ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT

FOR

THE PROPOSED INSTALLATION OF MACHINES FOR PRECAST PRODUCT DEVELOPMENT WITHIN PLOT L.R. NO. 12715/13432 IN SYOKIMAU AREA MAVOKO SUB-COUNTY, MACHAKOS COUNTY

(GPS COORDINATES, -1.373628, 36.937405)

NOVEMBER 2021

DECLARATION AND SUBMISSION

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

Lead Expert/Firm of Expert

Dr Ali Adan Ali
Africa Centre for Environment, Health & Safety

NEMA Reg No **2106/9128**

Email: ssache114@gmail.com

Signature……

Date……

Cell No. +254 722 961 233

Proponent: KQ Concrete Ltd

Name…….

Signature……

Cell No……..

Date……

Designation……

Name…….

Signature……

Cell No……...

Date……

Designation……

Table of Contents

LIST OF TABLES

LIST OF PLATES

LIST OF ACCRONYMS AND ABBREVIATIONS

CBD Central Business District

EA Environmental Audit

EHS Environmental Health and Safety

EIA Environmental Impact Assessment

EMC Environmental Management and Coordination

EMCA Environmental Management and Coordination Act

EOHS Environmental, Occupational Health and Safety

ESIA Environmental and Social Impact Assessment

ESMP Environmental and Social Management Plan

GOK Government of Kenya

KP Kenya Power

L.R Land Reference

MAVWASCO Mavoko Water and Sewerage Company

ME&NR Ministry of Environment and Natural Resources

MSDS Material Safety Data Sheets

NEAP National Environmental Action Plan

NEMA National Environment Management Authority

OHS Occupational Health and Safety

OSHA Occupational Safety and Health Act

PPE Personal Protective Equipment

SDGs Sustainable Development Goals

ToRs Terms of Reference

WRA Water Resources Authority

EXECUTIVE SUMMARY

Introduction

In compliance with the Environmental Management and Coordination Act (EMCA), Cap 387, the consultant as Registered Environmental Impact Assessment/Audit Experts, were appointed by the proponent to conduct an Environmental and Social Impact Assessment and prepare a Study Report for the proposed installation of machines for precast concrete products development on a yard within Plot L.r No. 12715/13432 (Original L.R No. 12715/347/3), Syokimau area, Athi River Sub-County, Machakos County.

Objectives, scope and criteria of Assessment

The overall objective of the ESIA study report was to identify and assess the potential environmental impacts that would be associated with the proposed project development, and to recommend several mitigation measures for the negative impacts through a Comprehensive Environmental Management/ Monitoring Plan (EMP).

The study of the project covered all negative and positive impacts associated with the whole life cycle of project including machines installation, operation and decommissioning stages. Impacts on the project area, areas of raw material extraction, areas of waste disposal and any other affected environments were all covered under the assessment. The information required for the study was gathered through questionnaires, interview schedules, checklists, observations, site visits and desk top environmental studies, where necessary in the manner specified in Part V (section 31-41) of the Environmental (Impact Assessment and Audit) Regulations, 2003.

PROJECT DESCRIPTION AND DESIGN

The proposed project components and design will involve the following,

- The construction activities comprise of installation of the machines on a yard.
- The yard will also provide temporary site offices, staff quarters, machinery sheds, vehicular parking spaces and storage space for raw materials upon receipt and finished products before dispatch.
- Construction of water storage tanks to store water during construction.
- Development utilities (water, drainage, electricity e.t.c.).
- Construction of tunnels to internal water reticulation system as a waste collection center which will be connected to an existing septic tank with a soak pit.

PROJECT ACTIVITIES

The major activities to be carried out during construction phase will include

- Pre-construction investigations-renovations,
- Sourcing and transportation of machines,
- Masonry, concrete work and related activities,
- Structural steel works,
- Roofing and sheet metal works,
- Electrical work,
- Plumbing,
- Installation of equipment, machines, and
- Landscaping.

The major activities during the operation of the existing warehouse will include;

- Commercial and related activities,
- Waste management,
- Cleaning, and General repairs and maintenance.

The decommissioning phase of the project will include;

- Demolition work, dismantling of equipment's and site restoration

KEY ENVIRONMENTAL ISSUES

The key negative biophysical, health and safety, and socio-economic impacts of the project during the operation phase are enumerated as follows: - use of the products in construction leading to negative impacts on their availability and sustainability, risks of accidents and injuries to construction workers, increased soil erosion and sediment release at the project site and

surrounding areas, exhaust emissions from materials transport trucks, noise and vibration caused by heavy trucks, and construction machinery.

The key negative environmental impacts of the operational phase of the project under study will include: commercial waste generation, increased dust, noise generation and vibrations, increased demand for sanitation, high levels of energy consumption, high levels of water use, increased storm water flow.

The key negative environmental impacts of the decommissioning phase of the project include: - Generation of large quantities of demolition waste, dust emissions during demolition works, noise and vibration during demolition works among others.

POSITIVE IMPACTS

Positive environmental impacts during construction - renovations to installation of machines activities include: - Creation of employment opportunities for construction workers, creation of market for supply of building materials for construction purposes, increased business opportunities for small-scale traders such as food vendors.

Positive environmental impacts of operational phase of the project will include:-Availability of affordable and efficient precast products for construction purposes for syokimau residents and the whole country in general, contribution of revenue to the national and local governments through payment of taxes, duties and rates, Improved security in the area as well as maximizing the plot usage.

The positive environmental impacts during decommissioning will include: Rehabilitation of the project site, and employment opportunities for demolition workers.

Recommended actions

Several measures have been suggested to prevent or minimize the negative environmental impacts and to maximise the positive ones using a Comprehensive Environmental Management Plan as discussed here under this report. The measures mainly focus on the following points:-

i. Use of alternative materials or products which are less damaging to the environment

ii. ii. Reduction of impacts of waste through minimization of waste generation, recycling, rethink, reuse and responsible disposal.

iii. iii. Energy and water conservation.

iv. Use of appropriate technologies to mitigate environmental impacts of various activities.

v. Ensuring compliance with relevant safety, health and environmental regulations.

