercial outlet businesses are located in vicinity to this proposed development project. Some of these people would prefer to live close to their places of work. This further justifies the relevance of the proposed development project in Katani area.

3.8.4 Trunk Infrastructure, Utilities and Community Social Services

a) Transport Network

Machakos County, where the proposed project falls is served by a well-established network of all-weather access roads. The main access road connecting the project site to Mombasa Road is all weather murram surface and evenly graded. A railway station is also well established in Syokimau area which are all well accessible at distances of about 10 KM from project site. The Jomo Kenyatta International Airport is also well accessible at a distance of about7 KM from the project site.

b) Water Supply

The area has existence of natural water sources including underground water.Due to unreliability of the seasonal natural water sources, most existing major development in the area have exploited underground water sources through drilling of boreholes which have proofed as adequate and reliable source of water.

The project proponent has a functional on-site borehole

c) Foul and Storm Water Drainage Systems

Mavoko Sub County has a major trunk sewer line running from Kitengela/Athiriver EPZ to the sewerage treatment plants at Kinanie. However, the project site is not sewered and thus the project proponent will use a waste water treatment plant.

d) Communication Facilities

The project area is well served with communication network and facilities. This has a strong implication on the socio- economic development activities of the area. Mobile phone services like Safaricom and Airtel are present in the area

CHAPTER FOUR: POLICY, LEGAL AND LEGISLATIVE FRAMEWORK

4.1 Introduction

Environmental Impact Assessment is an instrument for environmental management and development control. It is now accepted that development projects must be economically viable, socially acceptable and environmentally sound. It is a condition of the Kenya Government for developers to conduct Environmental Impact Assessment (EIA) on the development Projects. According to Sections 58 and 138 of the Environmental Management and Coordination Act (EMCA) No. 8 of 1999 (Revised under legal notice 31 of 2019) and Section 3 of the Environmental (Impact Assessment and Audit) Regulations, 2003 construction of light industrial warehouses require an Environmental Impact Assessment comprehensive project report prepared and submitted to the National Environment Management Authority (NEMA) for review and eventual licensing before the development commences. This was necessary as many forms of developmental activities cause damage to the environment and hence the greatest challenge today is to maintain sustainable development without interfering with the environment.

4.2 Legal and legislative Framework

Environmental policies cut across all sectors and government departments. As such policy formulation should be consultative steered by interdisciplinary committees.

4.2.1 The Constitution of Kenya, 2010

The Constitution of Kenya (2010) takes supremacy over all aspects of life and activity in the Republic. With regard to environment, article 42 of the CoK (2010) states as thus:

> Every person has a right to a clean and health 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 and
>
> (b) to have the obligations relating to the environment fulfilled under article 70 of CoK (2010)

Thus the implementation of the proposed development project is guided by this provision of the CoK (2010). Implementers will be expected to undertake their work with the understanding that persons are entitled to clean and health environment which must not be taken for granted.

The provisions of article 69 and article 70 of the CoK (2010) are enumerated hereunder

Article 69

Article 69**,** subsection (1): 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 per cent of the land area of Kenya; (c) protect and enhance intellectual property in, 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 audit and monitoring of the environment; (g) eliminate processes and activities that are likely to endanger the environment; and (h) utilize the environment and natural resources for the benefit of the people of Kenya

By this article, public participation is encouraged and non-compliance is a violation of the constitution. Trees are protected by this section and the policy to be applied is thus:

All mature indigenous trees should be not be cut. But when the best route for project implementation must affect the tree, then the project implementers must considers trimming the branches as the best option before considering cutting it. To cut mature trees especially indigenous trees should be the last option.

Subsection (2) "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". This obligation will be laid upon every stakeholder in the implementation process in order to maintain harmony in the development process. Key stakeholders targeted by this include the proponent, contractor and the host community. The following state organs may seek to inspect contractor' premises and should be allowed access; (i) NEMA (ii) DOSH (iii) Public health (iv) The county ministry in charge of LIHUD.

Article 70

This section provides for enforcement of environmental rights thus: (1) 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, denied, 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 (c) to provide compensation for any victim of a violation of the right to a clean and healthy environment. (3) For the purposes of this Article, an applicant does not have to demonstrate that any person has incurred loss or suffered injury. This means that the project players must be cognizant of the fact that the public has been empowered by this article and can "interrupt" work progress through the court process and therefore implementers should respect the environmental regulations especially to ensure the community right to a clean and health environment is honored.

The provisions for a clean and healthy environment notwithstanding, the ARTICLE 41 (1) on labor relations states thus: Every person has the right to fair labor practices WHICH include the right to fair remuneration and the right to reasonable working conditions. The contractor will be bound by this requirement to ensure that his workers remuneration is within the minimum wage provisions and that the working conditions (which include the equipment and sanitation) are reasonable. Each worker should be provided with Personal Protective Equipment during working hours. The contractor will develop a safety management policy and enforce it.

All Kenyan policies, regulations, and legislations relevant to sustainable development are anchored in the CoK (2010) and some are discussed below.

The proposed project activities will ensure that the ecological processes and the environment are not severely damaged through proper implementation of the proposed mitigation measures put in place to ensure that the project construction and operation activities do not adversely affect the surrounding environment.

4.2.3 Sessional Paper Number 10 of 2012 (Vision 2030)

This is the National Blueprint for economic advancement of Kenya. It is also called as the Vision 2030 and it is the long-term development strategy for Kenya towards achieving a "globally competitive and prosperous country [economy] with a high quality of life by 2030. The key objective of the Vision 2030 is to transform Kenya into a new industrializing middle income country by the year 2030 AD. It envisions a high quality of life for the majority of Kenya citizens in a clean and health environment as contemplated in the Sustainable Development Goals [SDGs]. Vision 2030 is anchored on 3 pillars:

Three pillars of Kenya' Vision 2030

Pillar	Description
Economic	To achieve a sustained annual economic growth rate of 10% to 2030
Social	To create a just, cohesive and equitable social development
Political	To build an issue, people centered democratic system that is result oriented and accountable to the public

Adopted from Vision 2030

Vision 2030 anticipates a Kenyan nation characterized by a clean, secure and sustainable environment by 2030 and sets the goals towards that:

(i) to increase forest cover from less than 3% at present to 4% and

(ii) to lessen by half all environment-related diseases.

It recommends specific strategies to promote environmental conservation in order to provide better support to the economic pillar flagship projects and for the purposes of achieving the SDGs. The implementation of the proposed project should not create room for breeding of mosquitoes which spread malaria plasmodium; neither should it lead to contamination of water [which increases incidence of water borne diseases]. The implementers must be careful on maintaining air quality [avoid air pollution] and enforce sound policies on waste management.

The proposed development project will promote the economic growth of the locality and help propel Kenya to a middle-income country as envisioned in the Vision 2030 development plan by developing the housing sector, one of the key target sectors in the plan.

4.3 National Policies

4.3.1 The National Environment Policy, 2013

The National Environment Policy aims to provide a holistic framework to guide environmental and natural resource management in Kenya. It also ensures that the link between the environment and poverty reduction is integrated into all government processes and institutions in order to facilitate and realize sustainable development at all levels in the context of a green economy, enhancing social inclusion, improving human welfare, creating employment opportunities and maintaining a healthy functioning of the ecosystem.

This policy presents the framework to deal with the ever-growing environmental issues and management challenges in Kenya like harmonizing of sectoral policy instruments with the Environmental Management and Coordination Act and the Constitution, implementing the Land Policy, valuing of environmental and natural resources, rehabilitating and restoring environmentally degraded areas, loss of biodiversity, concessions and incentives, urbanization and waste management, pollution, energy, climate change and disaster management, conservation of shared natural resources, invasive and alien species, public participation, environmental education and awareness, data and information, poverty, weak enforcement, and fragmentation.

4.3.2 National Policy on Water Resources Management and Development (Sessional Paper No.1 of 1999)

- The four specific objectives guiding in the management of water resources in Kenya include; Preserve, conserve and protect available water resources and allocate it in a sustainable, rational and economic way;
- Supply water of good quality in sufficient quantities to meet the various water needs, including poverty alleviation, while ensuring the safe disposal of wastewater and environmental protection;
- Establish an efficient and effective institutional framework to achieve a systematic development and management of the water sector; and
- Develop a sound and sustainable financing system for effective water resources management, water supply and sanitation development.

4.3.3 Policy on Environment and Development

This is presented as the Sessional paper No. 6 of 1999 on Environment and Development. The overall goal is to integrate environmental concerns into the national planning and management process and provide guidelines for environmentally sustainable development. It portrays portable water and water for sanitation as being central to satisfying basic human needs. Water resources have an extremely high value, and effective mechanisms for managing and conserving water could result into economic benefits as well as sustainable use of this vital resource. Its key objectives are protecting water catchments; ensuring that all development policies, programmes and projects take environmental considerations into account; and enhancing, reviewing regularly, harmonizing, implementing and enforcing laws for the management, sustainable utilization and conservation of natural resources.

The policy recommends the need for enhanced re-use/recycling of residues including water and wastewater as well as increased public awareness raising and appreciation of clean environment. It also enhances participation of stakeholders in the management of natural resources within their respective localities.