CONCLUSIONS

The proposed installation machines for manufacture of precast products will have numerous positive socio-economic impacts which outweighs the negative as outlined here in the report. The negative environmental impacts that will result from establishment of the proposed project are highly mitigatable. The proponent of the proposed project is committed to putting in place several measures to effectively mitigate the negative environmental, safety, health and social impacts associated with the life cycle of the project. It is recommended that in addition to this commitment, the proponent should focus on implementing the measures outlined in the EMP, as well as adhering to all relevant national and international environmental, health and safety standards, policies and regulations that govern establishment and operation of such projects. In addition, the positive impacts that emanate from such activities shall be maximised as much as possible.

CHAPTER ONE: INTRODUCTION

1.1 PROJECT BACKGROUND

Due to the increased urbanization within Kenya and abroad, the proponent has proposed to install machines for precast concrete products development on a yard on Plot L.R No. 12715/13432 (Original L.R No. 12715/347/3), Syokimau area, Athi River Sub-county, Machakos County to replenish the high demanding population for construction and landscaping services.

The plot, on which these proposed machines are to be installed, is described as for such developments land uses. The main aim of the project is to manufacture cabros and bricks and create storage spaces for various commodities including raw materials and finished concrete products, installation of machines, vehicle parking spaces and office working area. The development will create employment during the operational phase both directly and indirectly.

Since environmental concerns now need to be part of the planning and development process and not an afterthought, it is therefore advisable to avoid land use conflicts with the surrounding area. To avoid unnecessary conflicts and retard development of the country, the owner facilitated undertaking of this ESIA and incorporated environmental concerns as advised by the Authority. Finally, a Comprehensive Environment Management Plan is mandatory for a project of this magnitude and nature because minimal quantities of solid wastes (plastic wastes and office waste) and wastewater will be produced on construction activities, setting up the workstations and mainly during the operational phase of the proposed project.

Currently, most of the investors in our country in the past have faced pestering, disputes and campaign by their competitors and politically correct extortionists to have them not start or even close their business on minor excuses. As environmental concerns, need to be part of the planning and development process and not an afterthought is therefore advisable to avoid land use conflicts with the surrounding area. To avoid unnecessary conflicts that hinder development in the country, the proponent undertook this Environmental and Social Impact Assessment ESIA at this stage and incorporated environmental concerns as advised by the Authority.

1.2 ESIA OBJECTIVES

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

i. To describe the scope of the proposed project and associate works;

ii. To establish the baseline environmental status of the project site;

iii. To identify and assess the potential environmental and social impacts of the proposed installation of machines for the production of precast products;

iv. Have a series of dialogues with the identified stakeholders, local residents, business enterprises, institutions and government agencies around the proposed project site as well as other stakeholders of the project to obtain their views;

v. To identify and quantify pollution sources and determine the significance of impacts on sensitive receptors;

vi. To predict and evaluate environmental and social impacts expected during the construction and operational phases, if any;

vii. To develop mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction and functional phases;

viii. To design and specify the monitoring schedule necessary to ensure the implementation and effectiveness of the mitigation measures adopted;

ix. Propose and Environmental and Social Management Plan (ESMP) to guide the implementation of mitigatory measures and monitoring throughout the implementation of the project and contribute to the overall process of the project monitoring and auditing. This will enable the proponent of the project to take timely action to prevent negative environmental and social impacts before they become irreversible; and

x. To prepare an ESIA Study Report compliant with EMCA, Cap 387 and in compliance with the acceptable format as stipulated in the Environmental (Impact Assessment and Audit) Regulations, 2003; 2018; properly addressing all the items specified in the Terms of Reference (ToR) approved by NEMA and detailing findings and recommendations from the study.

1.3 PURPOSE AND TERMS OF REFERENCE

The general Terms of Reference (ToRs) for this study was to conduct an ESIA for the proposed installation of machines for production of Precast Products with associated works on plot L.R NO. 12715/13432 in Syokimau Area, Machakos County. This is in accordance with NEMAs' Environmental (Impact Assessment and Audit) regulations, 2003; 2018 and the Environmental Management and Coordination (Amendment)Act, 2015. Specifically, this assessment was commissioned under the following Terms of Reference;

1. The ecological effects. This covered;

    - Provision of background and baseline information\

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

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

3. Determination of the effects of landscape and land use;
    - Assessment of the effects on scenery modification
    - Analysis of the compatibility of the project with the surrounding land uses

4. Effects of the machines on current demands on water resource as well as possible implications on surface and underground water qualities and quantities
5. Proposition of mitigation measures to be taken during and after implementation of the project and development of an Environmental and Social Management Plan with mechanisms for monitoring and evaluating the compliance and environmental performance.

1.4 ESIA METHODOLOGY

During the field investigations, a survey was conducted in order to collect information on biophysical and socio-economic environment of the proposed project site and its environs including sampling campaigns. The following steps were involved:

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

1.4.1 ESIA SCREENING

This step was applied to determine whether an environmental impact assessment was required and what level of assessment was necessary. This was done in reference to requirements of the EMCA, Cap 387, and specifically the second schedule. Issues considered included the physical location, sensitive issues and nature of anticipated impacts.

1.4.2 ESIA SCOPING

The Scoping process helped narrow down onto the most critical issues requiring attention during the assessment. Environmental issues were categorized into physical, natural/ecological and social, economic and cultural aspects.

1.4.3 DESKTOP STUDIES AND LITERATURE REVIEW

Literature review pertaining to the project activities and salient features of the project area was done. This covered the review of the Environmental Management and Coordination Act, relevant studies and reports on the construction. A desk study was also conducted to review available reports, plans and maps in order to compile relevant bio-physical and socio-economic information about the study area. The bio- physical information was compiled on environmental aspects such

as topography, climate, drainage, soils, geology/hydrogeology, and vegetation among other aspects. The socio-economic environment study covered information on issues such as population, the dimensions of wellbeing and income levels, water supply and sewerage, sanitation levels, infrastructure development, political ramifications and community participation.

1.4.4 SITE ASSESSMENT

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

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

1.4.5 INTERVIEWS

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

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

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

1.4.6 PUBLIC MEETINGS

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

1.4.7 REPORT WRITING AND DOCUMENTATION

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

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

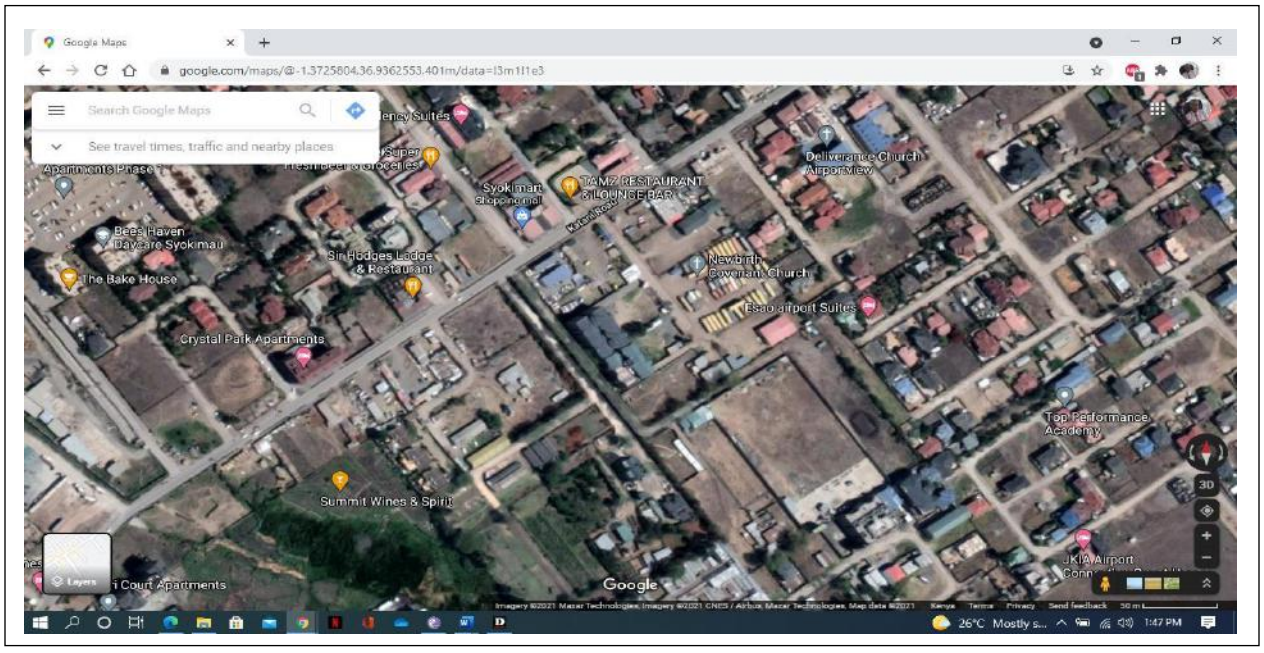
- Conclusions, recommendations for the success of the project; Chapter Nine and
- Any other information that NEMA may require

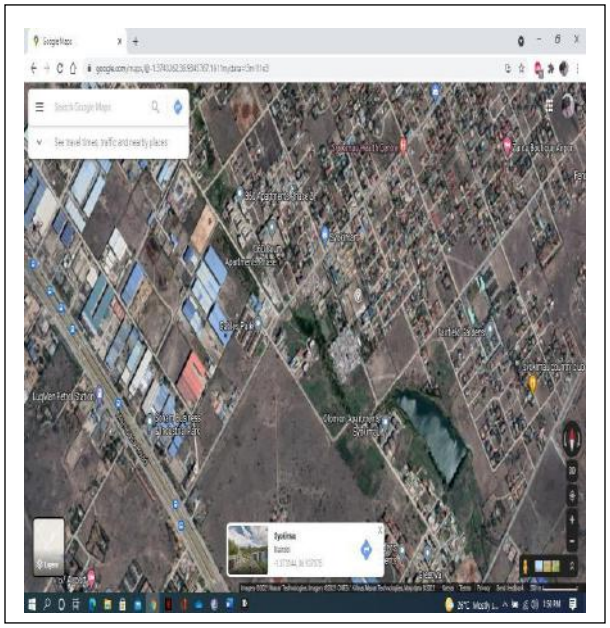
CHAPTER TWO: PROJECT DESCRIPTION

2.1 LOCATION OF THE PROJECT

The proposed project will be situated on a yard located within Plot L.r. No. 12715/13432 (Original L.R NO. 12715/347/3), Syokimau area, off Katani road in Athi River Sub-county, Machakos County. The facility neighbors both commercial and residential buildings both high rise and stand-alone maisonettes, homesteads all situated along the main access road. Other associated developments include a road network, electricity supply and other infrastructure.

Plate 1: Project location and maps





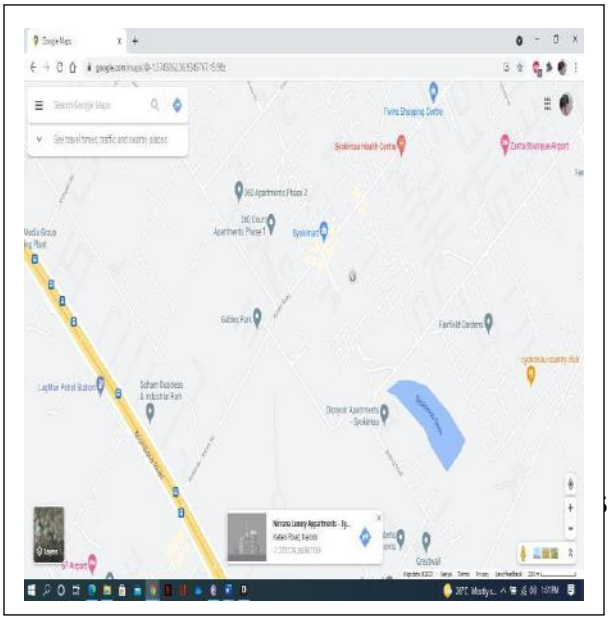


Plate 2: A section of Katani Road and the feeder roads to the project site

Plate 3: Water, electricity, and other amenities of the project site

2.4 PROJECT DEVELOPMENT DESIGN

The source of the raw materials is through purchase from vendors. Manufacturing of cabros and bricks is done through mixing of Dust 04, sand and cement by the mixer and then loaded into the mobile brick making machine. Batching is also done at the site. The proposed project is environmentally friendly and has nil negative effects to the environment.