The project proponent is encouraged to practise waste water recycling and re-use of the waste materials.

4.3.4 The Land Policy (Sessional Paper No. 3 of 2009)

The overall objective of the National Land Policy is to secure land rights and provide for sustainable growth, investment and the reduction of poverty in line with the Government's overall development objectives. Specifically, it seeks to develop a framework of policies and laws designed to ensure the maintenance of a system of land administration and management that will provide all citizens with the opportunity to access and beneficially occupy and use land; economically, socially, equitably, and environmentally sustainable allocation and use of land; effective and economical operation of the land market; efficient use of land and land-based resources; and efficient and transparent land dispute resolution mechanisms. The previously existing land laws have been repealed and the law consolidated into three statutes, namely the Land Act 2012, the Land Registration Act 2012 and the National Land Commission Act 2012.

4.3.5 The Kenya Health Policy (2012 – 2030)

The policy is based on the Constitution of Kenya 2010, Vision 2030 and global health commitments. Its broad aim is to ensure equity, people-centeredness and participation, efficiency, multi-sectoral approach and social accountability in delivery of healthcare services.

4.3.6 The National Environmental Sanitation and Hygiene Policy, (2007)

The Environmental Sanitation and Hygiene (ESH) Policy is intended to improve peoples' health and quality of life. It aims at clarifying the various roles in order to enhance the existing legal and constitutional framework and to encourage the private sector, civil society and community participation in the planning, implementation and ownership of ESH services; protect the environment from pollution and its negative effects on human health; and reduce poverty.

4.3.7 The Climate Change Act 2016

The objective of the Climate Change Act 2016 is to provide a regulatory framework for an enhanced response to climate change, and to provide mechanisms and measures to improve resilience to climate change and promote low carbon development. The Climate Change Act

adopts a mainstreaming approach, provides a legal basis for climate change activities through the National Climate Change Action Plan, and establishes the National Climate Change Council and the Climate Fund.

With this enactment, Kenya joins the league of nations that have taken concrete steps to domesticate the Paris Accord on Climate Change.

The main objective of the Climate Change Act is to be applied in the development, management, implementation and regulation of mechanisms to enhance climate change resilience and low-carbon development for the sustainable development of Kenya.

4.3.8 The Energy Act 2019

The Energy Act 2019 has a very broad scope, covering all forms of energy, from fossil fuels to renewables. The Energy Act mandates the government to promote the development and use of renewable energy, including biodiesel, bioethanol, biomass, solar, wind and hydropower. The Energy Act provides a useful supporting framework for the transition to a green economy with likely gains in environmental protection and climate change.

4.4 National Regulatory Frameworks

4.4.1 The Environmental Management and Co-ordination Act CAP 387

Environmental legislation in Kenya is provided in over 77 statutes. In order to provide a structured approach to environmental management in Kenya, the EMCA Act was enacted on January 14th 2000 as a framework law and contains provisions for the ESM of the proposed and ongoing Projects respectively in Kenya. With the coming into force of the EMCA, the environmental provisions within the sectoral laws were not superseded; instead, the environmental provisions within those laws were reinforced to better manage Kenya's ailing environment.

Section 58.(1) Of the Act states "Notwithstanding any approval, permit or license granted under this Act or any other law in force in Kenya, any person, being a proponent of a project, shall, before financing, commencing, proceeding with, carrying out, executing or conducting or causing to be financed, commenced, proceeded with, carried out, executed or conducted by another person any undertaking specified in the Second Schedule to this Act, submit a project report to the Authority, in the prescribed form, giving the prescribed information and which shall be accompanied by the prescribed fee". Environmental Management and Coordination Act

CAP 387 provide a legal and institutional framework for the management of the environmental related matters. This EIA study has been conducted and the final report compiled pursuant to section 58 (1) of the EMCA Act and its respective stipulations.

4.4.2 EMCA Related Regulations

4.4.2.1 Environmental (Impact Assessment and Audit) Regulations, 2003

The Environmental Impact Assessment and Audit Regulations, 2003 are subsidiary regulations of EMCA, 1999 and stipulate the steps to be followed in undertaking an EIA study. The Regulations highlight the stages to be followed, information to be made available, role of every stakeholder and rules to be observed during the EIA process.

This EIA study has been conducted as per the provisions and guidelines of the Environmental Impact Assessment and Audit Regulations, 2003; has been planned, designed, compiled and implemented based on the very regulations. It shall also be maintained and guided by the same regulations and an environmental audit study will be done periodically to monitor compliance with the set environmental standards.

4.4.2.2 EMCA (Water Quality) Regulations, 2006

The above regulation was promulgated on September 4th 2006 and became effective on July 1st 2007. This regulation provides for the sustainable management of water used for various purposes in Kenya. Its provisions are;

4(1) Every person shall refrain from any act which directly or indirectly causes, or may cause immediate or subsequent water pollution, and it shall be immaterial whether or not the water resource was polluted before the enactment of the Act.

(2) No person shall throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution.

Part IV Section 24 states that "No person shall discharge or apply any poison, toxic, noxious or obstructing matter, radioactive wastes, or other pollutants or permit any person to dump any such matter into water meant for fisheries, wildlife, recreational purposes or any other uses". According to these regulations, "Every person shall refrain from any action which directly or indirectly causes, or may cause immediate or subsequent water pollution, and it shall be immaterial whether or not the water resource was polluted before the enactment of the Act".

The proponent shall follow the necessary precautionary measures not to pollute underground water or surface water. The proponent will be required to immediately notify the authority any occurrence of pollution incidence at the site. Use of oils/sprays on site will be carefully done to control spills on the surface. Servicing of machines/trucks will be carried out at designated service bay.

4.4.2.3 EMCA (Waste management) Regulations, 2006

The Waste Management Regulations were promulgated on September 4th 2006 and became effective on July 1st 2007. This regulation is comprehensive and covers the management of various kinds of waste in Kenya. Various clauses relevant to the project are:

Section 4 (18): No owner or operator of a trade or industrial undertaking shall discharge or dispose of any waste in any state into the environment, unless the waste has been treated in a treatment facility and in a manner prescribed by the Authority in consultation with the relevant lead agency. Minimal waste is expected from the undertaking.

Section 4(2) and 6 explain that the waste generator must collect, segregate (hazardous waste from non-hazardous) and dispose waste in such a facility that shall be provided by the relevant local authority.

Section 5 provides for methods of cleaner production (so as to minimize waste generation) which includes the improvement of production processes through conserving raw materials and energy.

In section 14 (1) every trade or industrial undertaking is obliged to install anti- pollution equipment for the treatment of waste emanating from such trade or industrial undertaking.

The proponent shall ensure that the garbage collector contracted has a valid license from the National Environment Management Authority (NEMA). So as to comply with this, the contractor shall take precaution not to dump wastes in areas not registered and designated as dumpsites, and all waste disposed of as per the Waste management regulations.

4.4.2.4 EMCA (Noise and Excessive Vibration Pollution Control) Regulations, 2009

In May 2009, the Minister for Environment and Mineral Resources promulgated the above regulations for management of noise and excessive vibration. The general prohibition states that no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and

the environment. The regulations further provide factors that will be considered in determining whether or not noise and vibration is loud, unreasonable, unnecessary or unusual.

For fixed installations, excessive vibration under these regulations is defined as any vibration emanating from the source and exceeds 0.5cm/s. Rules 5 and 6 of the regulations define noise levels for various types of activities that generate noise. The first schedule to the regulations defines permissible noise levels measured 30m from the boundary fence of a project. A noise license will be required during the construction phase of the project and a noise survey conducted once operation is recommended for presentation to the authority.

The proponent shall implement these measures, ensure that all noise equipment, tools, vehicles, are in good working condition to reduce noise. The project contractor will be required to avoid carrying out noise emitting activities and work within the stipulated time periods . in addition, regular noise monitoring will be conducted and acquisition of noise permit in extreme cases

4.4.2.5 EMCA (Air Quality) Regulations, 2013

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 proponent shall implement the mitigation measures provided in the EMP to prevent air pollution during construction and operation phases.

The proponent will also conduct regular air quality monitoring.

4.5 Other Environment, health and safety, physical planning related laws

4.5.1 Water Act, 2002

Water in Kenya is owned by the Government, subject to any right of the user, legally acquired. However; this Act regulates conservation and management of all water resources within the republic, and related purposes.

In section 3 of part II, it states that every water resource is vested in the State, subject to any rights of user granted by or under this Act or any other written law. The Act also provides for

establishment of a Water Resource Management Authority, whose aim is to manage and coordinate conservation and utilization of water resources at national scale. The Act will thus play a central role in guiding the exploitation and conservation of the limiting and scarce water resource throughout the project life.

4.5 2 The Penal Code CAP 63

Chapter XVII on "Nuisances and offences against health and convenience" contained in the penal code strictly prohibits the release of foul air into the environment which affects the health of the persons. It states "Any person who voluntarily vitiates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carrying on business in the neighbourhood or passing along a public way is guilty of a misdemeanor".

Waste disposal and other project related activities shall be carried out in such a manner as to conform to the provisions of the code.