2.5 DESCRIPTION OF THE PROJECT CONSTRUCTION ACTIVITIES

2.5.1 RE-CONSTRUCTION INVESTIGATIONS

The implementation of the project's design and construction phase will start with investigation of the site biological and physical resources in order to minimize any unforeseen adverse impacts during the project cycle.

2.5.2 SOURCING AND TRANSPORTATION OF BUILDING MATERIALS

Building materials will be transported to the site from their extraction, manufacture, or storage sites using transport trucks. The building materials to be used in construction of the project will be sourced from major sub-counties in Machakos and neighbouring areas such as Nairobi. Greater emphasis will be laid on procurement of building materials from within the local area, which will make both economic and environmental sense as it will reduce negative impacts of transportation of the materials to the project site through reduced distance of travel by the materials transport vehicles.

2.5.3 STORAGE OF MATERIALS

Building materials will be stored on site. Bulky materials such as ballast, cement and sand will be carefully piled on site. To avoid piling large quantities of materials on site, the proponent will order bulky materials such as sand and gravel in bits. Materials such as cement, paints and glasses among others will be stored in temporary storage structures which will is constructed within the project site for this purpose.

2.5.4 EXCAVATION AND FOUNDATION WORKS

Excavation will be carried out to prepare the site for construction of foundations, pavements and drainage systems. This will involve the use of heavy earthmoving machinery such as tractors and bulldozers.

2.5.5 MASONRY, CONCRETE WORK AND RELATED ACTIVITIES

The construction of the building walls, foundations, floors, pavements, drainage systems, perimeter fence and parking area 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 supplement by machinery such as concrete mixers.

2.5.6 STRUCTURAL STEEL WORKS

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

2.5.7 ROOFING AND SHEET METAL WORKS

Roofing activities will include sheet metal cutting, raising the roofing materials such as tiles and structural timber to the roof and fastening the roofing materials to the roof.

2.5.8 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.

2.5.9 PLUMBING

Installation of pipe-work for water supply and distribution will be carried out within the development and associated facilities to ensure waste water system, and drainage of storm water from the rooftop will be managed environmental friendly manner to comply with the law. The area does not have a sewerage system. Septic tank technology will be utilized for effective management of the wastewater. Plumbing activities will include metal and plastic cutting, the use of adhesives, metal grinding and wall drilling among others.

2.5.10 LANDSCAPING

To improve the aesthetic value or visual quality of the site once construction ceases, landscaping will be carried out by the proponent. This will include establishment of flower gardens and lush grass lawns and will involve replenishment of the topsoil. It is noteworthy that the proponent will use plant species that are available locally preferably indigenous ones for landscaping.

2.6 SITE DEVELOPMENT PLAN

The project's site development plan was developed by a certified architecture as illustrated in Annex I.

2.7 DESCRIPTION OF THE PROJECT OPERATIONAL ACTIVITIES

2.7.1 FACILITY USAGE

The yard will be accompanied by several commercial activities such as storage, batching, mixing, brick making, washing, use of vehicles but the main aim is to install machines, provide an office area, storage area and working area. In addition, there will be production of domestic and sanitary wastes which should be manned according to the required environmental standards.

2.7.2 SOLID WASTE AND WASTE WATER MANAGEMENT

The proponent will provide facilities for handling solid waste generated within the facility. These will include colour-coded dustbins/skips for temporary holding of waste within the premises before final collection by a NEMA registered company to transport to the designated dumpsites. Sewerage generated from the premises will be connected to a septic tank with a soak pit while storm water from the project area will be channeled into the storm channel leading the municipal storm drainage along the main road. However, there is minimal waste generation due to the adoption of recycling of all concrete waste materials.

2.7.3 CLEANING

The occupants/workers will be responsible for the cleanliness of the property as assigned by the employer. The proponent will be responsible for regular washing and cleaning of the pavements, cleaning operations will involve the use of substantial amounts of water, disinfectants and detergents.

2.7.4 GENERAL REPAIRS AND MAINTENANCE

The structures within the yard and associated facilities will be repaired and maintained regularly during the operational phase of the project. Such activities will include repair of building walls and floors, repair and maintenance of the parking area, repairs and maintenance of electrical gadgets and equipment, repairs of refrigeration equipment, repairs of leaking water pipes, painting, maintenance of flower gardens and grass lawns, and replacement of worn-out materials among others.

2.8 DESCRIPTION OF THE PROJECTS DECOMMISSIONING ACTIVITIES

2.8.1 DEMOLITION WORKS

Upon decommissioning, the project components including buildings, pavements, drainage systems, parking areas and perimeter fence will be demolished. This will produce a lot of solid waste, which will be reused for other construction works or if not reusable, disposed of appropriately by a licensed waste disposal company.

2.8.2 DISMANTLING OF EQUIPMENT AND FIXTURES

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

2.8.3 SITE RESTORATION

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

2.9 PROJECT DEVELOPMENT COST

The proposed project's estimated cost will not exceed Kshs. 10,000,000.00 (Ten Million Kenya Shillings Only). The proponent will therefore in accordance to the Kenya Gazette Notice No. 13211 dated 17th September' 2013 requiring payment of 0.1% (Kshs. 10,000.00 - Ten thousand Shillings) of the total project cost as lodgment fees.