4.5.3 Occupational Health and Safety Act No.15 of 2007 and the 2007 Subsidiary legislation (Cap 514)

This Act of Parliament was enacted to provide for the health, safety and welfare of persons employed in workplaces and for matters incidental thereto and connected therewith.

Its relevant clauses and stipulations relevant to the proposed project are;

i. Part II of the Act provides the General Duties that Occupiers must comply with in respect to health and safety in the workplace. Such duties include undertaking S&H risk assessments, S&H audits, notification of accidents, injuries and dangerous occurrences, etc.

ii. Part III of the Act provides the Administrative framework for supervision of the Act.

iii. Part IV deals with the enforcement provisions that the DOSHS has been provided with under the Act. It discusses the instances when Improvement and Prohibition Notices can be issued as well as the powers of OSH officers.

iv. Part V of the Act requires all workplaces to be registered with the DOSHS. The Occupier has to apply for registration of their project with the DOSHS on completion of installation of the crusher and before the operational phase of the project.

v. Part XI of the Act contains Special Provisions on the management of health, safety and welfare. These include work permit systems, PPE requirements and medical surveillance. All sections of this part of the Act will be applicable to this project during the operational phase.

vi. Part XIII of the Act stipulates the fines and penalties associated with non-compliance of the Act. It includes those fines and penalties that are not included in other sections of the Act and will be important for an Occupier to read and understand the penalties for non-compliance with S&H provisions.

vii. Part XIV of the Act is the last section of the Act and contains miscellaneous provisions which are not covered elsewhere. Most of the sub-sections under this part of the Act will be applicable to mining projects and it is in the interest of an Occupier to read, understand and ensure compliance with it.

Some of the important subsidiary legislations which operationalized the Act and are applicable to the proposed project are described below.

i) ***(Safety and Health Committee) Rules 2004***

These rules came into effect on April 28th, 2004 and require that an Occupier formalize a Safety and Health (S&H) Committee if there are a minimum of 20 persons employed in the work place. The size of the S&H Committee depends on the number of workers employed at the place of work. For a Proponent and Contractor, the Occupational Safety and Health Act and the S&H Committee Rules 2004 are important as they require compliance with the following measures:

i. Posting of an Abstract of the Factories and Other Places of Work Act in key sections of each area of the workplace;

ii. Provision of first aid boxes in accordance with Legal Notice No. 160: First Aid Rules of 1977;

iii. Ensuring that there are an appropriate number of certified first aiders trained by a DOSHS approved institution and that the certification of these first aiders is current;

iv. Provision of a General Register for recording amongst other things all incidents, accidents and occupational injuries;

v. Appointment of a S&H Committee made up of an equal number of members from management and workers based on the total number of employees in the company;

vi. Training of the S&H Committee in accordance with these rules;

vii. Appointment of a S&H management representative by the Proponent;

The Safety & Health Committee must meet at least quarterly, take minutes, circulate key action items on bulletin boards and may be required to send a copy of the minutes to the DOSHS local office. Proper record keeping including maintenance of all current certificates related to inspection of critical equipment such as the tractor, transport vehicles and the generator, etc. Such inspections need to be undertaken by a competent person certified by the Director of the DOSHS.

ii) **(Noise Prevention and Control) Rules**

These rules have set minimum and maximum exposure limits beyond which workers and members of the public should not be exposed to noise without adequate means of protection. The rules also have limits for exposure out of workplaces. The rules have several recommendations on a comprehensive noise control program for workplaces that includes a requirement for medical examination of workers who are exposed to noise. The rules have also set the minimum noise levels that should emanate from a facility to public/neighbouring areas by day or by night. The proponent will provide functional earmuffs for those operating the noise emitting machines and those working in noisy environments; and keep on renewing their noise and vibration permit from NEMA. All in all, the project proponent will be required to adhere to all the stipulations of the OSHA Act, 2007 requirements and regulations.

iii) **Medical Examination Rules, 2005**

These rules provide for Occupiers to mandatorily undertake pre-employment, periodic and termination medical evaluations of workers whose occupations are stipulated in the Second Schedule of the Act and the First Schedule of the Regulation. The workers are to undergo medical evaluations by a Designated Health Practitioner (DHP) duly registered by the DOSHS. Exposure to airborne crystalline silica present negative impacts to human health, the workers exposed to the dust will be required to undergo medical examinations in accordance with the above Rules. The project proponent is required to ensure that on site workers are examined

medically and appropriate gears availed to them while at site, like earmuffs, helmets, overalls and respiratory gears.

iv) **Fire Risk Reduction Rules, 2007**

These rules were promulgated by the Minister for Labor on April 16th 2007 and apply to all workplaces. The rules apply to this sector project in several ways as enumerated below;

Rule 16 requires a Proponent to ensure that electrical equipment is installed in accordance with the respective hazardous area classification system. It is also a requirement that all electrical equipment is inspected after six months by a competent person and the Proponent is required to keep records of such inspections.

Rules 29 – 31 refer to the installation and maintenance of fire-fighting systems in workplaces. Fire extinguishers are to be mounted at least 60cm above ground while a fire hose reel must be located within a radius of 30m. Fires can arise from electrical fault at the site.

Worker's safety will be given priority during both construction and operation phases of the project. The proponent shall adhere to the provisions of OSHA, 2007 and the subsidiary rules and regulations under it.

4.5.3 The Work Injury Benefits Act (WIBA), 2007

The WIBA Act provides for compensation to employees for work related injuries and diseases contracted in the course of their employment and for connected purposes;

Section 7(a) of the Act, on the obligations of the employer, requires an employer to obtain and maintain an insurance policy with an insurer approved by the State in respect of any liability that the employer may incur under this Act to any of his employees.

Section 10(1) States that 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. It also states expressly that an employer is liable to pay compensation in accordance with the provisions of this Act to an employee injured while at work.

On First Aid covered in section 45(1), an employer is supposed to 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.

The proponent shall acquire insurance cover for all the workers for the time they will be working at the project site which will enable them get compensation in case of accident occurrence.

4.5.4 The Public Health Act CAP 242

Part IX, section 115 of the Act states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires local authorities to take all lawful, necessary, reasonable and practicable measures to maintain areas under their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable for injurious or dangerous to human health.

During the project works, construction and operation, the management will comply with the provisions of this Act in terms of constructing storm drains and sanitary facilities to the required standards and ensuring that the site is safe from nuisance or pollution of any nature.

4.5.5 The Land and Environment Court

The Land and Environment Court is established under the Environment and Land Court Act, 2011 (No. 19 of 2011). It is empowered by law, given the status of the High Court and has the jurisdiction to hear and determine disputes, actions and proceedings concerning acquisition of land as well as matters pertaining to the environment.

4.5.6 The County Government Act 2012

Section 163 allows counties to control or prohibit all businesses, factories and workshops which, by reason of smoke, fumes, chemicals, gases, dust, smell, noise, vibration or other cause, may be or become a source of danger, discomfort or annoyance to the neighbourhood, and to prescribe the conditions subject to which such businesses, factories and workshops shall be carried on. The same section allows counties to prohibit, control and regulate trade and trading activities within their jurisdiction.

4.5.7 The Physical Planning Act of 1996 CAP 286

The Act allows for prohibition or control over the use and development of land and building in the interest of proper and orderly development of an area. Section 30 states that any person who carries out development without permission will be required to restore the land to its original condition. It also states that no other licensing authority shall grant license for commercial or industrial use or occupation of any building without a development permission granted by the respective local authority.

Section 36 states that if in connection with a development application, a local authority is of the opinion that the proposed development activity will have injurious impact on the environment; the applicant shall be required to submit together with the application an environment impact assessment (EIA) report. EMCA, CAP 387 echoes the same by requiring that such an EIA is approved by the National Environmental Management Authority (NEMA) and should be followed by annual environmental audits.

The proposed project construction and operation activities must obtain a license from the county government of Machakos (Mavoko Sub-County).

4.5.8 Traffic Act Cap. 403

In Section 51, only proper fuel should be used in vehicles. Similarly, vehicles should be well maintained to prevent any fumes/exhaust that could pollute the environment. All vehicles transporting installation materials will be granted permits authorizing them to transport materials to the site plus all the equipment, lorries and heavy vehicle drivers will possess up to date driving licenses and certificates identifying them and the type of lorries/vehicles/equipment they are authorized to operate, plus deployment of traffic martials to help control the traffic flow.

4.5.9 Building Code 2000

The building code under Septic and conservancy tanks, section 202 allows for installation of septic tanks/ conservancy tanks where a sewer system has not been provided that the proponent abides with the provisions under the set table.

The effluent waste water from the project site will be channeled to a waste water treatment plant.

4.5.10 Lands Act, 2012 No. 6 of 2012

Part II Section 8 provides guidelines on management of public land by National Land Commission on behalf of both National and County Governments. This law in Section 8(b) stipulates that the Commission shall evaluate all parcels of public land based on land capability classification, land resources mapping consideration, overall potential for use, and resource evaluation data for land use planning. Section 8(d) stipulates that The Commission may require the land to be used for specified purposes subject to such conditions, covenants, encumbrances or reservations as are specified in the relevant order or other instrument.

In managing public land the Commission is further required in Section 10(1) to prescribe guidelines for the management of public land by all public agencies, statutory bodies and state

corporations in actual occupation or use. In these guidelines management priorities and operational principles for the management of public land resources for identified uses shall be stated. This in essence means that the Commission shall take appropriate action to maintain public land that has endangered or endemic species of flora and fauna, critical habitats or protected areas. As well the Commission shall identify ecologically sensitive areas that are within public lands and demarcate or take any other justified action on those areas and act to prevent environmental degradation and climate change.

Part VIII of the Act provides procedures for compulsory acquisition of interest in land. Section III (1) states that if land is acquired compulsorily under this Act just compensation shall be paid in full to all persons whose interest in the land have been determined. The Act also provides for settlement programmes. Any dispute arising out of any matter provided for under this Act may be referred to the Land and Environment Court for determination.

The land on which the project is to be developed fully belongs to the proponent and has a valid title deed

4.6 National Institutional Framework

4.6.1 National Environment and Management Authority

The responsibility of the National Environmental Management Authority (NEMA) is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principle instrument of government in the implementation of all policies relating to the environment. In addition to NEMA, the Act provides for the establishment and enforcement of environmental quality standards to be set by a technical committee of NEMA known as the Standards and Enforcement Review Committee.

CHAPTER FIVE: PUBLIC CONSULTATION AND PARTICIPATION

5.1Introduction

The main purpose of carrying out consultations with community and key stakeholders was to obtain views and concerns from the project affected people regarding the proposed housing estate so as to incorporate their contribution into the project development to safeguard the environment and the interest of key stakeholders particularly the local community and project area leadership and agencies directly or indirectly affected by the project.

Stakeholder consultation was conducted to disclose the details of the proposed project, to inform the stakeholders of any potential negative impacts and elaborate on the positive aspects so that informed decision are made by the stakeholders.

The public consultation meeting was aimed at achieving the following specific objectives:

- Collection of additional baseline data/ information on the project area community;
- Conduct further stakeholder and community consultations and sensitization; and
- Provide the project area community and stakeholders with an opportunity to directly interact with the project developer through the EIA Consultants and ask questions, raise issues and concerns pertaining to the proposed project and contribute to the identification of project impacts, mitigation measures and project alternatives.
- Facilitate consideration of project alternatives, mitigation measures and trade-offs;
- Ensure that important impacts are not overlooked and benefits are maximized;
- Reduce conflict through early identification of contentious issues;
- Provide an opportunity for the public to influence project activities in a positive manner;

Improve transparency and accountability of decision-making; and increase public confidence in the Environmental Impact Assessment process and the proposed project's undertaking.

5.2 Approach to Consultations with Community/Key Stakeholders

The Consultant visited key stakeholders in their offices and discussed the proposed project. For the area administration, the Assistant County Commissioner and Local Area Chief assisted in planning for a public meeting (Barazas) where the community representative were informed of the project and also sensitized on the benefits of the proposed development.

The EIA employed three main methods of consultations to get the data presented in this report. These are:

- Meetings and discussions with Key Stakeholders;
- Questionnaire administration and interviews; and
- Convening of Public Consultation Meetings (PCMs) within the project affected persons.

Key informants included local administration/leaders and community representatives, religious leaders, Private establishments/companies and general members of the community.

Public Consultation Meetings

A public baraza was held on January 25th 2023 with project affected persons. Questionnaires were also distributed to the members present to collect their views. Signed minutes of the meetings and the dully filled stakeholder questionnaires have been attached herewith.

5.3 Socio-economic Impacts

The local communities were keen to talk to the EIA field team on the proposed project and they were appreciative of the fact that the consultancy team involved them in a consultative manner. The people encountered participated actively in raising their concerns and they expressed their hope that lawful procedures will be taken into consideration during the project implementation. In addition, below are the various social economic aspects that the community members raised:

Employment: Most respondents pointed that the proposed project will create employment to people and especially youth in the area in all phases of the project. This will also directly contribute to improving the economy of Machakos County and the wider Kenya.

5.4 Environmental views

Waste Management: Waste disposal was highlighted by the local communities as one component from the project activities that will pollute the environment if not properly handled. Respondents proposed waste management methods such as private contractor, dust bin installing within estate, waste recycling, county government disposal/private garbage collectors services, use of waste water treatment plant, and construction of own sewerage treatment plant.

Air quality: Majority of the respondents were of the opinion that the dust emissions will increase during the construction. The respondents acknowledged existence of air pollution from the quarries and the lorries ferrying construction materials. A number of respondents proposed

planting of trees to minimize deterioration of air quality, and fence the construction site with dust Nets. Workers to be provided with PPES. They also recommended sprinkling of water to reduce dust.

5.5 Support for the Proposed Project

Majority of the total respondents interviewed were in support of the project. Most of these respondents argued that the proposed development was good and recommendable for general development and basically it conformed to other developments in the area. Some quoted that increased development will necessitate services such as Schools, Modern Housing and other Social Amenities around the area.

Public participation exercise

CHAPTER SIX: PROJECT ALTERNATIVES

6.1 Introduction

In deciding on the type of developments to be included in the project, the proponents considered various alternatives. Three options were considered as outlined below. Note that for some issues, little data is available on which to base the assessment, and that many of the judgments are subjective. Also, despite a number of detailed technological alternatives at project proponent's discretion, the technology adopted in this project is informed by conventional building trend in the project area. It's worth noting also that only those alternatives with the potential to materially affect the outcome of the environment have been discussed here.

6.1.1 Zero Option/ No Development

The zero option in respect to the proposed project implies that the status quo is maintained. This option is the most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. This option will however, involve several losses both to the landowner and the community as a whole. The landowner will continue to pay rent on the plot while the property remains underutilized. The Option is the least preferred from the socio-economic and partly environmental perspective due to the following factors:

The landowner will continue to pay rent on the plot while the property remains idle. The No Project Option is the least preferred from the socio-economic and partly environmental perspective due to the following factors:

- The economic status of the Kenyans and the local people would remain unchanged.
- The local skills would remain underutilized.
- Reduced interaction both at county, national and international levels
- No employment opportunities will be created for Kenyans who will work in the project.
- No housing provided to alleviate a critical shortage high standard commercial use
- Development of infrastructural facilities (roads, electrical etc.) will not be undertaken. From the analysis above, it becomes apparent that the No Project alternative is no alternative to the local people, Kenyans, and the Government of Kenya.

6.1.2 Relocation Option

Relocation option to a different site is an option available for the project implementation. At present the landowner/developer does not have an alternative site. This means that he has to look for the land. Looking for the land to accommodate the scale and size of the project and completing official transaction on it may take up to three (3) years although there is no guarantee that the land would be available. The developer will spend another two years on design and approvals since design and planning has to be according to site conditions. Project design and planning before the stage of implementation will cost the developer hundreds of thousands of Kenya shillings. Whatever has been done and paid to date will be counted as a loss to the developer. Assuming the project will be given a positive response by the relevant authorities including NEMA, this project would have been delayed for about two (2) years period before implementation. This is a delay that our economy can ill afford. This would also lead to a situation like No Project Alternative option. The other consequence of this is that it would be a discouragement for private/local investors especially in the housing sector that has been shunned by many public and private investors already aggravating our critical housing shortages. In consideration of the above concerns and assessment of the current proposed site, relocation of the project is not a viable option.

6.1.3 Alternative Land use

The proponent has no option to use the land for other purposes other than proposed residential apartments.

6.1.4 Proposed Alternative

Various alternative methods for development of the proposed project were considered, however in all instances the outstanding difference was either material or technology used but development of the residential development emerged as the most plausible option according to the project area setting and primacy.

CHAPTER SEVEN: IDENTIFICATION OF ENVIRONMENTAL AND SOCIAL IMPACTS

7.1 Basis of Identification of Impacts

In order to accurately identify the environmental impacts the following environmental Issues were considered pertinent and important as per the Terms of Reference.

7.1.1 Physical Environment (Biophysical Impacts)

a) Water quality aspects for both surface water sources like piped water, storm water, and other related aspects.
b) Soil conditions, soil contamination and landscape alterations/degradation (based on aesthetic aspects) associated with the proposed project.
c) Drainage patterns especially in relation to waste water effluents
d) Air quality aspects especially atmospheric emissions and related discharges from machinery like diesel run equipment etc.
e) Noise and vibrations where applicable

7.1.2 Natural Environment

f) Flora and fauna from the adjacent ecosystem (i.e. effects to natural plants and animals where applicable).
g) River pollution indicators, impacts on water flow patterns and quality aspects, user interference and contamination.
h) Topography: effects on soil and landscape.