CHAPTER THREE: BASELINE INFORMATION

3.1 INTRODUCTION

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

3.2 METHODOLOGY

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

• Conducting reconnaissance surveys for knowing the study area; and

• Selecting sampling locations for conducting various environment baseline studies.

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

1. Existing topography;

2. Drainage pattern and location of existing facilities; and

3. Areas, which represent baseline conditions.

The field observations have been used to:

1. Assess the positive and negative impacts due to the proposed site; and

2. Suggest appropriate mitigation measures for negating the adverse environmental impacts, if any; and

3. Suggesting post-project monitoring requirements and suitable mechanism for it.

3.3 PHYSICAL ENVIRONMENT

3.3.1 CLIMATE

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

3.3.2 TEMPERATURES

The sunniest and warmest part of the year is from December to March, when temperatures average the mid-twenties during the day. The mean maximum temperature for this period is 27 °C (75 °F). The minimum temperature also remains low during cloudy nights, usually hovering around 11 °C and at times reaching 8°C. Clear skies in January and February also bring colder nights. Temperature range from a minimum of 9.10 C to a maximum of 26.7 0 C.

3.3.3 RAINFALLS

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

3.3.4 WIND FLOWS

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

3.3.5 GEOLOGY

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

3.3.6 TOPOGRAPHY AND DRAINAGE

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

3.3.7 HYDROGEOLOGY AND SOILS

In general groundwater in volcanic rocks is limited to fractures and erosion levels within the volcanic succession. Fresh lavas are usually not water bearing because of their massive and impervious nature. The most significant aquifer system west of the project area is the Upper Athi Series aquifer system. This is the main aquifer for boreholes in Upper Machakos, Nairobi and Kiambu areas and is composed of tuffs, lakebeds and sediments. The rocks in the Upper Machakos regions such as Mavoko, Syokimau and Mlolongo area mainly comprise a succession of lavas and Pyroclastic of the Cainozoic age and overlying the foundation of folded Precambrian schist‘s and gneisses of the Mozambique basement rock which traverses the entire lower eastern region up to Kilimambogo area The crystalline rocks are rarely exposed but occasionally fragments are found as agglomerates derived from former Ngong volcano.

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

3.3.8 SOIL CHARACTERISTICS

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

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

- To determine the baseline soil characteristics of the study area; and

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

3.3.9 WATER QUALITY

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

• Assess the water quality characteristics for critical parameters;

• Evaluate the impacts on the water quality; and

• Prediction of impact on water quality by this project and related activities.

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

3.3.10 AIR QUALITY

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

Methodology adopted for Air Quality Survey

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

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

Based on the proposed project site baseline conditions and envisaged project activities, the experts determined that the key challenge would emanate from dust generation. This resulted to the determination or quantification of PM10 and PM 2.5 concentrations at identified locations around the project site so as to assess compliance with relevant Air quality Regulations. Weather conditions observed during the survey period were normal within with skies day temperatures averaged at 250 C with light winds and short rains. The measurements were undertaken for 24hrs weighted time for each point between 11th and 13th April, 2021. The measurements results for the four points sampled along the property boundary for Particulate matter(dust) PM10 and PM2.5 were all within the guideline values stipulated in the Environmental Management and Co-ordination Act (Air Quality Regulations, 2014) for Ambient Air Quality (100µg/m3).

Table 1: EMC (Air Quality Regulation 2014) limits at the property boundary

Pollutant	Time weighted average	Industrial area	Residential, rural and other areas	Controlled areas
Respirable particulate matter (<10pm) (RPM)	Annual average	70 µg/m3	50 µg/m3	50 µg/m3
	24 hours	150 µg/m3	100 µg/m3	75 µg/m3
$PM_{2.5}$	Annual average	35 µg/m3	-	-
	24 hours	75 µg/m3	-	-

Table 2: WHO air quality guidelines

Pollutant	Time weighted average	Air quality guideline
Respirable particulate matter (<10pm)	24-Hr Mean	100 µg/m3
$PM_{2.5}$	24-Hr Mean	25 µg/m3

3.3.11 NOISE LEVEL SURVEY

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

• Characteristics of noise sources (instantaneous, intermittent or continuous in nature). It can be observed that steady noise is not as annoying as one which is continuously varying in loudness;

• The time of day at which noise occurs, for example high noise levels at night in residential areas are not acceptable because of sleep disturbance; and

• The location of the noise source, with respect to noise sensitive land use, which determines the loudness and period of exposure.

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

Identification of Sampling Locations

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

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

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

3.4 BIOLOGICAL ENVIRONMENT

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

Methodology adopted for the Survey

The different methods adopted were as follows:

Compilation of secondary data with respect to the study area from published literature and Government agencies;

Generation of primary data by undertaking ecological studies in the area; and

Gathering data for ethno-biology.

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

3.4.1 FLORA

Natural vegetation in Upper Machakos region (Syokimau, Mlolongo and Athi River) has been cleared to pave way for the establishment of both residential and commercial developments. The natural vegetation in the project area has thus been greatly modified. The remnants of the natural

vegetation off the site and its environs are a few scattered Acacia and grasses. The site had no great vegetation cover as it had been cleared at the time of the assessment.

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

Plate 4: Flora of the proposed project site

3.4.2 FAUNA

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

LAND USE

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

The objectives of land use studies are:

1. To determine the existing land use pattern in the study area;

2. To analyze the impacts on land use in the study area; and

3. To give recommendations for optimizing the future land use pattern vis-a-vis proposed project in the study area and its associated impacts.

Methodology

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

Plate 5: Neighboring developments around the project area

3.5 SOCIO-ECONOMIC ENVIRONMENT

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

The proposed project site is within an area predominantly residential with commercial activities and therefore almost every other plot in the neighbourhood is residential and/or commercial activities. Some residential houses in the neighbourhood have been officially or unofficially turned into offices and other commercial uses. All major urban infrastructures (water, electricity, sewer, roads, and landline telephony) are in close proximity for connection to the proposed project site. The area is within the County Government of Machakos jurisdiction and therefore served by Machakos County infrastructure and is also bound by the County's by-laws.

3.5.1 POPULATION SIZE

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

3.5.2 INFRASTRUCTURE, ROADS AND ACCESSIBILITY

Plate 6: Infrastructure, roads and accessibility

3.5.3 WATER SUPPLY

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

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

Plate 7: Water supply to the project site

3.5.4 EDUCATION INSTITUTIONS

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

3.5.5 HEALTH

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

3.5.6 ENERGY AND ELECTRICITY ACCESS

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

3.5.7 COMMUNICATIONS

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

3.5.8 SECURITY

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

3.5.9 SEWER SYSTEM

The project area has a sewer system that is maintained by the County Government of Machakos through MAVWASCO. The area within which the proposed project site lies is served by MAVWASCO sewer and shall therefore be connected to the same. The sewer system reticulation

has been effectively designed in the proposed plans and will be connected to each unit and to the existing sewer system with approval from MAVWASCO.

3.5.10 SOLID WASTE MANAGEMENT

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

CHAPTER FOUR: POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

4.1 GENERAL OVERVIEW

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

4.2 POLICIES

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

4.2.1 NATIONAL ENVIRONMENTAL ACTION PLAN (NEAP)

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

4.2.2 NATIONAL ENVIRONMENTAL ACTION PLAN COMMITTEE

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

- Contain an analysis of the Natural Resources of Kenya with an indication as to any pattern of change in their quality, distribution and quantity over time.

- Contain an analytical profile of the various uses and value of the natural resources incorporating considerations of intergenerational and intra-generational equity.
- Recommend appropriate legal and fiscal incentives that may be used to encourage the business community to incorporate environmental requirements into their planning and operational processes.
- Recommend methods for building national awareness through environmental education on the importance of sustainable use of the environment and natural resources for national development.
- Set out operational guidelines for planning and management of the environment and natural resources
- Identify actual or likely problems as may affect the natural resources and the broader environmental context in which they exist.
- Identify and appraise trends in the development of urban and rural settlements, their impact on the environment, and strategies for the amelioration of their negative impacts.
- Propose guidelines for the integration of standards of environmental protection into development planning and management.
- Identify and recommend policy and legislative approaches for preventing, controlling or mitigating specific as well as general diverse impacts on the environment.
- Prioritize areas of environmental research and outline methods of using such research findings.
- Without prejudice to the foregoing, be reviewed and modified from time to time to incorporate emerging knowledge and realities.
- To be binding on all persons and all government departments, agencies, States Corporation or other organ of government upon adoption by the National Assembly.

4.2.3 NATIONAL POLICY ON WATER RESOURCE MANAGEMENT AND DEVELOPMENT

The National Policy on Water Resources Management and Development (1999) seeks to enhance a systematic development of water facilities in all sectors for the country‘s socio-economic progress, and therefore calls for development of appropriate sanitation systems to protect people‘s

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

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

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

- To ensure that from the onset, all development policies, programmes and projects take environmental considerations into account,
- • To ensure that an independent Environmental Impact Assessment (EIA) report is prepared before project implementation, and
- • To come up with effluent treatment standards that will conform to acceptable health guidelines. Under this paper, broad categories of development issues have been covered that require a sustainable approach

Among these issues are waste management and human settlement. The policy recommends a need for enhanced re-use/ recycling of residues including wastewater, use of low non-waste technologies, increased public awareness and appreciation of a clean environment. It also encourages participation of stakeholders in the management of wastes within their localities. On human settlements, the paper advocates for better planning in both rural and urban areas and provision of basic needs such as water, drainage and waste disposal facilities among others. The design of the proposed project should be such that it adequately addresses the need for a sound waste management system. (GOK, 1999)

4.2.5 PHYSICAL PLANNING POLICY

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

4.2.6 ENVIRONMENT IMPACT ASSESSMENT GUIDELINES POLICY, 2002

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

SUSTAINABLE DEVELOPMENT GOALS, (SDG)

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

NATIONAL CLIMATE CHANGE RESPONSE STRATEGY (NCCRS)

Climate change is considered one of the most serious threats to sustainable development globally. Studies have shown that about 90% of all-natural disasters afflicting the world are related to severe weather and extreme climate change events. Impacts of the projected climate change are expected in many sectors such as environment, human health, food security, economic activities, natural resources and physical infrastructure. Kenya acknowledges that the change in the Earth's climate and its adverse effects are a common concern of humankind. The Ministry of Environment and Mineral Resources (MEMR) has therefore recognized the need to enhance coordination of climate change activities in the country with a view to ensuring a climate-proof socioeconomic development anchored on a low - carbon path. The vision of the Strategy is for a prosperous and climate change resilient Kenya. The mission is to strengthen and focus nationwide actions towards climate change adaptation and GHG emission mitigation. This will be achieved by ensuring commitment and engagement of all stakeholders while taking into account the vulnerable nature of Kenya's natural resources and society.

The objectives are to:

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

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

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

4.3 LEGAL ASPECTS

4.3.1 NATIONAL

THE CONSTITUTION OF KENYA (2010)

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

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

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

ARTICLE 69: OBLIGATIONS IN RESPECT TO THE ENVIRONMENT

The Article provides that – The State shall

a) Ensure sustainable exploitation, utilization, management, and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits.

b) Work to achieve and maintain a tree cover of at least ten percent (10%) of the land area of Kenya.

c) Protect and enhance intellectual property and indigenous knowledge of biodiversity and the genetic resources of the communities.

d) Encourage public participation in the management, protection, and conservation of the environment.

e) Protect genetic resources and biological diversity.

f) Establish systems of Environmental Impact Assessment, Environmental Audits and monitoring of the environment, processes and activities that are likely to endanger the environment; and

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

ARTICLE 70: ENFORCEMENT OF ENVIRONMENTAL RIGHTS

1. It stipulates that: If a person alleges that a right to a clean and healthy environment recognized and protected under Article 42 has been, is being or is likely to be, violated, infringed or threatened, the person may apply to a court for redress in addition to any other legal remedies that are available in respect to the same matter.