7.13 Social welfare, Economic and Cultural Environment

i) Determination of implications to the human society distribution, demographic details, settlement patterns, changes to the cultural lifestyle and indigenous knowledge of the local society/public where applicable.
j) Notable changes in land use systems and the general land utilization types where applicable.
k) Aesthetic, landscape alterations and changes to infrastructural facilities, among others.
l) Effects associated with the construction and operation activities and related handling and disposal of wastes generated during the operations.
e) Effects associated with income generation opportunities created by the project due to the upcoming operations.

f) Implications on the employees, visitors and public health, safety and related hazards/risks such as HIV/AIDS, consumption of contaminated intravenous infusions products due to disease outbreaks, sanitary facilities, etc.

g) Introduction of nuisances, such as pests, invasive species and related multiplication breeding sites

7.2Description of the Existing and Anticipated Impacts

7.2.1 Existing impacts

There were major environmental impacts at the time of the study;

- ✧ Air and noise pollution from the nearby quarries and trucks ferrying quarry products

7.2.2 Anticipated impacts

The anticipated impacts of the proposed project on the environmental elements are both positive and negative. The magnitude of each impact is described in terms of being significant, minor or permanent, short-term or long term, specific (localized) or widespread, reversible or irreversible. The table below shows the assessment criteria for the significant impacts are.

Table 1. Assessment criteria for significant impacts

Key	Type of impact	Key	Type of impact
++	Major positive impact.	+	Minor positive impact
--	Major negative impact	-	Minor negative impact
0	Negligible/Zero impact	NC	No change
Sp	Specific/Localized impact	W	Widespread impacts
R	Reversible impacts	Ir	Irreversible impacts
Sh	Short term impacts	L	Long term impacts
T	Temporary impacts	P	Permanent impacts

On the basis of information gathered during the desktop and field study, the potential environmental impacts of the proposed project are tabulated below:

7.3 Positive Impacts

There are a number of positive benefits associated with the proposed development. The Following are some of the positive benefits anticipated:

Table 2 ; Positive Impacts of the Proposed Development and Justification

No.	Positive Impacts	Justification
1	Provision of high class and affordable Housing to the residents	The proposed project will provide affordable housing to the residents with emphasis on their safety and well - being.
2	Generation of direct and indirect employment and income.	Besides the direct employment by the proposed development, other forms of employment are likely to result from the spillover effects, through indirect services During the construction and operation phases. The employment opportunities will generate income and improve the living standards of the local population and its environs.
3	Contribution To Government Revenue	Through payment of relevant taxes, rates and fees to the national and county governments, the project will Contribute towards the national and local revenue earnings. The proponent will receive returns on his investments hence increases in wealth.
4	Improved Security.	Security will be ensured around the proposed development Through distribution of suitable security lights and presence of 24 hour . This will lead to improvement in the general security in the surrounding area.
5	Social amenities such as Schools, houses Creation of market for local goods and services.	The proposed project will boost social amenities in the general area and this will stimulate more development. The proposed project will create demand for local produce and this will greatly benefit small scale businesses within within the project area.

7.4 Specific Negative Impacts during Construction and Operational Phases and Mitigation Measures

The issues that are seen as likely to negatively affect the environment and population therein Include the following:

7.4.1 Air quality

Construction Phase

Dust is likely to be generated due to excavation activities, during building construction and deliveries of raw materials. There will be minimal air pollution due to combustion of fossil fuels expected from transportation and construction machinery and dust from excavation activities. The proponent will ensure that plant and equipment which will be acquired for on site preparation of pre-cast materials and concrete mixing will utilize the latest technology to have minimum emission.

Operational Phase

During operational phase, air quality is not likely to be affected.

Potential mitigation measures

i. Provision of full protective gear for workers. Workers shall also be sensitized on hazards encountered in such work environment and shall undergo regular health check-ups.
ii. Watering access roads and the site to suppress dust
iii. Covering truck loads using tarpaulins
iv. Personnel will be also provided with dust masks to avoid inhalation of the same.

7.4.2 Soil Erosion

Construction Phase

The activities involved in the site preparation and construction phase of the development may have a major negative and moderate impact on soil and geology of the project site. This is due to the removal of vegetation from the area which will leave considerable areas of soil exposed to the elements, which may result in soil erosion. Heavy machinery will be traversing the site due to the construction activities this may lead to soil compaction and erosion of the soil. Uncontrolled soil erosion can have adverse effects on the local water bodies.

Operational phase

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

Potential mitigation measures

Excavation should be done under controlled conditions which will include minimizing vegetation removal, avoiding creating large open expanses of bare soil, creating wind breaks, using of single or few

designated tracks to bring vehicles into the area and watering using water.

Landscaping should be done on the land during the operation phase and de-commissioning phase to ensure that the same is returned to its original state. The contractor should also provide adequate soil conservation structures to ensure that areas prone to soil erosion are protected from run-off.

7.4.3 Solid Waste

Construction Phase

A significant amount of solid waste will be generated in this phase through the clearing of vegetation. The other activities that will generate related solid wastes include stones, wood, broken glasses, containers, rods of metal, cement bags, sharp objects (nails) etc. This will therefore have a major negative short-term impact on solid waste collection in the area. The proponent should take the initiative of removal of the solid waste which is expected to be generated during this phase of the development.

Operational phase

The project is expected to generate enormous amounts of solid waste during its operation phase. Solid waste will be generated from the residential houses and the associated facilities. The accumulation of solid waste can cause the proliferation of domestic pests such as rats (*Rattusnorvegicus*and *Rattusrattus*. These vermin are very destructive and can rapidly multiply especially where garbage collection is infrequent and therefore food is abundant. This phase may also encourage stray animals such as dogs which can be nuisance species because they may bring with them ecto-parasites such as fleas (*Ctenocephalidescanis*) and ticks (*Ixodes sp.*) which can create health problems for domestic pets.

The bulk of the solid waste generated during the operation of the project will consist of domestic waste such as paper, plastic, glass, metal, textile and organic wastes. Such wastes can be injurious to the environment through blockage of drainage systems, choking of water bodies and negative impacts on animal health. Some of these waste materials especially the plastic/polythene is not biodegradable may cause long term injurious effects to the environment. Even the biodegradable ones such as organic wastes may be injurious to the environment because as they decompose, they produce methane gas, a powerful greenhouse gas known to contribute to global warming.

Potential mitigation measures for solid waste

Express condition shall be put in the contract that before the contractor is issued with a completion certificate; he will clear the site of all debris and restore it to a state acceptable to the supervising architect and environmental consultant.

Materials from excavation of the ground and foundation works shall be reused for earth works and landscaping.

Bins/ receptacles shall be placed at strategic locations within the site as collection centers to facilitate separation and sorting of the various types of wastes.

The contractor and proponent shall work hand in hand with licensed private refuse handlers and Mavoko Sub-County to facilitate sound waste management.

The wastes shall be properly segregated and separated to encourage recycling of some useful waste materials i.e. some demolished stone and concrete materials can be used as backfills.

Use of an integrated solid waste management system through a hierarchy options i.e. source reduction, recycling, composting and reuse shall be encouraged. This will facilitate proper handling of solid waste during operation stage.

7.4.4 Noise pollution

Construction phase

This phase of the development may likely have the most negative impact to the ambient noise and vibration in the development area. A number of measures may be undertaken by the developer to reduce the impact of noise on the existing and potential residents as well as the workers involved in the project. This is temporary, however, and the aim at this point is to make the increase in noise as small as possible until this phase is complete. The cumulative impact of the construction activities occurring simultaneously with the other proposed developments for the area may increase the noise and vibration levels in the area significantly.

Operation Phase

This phase is not likely to cause noise pollution as residential activities do not cause any significant noise.

Proposed mitigation measures

Equipment to be used should be selected on the basis of the noise minimization during acquisition.

Equipment should also be properly maintained while in use during the construction phase.

The equipment to be used should be located far away from the receivers and also so as to prevent interference, the proponent should ensure that construction is done between 8:00am - 5:00pm.

The proponent should also establish the noise levels during construction and install appropriate noise barriers and acoustic screens.

7.4.5 Increased Water Demand

Construction Phase

This phase of the development might place a strain on an already limited supply through the construction of buildings and other infrastructural works proposed for the development. This will

create additional demand to the water supply within the project vicinity as most people source water from county which is unreliable. The impact on water availability will therefore be compatible and short-term.

Operational phase

The operation phase of the proposed development might place a strain on the water availability in the area. Even with the use of recycled water for irrigation, the current supply will have a cumulative major negative impact on already limited supply. This phase of the development will therefore have a major negative long-term impact on the water availability in the area.

Potential mitigation measures

i. Drilling a borehole.
ii. Provision of notices and information signs within the project site to notify on means and needs to conserve water resource.
iii. Installation of water conserving taps will be done.
iv. Encourage water recycling during both construction and occupation phases of the project.
v. During operational phase, water abstraction will be according to the amount stated in the abstraction permit.
vi. Practice rain water harvesting to supplement the borehole water.

7.4.6 Surface Drainage/storm water

Construction phase

Clearance of land and excavation works will lead to increased soil erosion at the project site and release of sediments into the drainage systems.

Operational phase

The building roofs and pavements will lead to increased volume and velocity of storm water or runoff lowing across the area covered by the buildings. This will lead to increased amounts of storm water entering the drainage systems, resulting in overflow and damage to such systems.

Potential mitigation measures

Leveling the project site to reduce run-off velocity and increase infiltration of rainwater into the soil.