2. On application under clause (1), the court may make any order or give any directions, it considers appropriate –

a) To prevent, stop or discontinue any act or omission that is harmful to the environment;

b) To compel any public officer to take measures to prevent or discontinue any act or omission that is harmful to the environment; or to provide for compensation for any victim of a violation of the right to a clean and healthy environment. For the purposes of this Article, an applicant does not have to demonstrate that any person has incurred loss or suffered injury.

THE ENVIRONMENTAL MANAGEMENT AND COORDINATION ACT, CAP 387

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

Part VIII, section 72 of the Act prohibits discharging or applying poisonous, toxic, noxious or obstructing matter, radio-active or any other pollutants into the environment. Section 73 requires

that operators of projects which discharge effluent or other pollutants submit for NEMA accurate information about the quantities and quality of the effluent. Section 74 demands that all effluent generated from point sources are discharged only into the existing sewage system upon issuance of a prescribed permit from the Local Authorities with jurisdiction. Part VI Section 58 stipulates that before any development or project is undertaken, an Environmental Impact Assessment must be undertaken under the rules governing the nature of the project and type of impacts.

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

THE ENVIRONMENT (IMPACT ASSESSMENT AND AUDIT) REGULATIONS, 2003

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

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

11. (1) An Environmental Impact Assessment study shall he conducted in accordance with terms of reference developed during the scoping exercise by the proponent and approved by the Authority - NEMA. (2) The terms of reference shall include matters required to be considered in the Environmental Impact Assessment as may be contained in the Second Schedule to these Regulations and such other matters as the Director General-NEMA may in writing require.

12. (1) An Environmental Impact Assessment study shall be conducted in accordance with the general Environmental Impact Assessment guidelines and sector Environmental Impact

Assessment guidelines set out in the Third Schedule to these Regulations. (2) Sector environmental impact assessment guidelines shall be developed by the relevant lead agency in consultation with the Authority.

ENVIRONMENTAL MANAGEMENT AND COORDINATION (WATER QUALITY) REGULATIONS, 2006

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

ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION (WASTE MANAGEMENT) REGULATIONS, 2006

These regulations define the responsibilities of waste generators and define the duties and requirements for transportation and disposal of waste. The regulations provide for mitigation of pollution and handling of hazardous and toxic wastes. The regulations require a waste generator to dispose waste only to a designated waste receptacle. The proponent shall adhere to the regulations and proposes to contract a NEMA registered waste transporter (NEMA, 2006).

ENVIRONMENTAL MANAGEMENT AND COORDINATION (NOISE AND EXCESSIVE VIBRATIONS POLLUTION) (CONTROL) REGULATIONS, 2009

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

ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION (AIR QUALITY) REGULATIONS, 2014

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

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

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION (CONTROLLED SUBSTANCES) REGULATIONS, 2007; LEGAL NOTICE NO. 73

The Controlled Substances Regulations defines controlled substances and provides guidance on how to handle them. The regulations stipulate that controlled substances must be clearly labelled with among other words, ―Controlled Substance-Not ozone friendly, to indicate that the substance or product is harmful to the ozone layer. Advertisement of such substances must carry the words, ―Warning: Contains chemical materials or substances that deplete or have the potential

to deplete the ozone layer. Persons handling controlled substances are required to apply for a permit from NEMA. Products containing controlled substances include air conditioners, air coolers, refrigerants, portable fire extinguishers, heat pump equipment, dehumidifiers, insulation boards, panels and pipe covers, pre-polymers, etc. The proponent is thus required to comply with these regulations during the project implementation phase.

THE OCCUPATIONAL HEALTH AND SAFETY ACT (OSHA), 2007

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

PART VI – HEALTH – GENERAL PROVISIONS

CLEANLINESS: SECTION 47

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

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

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

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

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

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

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

OVERCROWDING: SECTION 48

1) An occupier shall ensure that his workplace shall not, while work is carried on, be so overcrowded as to cause risk of injury to the health of the persons employed therein.

2) Without prejudice to the generality of subsection (1) a workplace shall be of sufficient size for work to be carried out with ease and shall further have the necessary free space and , having regard to the nature of the work ,an adequate amount of air for each employee, the minimum permissible being ten cubic meters per person:

3) Provided that, in determining, for the purposes of this sub-section the amount of cubic space in any room, no space more than four point five metres from the floor shall be taken into account, and where a room contains a gallery, the gallery shall be treated for the purposes of this subsection as if it were partitioned off from the remainder of the room and formed a separate room.

4) Every workroom shall be not less than three metres in height, measured from the floor to the lowest point of the ceiling or, where there is no ceiling, to the lowest point of the roofing material.

5) Provided that, if the Director is satisfied that owing to the special conditions under which the work is carried on in any workroom the application of the provisions of this subsection to that workroom would be inappropriate or unnecessary, he may by certificate in writing exempt the work room from those provisions subject to any conditions specified in the certificate.

VENTILATION: SECTION 49

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

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

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

LIGHTING: SECTION 50

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

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

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

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

WORK INJURY BENEFITS ACT 2007 (WIBA)

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

PART II – OBLIGATIONS OF EMPLOYERS

SECTION 7: EMPLOYER TO BE INSURED

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

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

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

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

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

SECTION 8: REGISTRATION OF EMPLOYER.

(1) Every employer carrying on business in Kenya shall within the prescribed period and in the prescribed manner – (a) Register with the Director; (b) Furnish the Director with the prescribed particulars of their business; and (c) Within a period determined by the Director furnish additional particulars as the Director may require.

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

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

PART III – RIGHT TO COMPENSATION

SECTION 10: RIGHT TO COMPENSATION

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

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

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

(4) For the purposes of this Act, an occupational accident or disease resulting in serious disablement or death of an employee is deemed to have arisen out of and in the course of employment if the accident was due to an act done by the employee for the purpose of, in the interests of or in connection with, the business of the employer despite the fact that the employee was, at the time of the accident acting:- (a) In contravention of any law or any instructions by or on behalf of his employer; or (b) Without any instructions from his employer.