Drainage channels shall be installed in all areas that generate or receive surface water. The channels will be covered with gratings or other suitably approved materials to prevent occurrence of accidents and dirt entry that may compromise flow of run-off.

The channels shall be designed with regard to peak volumes.

Paving of the sidewalks, parking and other open areas shall be done using pervious materials i.e. concrete blocks to encourage water percolation thus reducing run-off volume.

7.4.7 Oil Leaks and Spills

It is 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. They contain such heavy metals as mercury, lead, and sulphur among others. 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.

Potential Mitigation Measures

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. Waste water/ wash water from these areas should be properly disposed.

All oil products and materials should be stored in site stores or in the contractor's yard. They should be handled appropriately to avoid spills and leaks.

Car wash areas and other places handling oil activities within the site must be well managed and the drains from these areas controlled. Oil interceptors must be installed along the drainage channels leading from such areas.

7.5 Socio-Cultural and Socio-Economic Impacts

7.5.1 Increase in Population

There is currently no evidence of overcrowding around the development area and therefore there will be minimal variations on its demography. The population growth rates in the area are not expected to be consistent in the future however, as there has been a significant increase in the number of approved and proposed developments for the Katani /Mavoko areas. These proposed developments will serve to attract migrants to the area who will be seeking employment during construction phase. This will result to an increase in population.

In the operational phase, the area will experience immigrants who will become the new residents of the constructed houses and this will impact on the population of the area.

Proposed mitigation measures

Planned settlement, ensuring that adequate social and other infrastructure meet the needs of migrants.

7.5.2 Employment and Income

Majority of the residents highlighted job opportunities as a major positive impact. Any available jobs will provide an immediate positive impact on the employment and income situation at the level of the study area as well as at the county and national levels. This phase of the development will provide the most benefits in terms of sustained employment and increase in income. Initially, the site preparation phase will employ specific vehicles and equipment in order to clear vegetation, for landscaping and grading and leveling and the cutting of access roads for these vehicles and labourers to access the site. This means that many skilled workers will be necessary to operate front-end loaders, excavators, bulldozers and backhoes and other vehicles. In addition to this semi-skilled labourers will still be necessary for other tasks. This phase of the development will therefore have a short-term major positive impact on the employment and income at the local level. During operation phase, employment opportunities will be created e.g. at the laundry and maintenance personnel.

Proposed mitigation measures

The proponent should encourage recruitment of labour from the locals for unskilled and semi-skilled labour. For skilled labour this will depend on how much is available locally and the shortfall shall be supplemented by artisans from outside.

The proponent will give equal opportunities to women where possible.

7.5.3 Increased Energy Demand

The construction and operation phases of the development will impact slightly on the electricity supplying the area as well as demand will increase.

Proposed mitigation measures

All electrical appliances should be switched off when not in use during construction and operation phases.

Use of energy conserving electric lamps for general lighting during operational phase.

Residents should utilize natural light when inside their houses to avoid using electricity for lighting during the day.

The contractor should ensure that all buildings have access to natural light during the day.

The proponent should consider installation of renewable energy sources such as solar panels.

7.5.4 Workplace Accidents

Workers at the site may be exposed to various workplace accidents especially during construction period. These include being hit by falling objects and falling off from elevated heights among others. During operation period, accidents may include exposure to exposed electrical parts.

Potential mitigation measures

Occurrences of accidents may be prevented by observing the following:

i. Ensuring that the operational manuals are available and accessible for every equipment/machinery used at the site.
ii. Proper maintenance of all machinery and equipment to prevent premature failure or possible accidents
iii. Ensuring all electrical equipment and machinery are properly grounded
iv. Only properly trained employees to operate equipment or machinery and proper instructions in their safe operation is provided.
v. Workers to wear personal protective equipment (PPE)
vi. Naked wires should always be sealed

7.5.5 Site Security

Security of the site and those working within is of utmost significance and those operating within the facility must be assured of their security at all times. Security lapses that may lead to injury of occupants of the building and loss of personal property should be taken care of.

Potential mitigation measures

The management shall strategically install lighting as well as security alarms and backup systems including surveillance of the area on a 24 hours basis.

Security guards shall guard the property in a 24-hour basis and document any suspicious movement within the facility and its environs.

7.5.6 Fire Hazards

The operations that lead to fire outbreaks include poor handling of electricity systems, faulty electrical equipment, carelessness etc. These should be avoided both during construction and operation phases of the project.

Potential mitigation measures

In this regard, the design of the project has provided and recommended implementation of firefighting measures and control facilities. These include the following:

i. Installation of an automatic fire alarm system for the estate
ii. Provision of firefighting equipment and hydrant points
iii. Display fire evacuation procedures and emergency at the buildings
iv. Regular maintenance of fire electrical and first aid equipment
v. Provision of sufficient fire exit points and fire assembly points

7.5.7 Road Infrastructure

Traffic along the access road may increase during construction phase since vehicles will be accessing the site to deliver construction materials, to take away waste materials and experts coming for supervision purposes. The roads in their current states will be able to handle this increased traffic including for heavy-duty equipment traffic. This phase of the development may have a major negative impact of surface status deterioration on the present road network in the study area.

Operational Phase: During the operation phase of the project, there might be a major negative impact on the road network in the area as the volume of traffic associated with the development will increase significantly, therefore placing a strain on the existing road network. Within the immediate environs of the project site the following traffic measures and rules will be observed:

- Maximum speed limit within this area will be 20km/hr for both operation and personal vehicles
- Speed limits and all other road signs and traffic rules shall be strictly observed.
- Vehicles will be used for the purposes to which they are intended only.

7.5.8 Occupational Health and Safety (OHS)

Construction phase

During the proposed project construction works, there may be increased risks to health and safety such as dust, air, and noise pollution. The workforce and general public involved would be more subjected to these possible environmental hazards and disturbances. Food for the construction workforce is usually provided by individuals most of who in most cases operate without public health licenses. This can compromise health of the workers especially if such foodstuff is not prepared following strict hygiene standards. Flammable substances including diesel and motor oil may be stored or used within the project site for heavy-duty equipment. These substances are precursors for fires and explosions, which may range from small incipient to larger fires of great intensity, which generates heat causing damage to property, injuries or loss of human life.

Operational phase

It is expected that most residents will use LPG for cooking which is also highly flammable, which may increase the vulnerability of the operation to a fire or an explosion.

Potential mitigation measures

During construction, the contractor will be required to prepare a waste management plan for the worksites and equipment camp at the start of the project. The site is to be kept clean, neat and tidy at all times. The contractor shall implement measures to minimize waste and develop a waste management

plan to include the following:

i. All personnel shall be instructed to dispose off waste in designated waste baskets.

ii. At all places of work, the contractor shall provide litter collection facilities.

iii. The final disposal of the site waste shall be done at the location that shall be approved by the engineer on site. This must be in full recognition of the existing legal requirements.

iv. There shall be provision of sufficient bins to store the solid waste produced on a daily basis.

v. Wherever possible, materials used or generated by construction shall be recycled. Provision shall also be made of responsible management of any hazardous waste generated during the construction works.

vi. Workmen shall be provided with suitable protective gear (such as dust masks, ear muffs, helmets, overalls, industrial boots etc.) particularly during construction. There must be fully equipped First Aid kits on site and a safety officer who has First Aid training and knowledge of safety procedures. In addition, the contractor must have insurance for the workmen.

vii. The contractor will be required to adhere to Occupational Safety and Health Act (OSHA) 2007, especially the building operations and works of engineering construction rules and its subsidiary and supplementary regulations on safety and public health in the construction activities.

7.5.9 Social Conflict with the Community

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

Potential Mitigation measures

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

The proponent will give women equal employment opportunities as men whenever possible.

The proponent will give priority to the local community in allocation of jobs at both skilled and unskilled level

CHAPTER EIGHT: ENVIRONMENTAL MANAGEMENT PLAN (EMP)

8.1 introduction

Integrating environmental issues in business management, such as those related to development increases efficiency while enhancing the project proponent financial and environmental management. These issues, which are normally of financial concern, are: costs, product quality, investments, level of productivity and planning. Environmental planning and management as a concept seeks to improve and protect environmental quality for both the project site and the neighbourhood through segregation of activities that are environmentally incompatible. Environmental planning and management integrates land use structure, social systems, regulatory law, environmental awareness and ethics.

Environmental management plan (EMP) for development projects such as the proposed residential apartments aims at providing a logical framework within which identified negative environmental impacts can be mitigated and monitored. In addition, EMP assigns responsibilities for action to various actors, and provides time frame within which mitigation measures can be done. EMP is a vital output for an environmental impact assessment as it provides a checklist for project monitoring and evaluation. A number of mitigation measures are already incorporated into the project design. The EMP outlined in Table 8-1 has addressed the identified potential negative impacts and mitigation measures for the proposed hotel development.

8.2 Environmental Monitoring and Evaluation

Environmental monitoring and evaluation are essential in the project lifespan as they are conducted to establish if the project implementation has complied with the set environmental management standards as articulated in the Environmental Management and Coordination Act (EMCA) No. 8 of 1999, and its attendant Environmental (Impact Assessment and Audit) Regulations, 2003.

In the context of the proposed project, design has made provisions for an elaborate operational monitoring framework for the following among others:

(a) Disruption of natural environment and modification of micro-climate

(b) Air and noise pollution

(c) Proliferation of related businesses

(d) Workers accidents and health infections during construction process

(e) Table 8.1: Environmental Management Plan

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES) ESTIMATE	MONITORING MEASURES
IMPLIMENTATION PHASE				
Commissioning of the Construction Works	- Site hand-over and Ground breaking	Project team (Lead Consultant/Architect, contractor Proponent)	Part of/Covered in the Project Cost	Presence of the project Team
Securing the Construction Site	- Construction of Perimeter Wall and Hoarding	Contractor Proponent	Part of/Covered in the Project Cost	Presence of Perimeter Fence
Security for Construction Material	- Construction of Site Stores - Construction materials to be delivered in small quantities to minimise storage problems	Contractor Proponent	200,000	Presence of Site store
Extraction and Use of Building Materials	- Availability and sustainability of the extraction sites as they are non-renewable in the short term - Landscape changes e.g. displacement of animals and vegetation, poor visual quality and opening of depressions on the surface - Ensure suppliers are licensed by NEMA	Contractor/Proponent /project team	Part of/Covered in the Project Cost	Material site rehabilitation
Collapse of Building during Construction	- Ensuring Building Strength and stability - Use of appropriate construction materials and reinforcements as per specifications - Ensuring building components are as per designs - Proper supervision - Ensure proper timelines are followed e.g. curing time	Contractor Proponent project team	Part of/Covered in the Project Cost	Presence of the project Team
Disturbance of Traffic flow during construction	- Proper signage - Awareness creation - Education to truck drivers - The proponent to come up with a traffic management plan	Contractor/Project team and general public	200,000	- Presence of site Notice Board /Hoarding - Presence of Security guards to control traffic - warning signs

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES) ESTIMATE	MONITORING MEASURES
CONSTRUCTION PHASE				
Soil Excavation leading to site disturbance	- Excavate only areas to be affected by buildings - Dumping of excess excavated materials to sites designated by NEMA and County - Restoration of sites Excavated	Contractor	10,000,000	Landscaping after completion of construction
Soil Erosion	- Create and Maintain soil traps and embankments. - Landscaping after completion of construction - Excavated soil to be used for back filling - Develop soil erosion management measure.	Contractor/Proponent, Architect/Site engineer Landscape Architect	1,000,000	Lack/Absence of Soil Erosion
Noise Pollution and Vibration	-Switch off engines not in use - Construction work to be confined to between 7am to 5pm -Ensure use of earmuffs by machine operators - Provide and enforce use of PPE e.g ear muffs - Proper servicing of machinery and equipment (oiling and greasing) - Monitor noise levels as per NEMA guidelines	Proponent and Contractor	1,000,000	Lack of complaints from the immediate neighbours
Air emissions	- Water sprinkling of driveways or the use of biodegradable hydrant e.g. Terraform polymer will reduce dust emission during construction - Ensure servicing of vehicles regularly - Cover loads of friable materials during transportation. - Control speed of construction vehicles and switch off machines when not in use. - Provide PPE to workers.	Proponent and Contractor	700,000	- Lack of complaints - Workers wearing protective clothing and earmuffs
Risks of Accidents and Injuries to Workers	- Education and awareness to all construction workers - Ensure use of appropriate personal protective clothing - Provide First Aid Kits on site	Proponent Contractor	1,000,000	- Presence of well-equipped First Aid kit Presence of Security Guards

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES) ESTIMATE	MONITORING MEASURES
	- Ensuring Building Strength and stability - Proper supervision			on site Presence of a register on the site
Health and Safety	- Provide First Aid Kits on site - Proper signage and warning to public of heavy vehicle turning - Ensuring Building Strength and stability - Provide clean water and food to the workers - The contractor to abide by all construction conditions especially clause B12 which stipulates health safety and workforce welfare - Personnel to stick to standard operation procedures - Personnel to wear complete protection gear - Provision of firefighting equipment - Put in place an emergency response plan. - Put in place guideline for operation of machinery and appliances and ensure workers are aware of the same. - Comply with Kenyan safety policy and safe working procedures, laws and regulations	Proponent Contractor	1,000,000	- Presence of well-equipped First Aid kit - Presence of Security Guards on site - Presence of a register on the site
Solid Waste Generation	- Ensure waste materials are disposed of on County and NEMA approved sites - Use of the 3rs – Reduce, Re-use, Re-cycle - Solid waste to be put in designated areas for appropriate disposal(waste cubicle) - Waste segregation to at source - Engage a licensed, competent and effective waste handler	Proponent Contractor	1,000,000	- Absence of Solid waste on the site
Energy Consumption	- Use electricity sparingly since high consumption of electricity negatively impacts on these natural resources and their sustainability - Use of Standby Generators - Use of renewable sources of energy i.e. solar panels	Proponent Contractor	1,000,000	- Presence of KPLC power lines - Presence of generator
Excessive Water Use	- Excessive water use may negatively impact on the water source and its sustainability - Getting supplementary source of water	Proponent Contractor	1,000,000	- Metering of water

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES) ESTIMATE	MONITORING MEASURES
	- Drilling a borehole - Abstract as indicated in the WRMA permit - Installation of toilet flushes with low volume cisterns - Recycling of water	WRA		
OCCUPATION PHASE				
Architectural incompatibility leading to distortion of neighbourhood aesthetic image	- Harmonise building scale with existing developments in neighbourhood - Harmonise detail, material and finishes for roofs and walls with existing development in the neighbourhood.	Architect Proponent Contractor	Part of/Covered in the Project Cost	- Compatibility with the neighbourhood
Solid Waste Generation and Management	- Regular inspection and maintenance of the waste disposal systems during operation phase - Establish a collective waste disposal and management system - Provide waste disposal bins to each suite well protected from adverse weather and animals - Ensure waste materials are disposed off on County approved sites - Engage a NEMA licensed waste handler to transport the waste - Use of the 3rs – Reduce, Re-use, Re-cycle	Proponent Contractor	1,500,000	- Presence of NEMA registered waste management companies - Presence of waste handling bins - Absence of wastes
Liquid Waste Generation and Management	-Regular inspection and maintenance of the waste disposal systems during the operation phase - Proper connection to the wastewater treatment plant - Routine check-ups and monitoring of the waste water treatment plant to avoid leakages and blockages. - The proposed capacity of the WWTPs should be sufficient to accommodate the anticipated people. - Proper construction of WWTPs will be done to meet the standards required by Mavoko Sub County. - Construction of separate storm water drainage channel	Proponent Contractor	3,000,000	- Absence of liquid wastes

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES) ESTIMATE	MONITORING MEASURES
Increased loading on Infrastructure services - Increased vehicular and/or pedestrian traffic - Increased demand on water, sanitation services	- Have paved road drainage system - Encourage rainwater harvesting - Provision of increased water storage capacity - Provide adequate storm water management system	Contractor Proponent	1,000,000	- Absence of runoff - Presence of good roads - Pavements and drainage channels
Traffic	- Provide adequate parking facilities within the project site	Contractor Proponent	Routine operation procedure	- Presence of amble parking in the premises
Increased social conflict	- Increased economic activities –employment generation and income earnings - Encourage good relation with the neighbours through neighbourhood associations	Contractor Proponent		-Good relationship with neighbours -absence of conflicts
Storm water impacts	- Provide roof gutters to collect and direct roof water to drains - Construct drains to standard specifications - Develop a storm water drainage system and linkage to natural drains	Proponent Contractor	900,000	Absence of Flooding and dampness in the hotel
Disruption of existing natural environment and modification of micro-climate: - Increased development density - Increased glare/solar reflection - Reduced natural ground cover/surface runoff - Obstruction of ventilating winds	- Development restricted to follow zoning policy/approved density – building line, plot coverage and plot ratio. - Careful layout and orientation of buildings to respect wind and sun direction. - Adequate provision of green and open space planted with grass, shrub and tree cover. - Minimum use of reflective building material and finishes for roof, wall and pavement. - The balconies should have garden	Project team (Contractor Proponent, Architect or Lead Consultant, etc)	600,000	Proper orientation Planted trees/Landscaping

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES) ESTIMATE	MONITORING MEASURES
Insecurity	- secure the premise with a perimeter wall and an electric fence - Installation of CCTV cameras at strategic points - Have a entry point that is manned 24 hours - Construction of gate house	Contractor Proponent	2, 000,000	Presence of perimeter wall Presence of day and night security guards
DECOMMISSIONING PHASE				
Building Safety	Assess the condition of buildings to ascertain usefulness	Engineer Proponent	1,000,000	Engineer and Tests on the building
Land and Building use	Ascertain the Planning development policy	County Physical Planner	200,000	Consultants present
Accidents/Injuries	Securing the Site by fencing off	Contractor Proponent	1,000,000	Presence of perimeter fence
Un-disconnected Services e.g. Power, Water, telephone, sewer etc	Ensure disconnection of all services Remove all surface and underground cables and wiring	Contractor	2,000,000	Absence of cabling
Solid Waste Generation (demolition waste)	Ensure waste materials are disposed of on County and NEMA approved sites Ensure re-use of materials that can be re-used -Use of the 3rs – Reduce, Re-use, Re-cycle	Proponent/Contractor	2,000,000	Absence of Debris
Noise and Vibration	- Ensure use of serviced equipment - Switch off engines not in use - Demolition work to be confined to between 8am to 5pm - Ensure use of earmuffs by workers	Proponent Contractor	100,000	Lack of complaints from the neighbours

CHAPTER NINE: ENVIRONMENTAL HEALTH AND SAFETY (EHS)

9.1 EHS Management and Administration

The EHS is a broader and holistic aspect of protecting the worker, the workplace, the tools / equipment and the biotic environment. It is an essential tool in determining the EIA study. The objective of the EHS on the proposed project is to develop rules that will regulate environmentally instigated diseases and occupational safety measures during construction and the operation phases of the proposed project by:

- Avoidance of injuries
- Provision of safe and healthy working environment for workers comfort.
- Control of losses and damages to plants, machines, equipment and other products.
- Enhance environmental sustainability through developing sound conservation measures.

9.2 Policy, Administrative and Legislative Framework

It is the primary responsibility of the contractor to promote a safe and healthy environment at the workplace and within the neighbourhood in which the proposed project will be constructed by implementing effective systems to prevent occupational diseases and ill-health, and to prevent damage to property. The EHS Management Plan when completed will be used as a tool and a check-list by the contracted engineers in planning and development of the construction of this project.

9.3 Organisation and implementation of the EHS Management Plan

The contractor shall use the EHS plan at the proposed project site both during construction and operation. The engineer will use it during construction phase with the assistance of an EHS consultant.

9.4 The Guiding Principles to be adopted by the contractor

The company will be guided by the following principle: -

- It will be a conscious organisation committed to promotion and maintenance of high standards of health and safety for its employees, the neighbouring population and the public at large.
- Ensuring that EHS activities are implemented to protect the environment and prevent pollution.
- Management shall demonstrate commitment and exercise constant vigilance in order to provide employees, neighbours and the environment, with greatest safeguards relating to EHS.
- Employees will be expected to take personal responsibility for their safety, safety of colleagues and of the general public as it relates to the EHS management plan.

9.5 EHS management strategy to be adopted by the contractor

The following strategies will be adopted to achieve the above objectives

- Create an Environment Health and Safety Management committee and incorporate EHS as an effective structure at various levels and units to manage and oversee EHS programs in all construction and operation phases of the project
- Maintain an effective reporting procedure for all accidents.
- Provide appropriate tools and protective devices for the success of the project.
- Encourage, motivate and reward employees to take personal initiatives and commitment on EHS.

9.6 Safety Agenda for both the proponent and contractor

There will be a permanent EHS agenda during construction.

(a) Contractors

The EHS management plan code of practice shall be applicable to the contractors working in the premises, and shall be read and signed. This should also remind the contractor of his/her;

- Legal requirements.
- Statutory obligations.
- Obligation to lay-down a system for reporting accidents
- Responsibility to ensure that his/her employees are supplied with personal protective equipment
- Obligation to ensure that he obtains detail of jobs and areas where permit-to-work must be issued

(b) All residents' and workers' responsibility

- Know the location of all safety equipment, and learn to use them efficiently.

9.7 Safety requirement at the project site during construction and operation Period

(a) The contractor

The contractor will ensure that:

- Safe means of entry and exit at the proposed project site.
- Ensure adequate briefing of job at hand on the safe system before commencement of work.

- The EHS coordinator must be in attendance at all times throughout the duration of the project.
- The EHS consultant must maintain constant assessment of the risk involved
- A safety harness must be worn before entry into all confined spaces
- An EHS consultant must be posted at the entrance at the project site to monitor

(b) The Traffic / Drivers

Within the construction premises, the following traffic rules will be observed: -

- Observe speed limits and all other signs and obey traffic rules.
- Use the vehicle for the purpose to which it is intended only.

c) Fire hazard at the construction site,

Workers at the site shall ensure that: -

- Oxy-acetylene cylinders are not contaminated with grease or oil.
- Oxy-acetylene cylinders are not subjected to direct sunlight or heat.
- Oxy-acetylene cylinders are not to be used or stored standing in a vertical position.
- When in use, ensure the inclination should never be over 30° from the vertical.

9.8 Welding at the construction site

It is the responsibility of the contractor during construction to: -

- Ensure that welding clamp is fixed such that no current passes through any moving parts of any machine.
- Ensure that all welding clamps are in good operating condition
- Ensure that welding clamps are free from any contact with explosive vapours.
- Ensure that any slag or molten metal arising from welding activities does not start up fires by:
    - ✓ Clearing combustible material to distance of at least 3 meters away from working area.
    - ✓ Appropriate fire extinguisher is to be kept available for immediate use at all times

9.9 Emergency procedure during construction and operation

An emergency situation means:

- Unforeseen happening resulting in serious or fatal injury
- Fire or explosion.

- Natural catastrophe.

In the event of such an emergency during construction, the workers shall:

- Alert other persons exposed to danger.
- Inform the EHS coordinator.
- Do a quick assessment on the nature of emergency.

Call for ambulance on standby.

CHAPTER TEN: DECOMMISSIONING

10.1 Introduction

Decommissioning is an important phase in the project cycle and comes last to wind up the operational activities of a particular project. It refers to the final disposal of the project and associated materials at the expiry of the project lifespan. If such a stage is reached, the proponent needs to remove all materials resulting from the demolition/ decommissioning from the site. The following should be undertaken to restore the environment.

- Remove all underground facilities from the site
- The site should be well landscaped by flattening the mounds of soil and
- Planting indigenous trees and flowers
- All the equipment should be removed from the site
- Fence and signpost unsafe areas until natural stabilization occurs
- Backfill surface openings if practical

The table below shows the proposed decommissioning plan:

Table 10.1. EMP for Decommissioning

Expected Negative Impacts	Recommended Measures	Responsible Party	Time Frame	Cost (KShs)
1. Construction Machinery/Structure & Wastes				
Scraps material and other debris	Use of an integrated solid waste management system i.e. through a hierarchy of options. Wastes generated as a result of facility decommissioning activities will be characterised in compliance with standard waste management procedures. The contractor will select disposal locations and the county based on the properties of the particular waste generated.	Project Manager & Contractor	During decommissioning	3,000,000
	All buildings, machinery, equipment, structures and partitions that will not be used for other purposes should be removed and reused or rather sold/given to scrap material dealers.	Project Manager & Contractor	During decommissioning	-
	Where recycling/reuse of the machinery, equipment, structures and other waste materials is not possible the materials should be taken to approved dumpsites.	Project Manager & Contractor	During decommissioning	-
Rehabilitation of project site				
Vegetation disturbance Land deformation: soil erosion, drainage problems	-Implement an appropriate re-vegetation program to restore the site to its original status. -During the vegetation period, appropriate surface water run-off controls will be taken to prevent surface erosion; -Monitoring and inspection of the area for indications of erosion will be conducted and appropriate measures taken to correct any occurrences; -Fencing and signs restricting access will be posted to minimise disturbance to newly-vegetated areas;	Project Manager & Contractor	During decommissioning	4,000,000
Social- Economic impacts				

Expected Negative Impacts	Recommended Measures	Responsible Party	Time Frame	Cost (KShs)
-Loss of income -Loss of housing facilities	The safety of the workers should surpass all other objectives in the decommissioning project. -Adapt a project – completion policy; identifying key issues to be considered. -Compensate and suitably recommend the workers to help in seeking opportunities elsewhere. -offer alternative housing facilities	Project Manager & Contractor	During decommissioning	3,000,000

CONCLUSION AND RECOMMENDATIONS

Overview

From the foregoing analysis, the social and economic rating for this project is highly positive. Evaluation of alternatives has already shown that options are limited and costly. Already the proponent has sunk substantial amount of money in the project up to design stage. Further delay of the project is denying all stakeholders the anticipated benefits of the investment. On the other hand, redesigning or relocation will lead to loss of time and money that is already tied in the preliminary costs of the project. The project does not pose major negative environmental impacts. Adequate mitigation measures have been proposed to address any of the anticipated negative impacts arising from the project. The project will create employment and improve income earnings. The project will boost the diminishing housing supply in the country and more in urban areas.

During the preparation of this report for the proposed development it is observed and established that most of the negative impacts on the environment are rated low and short term with no significant effect. The positive impacts are highly rated and will benefit all stakeholders and the Katani residents at large. The project proponents have proposed to adhere to prudent implementation of the environmental management plan. They are obtaining all necessary permits and licenses from the relevant authorities and have qualified and adequate personnel to do the project as proposed. They have proposed adequate safety and health mitigation measures as part of the relevant statutory requirements

Conclusion

This study is recommendable and should be approved by NEMA for issuance of an EIA license subject to annual environmental audits after it has been completed and occupied. This will be in compliance with the Environmental Management and Coordination Act of 1999 and the Environmental Impact Assessment and Audit regulations, 2003. Above all the proponent should carry out Environmental Audit 12 months after the project is completed.

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