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

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

PART VII – MEDICAL AID

FIRST AID SECTION 45

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

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

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

SECTION 46: CONVEYANCE OF INJURED WORKER

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

THE KENYA CIVIL AVIATION ACT, CAP 394

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

THE WATER ACT, 2016

The Act vests the rights of all water to the state, and the power for the control of all body of water with the Cabinet Secretary, the powers is exercised through the Cabinet Secretary and the Water Resources Authority in consultation with the regional water resources boards. It provisions aim at the conservation of water, apportionment, and use of water resources. Part II, section 18, of the

Principal Act provides for national monitoring and information archiving system on water resources. Following on this, sub-section 3 allows the Water Resources Authority (WRA) to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specific records may require to be kept by a facility operator and the information thereof furnished to the authority.

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

Section 73 of the Act allows a person, who has been granted a license to supply water (licensee), to make regulations for purposes of protecting against degradation of their water source(s). Under the Section, the licensee could be a local authority, a private Trust or an individual, and enforcement will under the supervision of the Regulatory Board with jurisdiction. Section 76 states that no person shall discharge any trade effluent from any trade premises into sewers of a licensee without the consent of the licensee upon application indicating the nature and composition of the effluent, maximum quantity anticipated, flow rate of the effluent and any other information deemed necessary. The consent shall be issued on conditions including the payment rates for the discharge as may be provided under section 77 of the same Act. The proposed project shall require large quantities of water during the construction phase and generation of equally large volumes of surface run-off during construction and operations. The contractor shall seek the necessary permits to obtain water and shall abide by the conditions attached to the permit(s).

CLIMATE CHANGE ACT NO. 11, 2016

The Act applies to the development, management, implementation and regulation of mechanisms to enhance climate change resilience and low carbon development for the sustainable development of Kenya. Without prejudice to subsection (1), the Act is applicable in all sectors of the economy by the national and county governments to: mainstream climate change responses into development planning, decision making and implementation; build resilience and enhance adaptive capacity to the impacts of climate change; formulate programs and plans to enhance the resilience and adaptive capacity of human and ecological systems to the impacts of climate change; mainstream and reinforce climate change disaster risk reduction into strategies and actions of public and private entities; promote low carbon technologies, improve efficiency and reduce emissions intensity by facilitating approaches and uptake of technologies that support low carbon,

and climate resilient development; facilitate capacity development for public participation in climate change responses through awareness creation, consultation, representation and access to information; mobilize and transparently manage public and other financial resources for climate change response; provide mechanisms for, and facilitate climate change research and development, training and capacity building; mainstream the principle of sustainable development into the planning for and decision making on climate change response; and integrate climate change into the exercise of power and functions of all levels of governance to enhance cooperative climate change governance between the national and county governments.

THE PUBLIC HEALTH ACT (CAP. 242)

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

ENERGY (SOLAR WATER HEATING) REGULATIONS, 2012

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

- Developer of a housing estate, a promoter of the construction, an owner of the premises or an Architect or an Engineer engaged in the design or construction of premises.

- An owner of premises, architect and an engineer engaged in the design, construction, extension or alteration of premises shall incorporate solar water heating systems in all new premises designs and extensions or alterations to existing premises.

- An owner or occupier of premises that has a solar water heating system shall use and carry out the necessary operational maintenance and repairs required to keep the installation in good and efficient working condition.

- An electric power distributor or supplier shall not provide electricity supply to premises where a solar water heating system has not been installed in accordance with these Regulations.

- An owner or occupier to whom these regulations apply may investigate the inclusion of the relevant solar water heating system into a project to be registered under any carbon finance mechanism that may be established from time to time including the Clean Development Mechanism (CDM). A person who contravenes the provisions of this regulation commits an offence and shall be liable, on conviction, to a fine not exceeding one million shillings, or imprisonment for a term not exceeding one year, or to both. (GOK, 2012).

Urban and Cities Act No 13 of 2011

The Act came into function with regard to Article 184 of the Constitution providing regulations on the classification, governance and management of urban areas and cities and further providing the criteria of establishing urban areas. Part III of the Act gives the regulations and functions of every city or municipality with regard to integrated development plans, which shall include but not limited to environmental plans and disaster preparedness, within the area of jurisdiction in achieving objects of devolved governments under section 174 of the constitution while maintaining the socio-economic rights of the people. Moreover, in the first schedule, the Act enlists the services that any municipality shall provide to its residents which include but not limited to traffic control and parking, water and sanitation, refuse collection, solid waste management, pollution abatement services among others (GOK, 2011).

Physical Planning Act (Cap 286)

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

County Government Act, 2012

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

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

The Penal Code (Cap 63)

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

The National Construction Authority Act (NCA), 2011

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

must be registered and subsequent construction permit secured from the Authority prior to commencement of the project activities.

The Environment and Land Court Act, 2011

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

Employment Act 2007

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

The Labour Relations Act, 2007

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

4.3.2 INTERNATIONAL CONVENTIONS AND TREATISES

UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC), 1992

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

AFRICAN CONVENTION ON CONSERVATION OF NATURE AND NATURAL RESOURCES (1968)

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

KYOTO PROTOCOL

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

Some of the principal concepts of the Kyoto Protocol are:

1) The main feature of the Protocol is that it establishes legally binding commitments to reduce emissions of greenhouse gases. The commitments are based on the Berlin Mandate, which is a part of UNFCCC negotiations leading up to the Protocol.

2) Implementation: In order to meet the objectives of the Protocol, Annex I Parties are required to prepare policies and measures for the reduction of greenhouse gases in their respective countries. In addition, they are required to increase the absorption of these gases and utilize all mechanisms

available, such as joint implementation of the Clean Development Mechanism and emissions trading, in order to be rewarded with credits that would allow more greenhouse gas emissions at home.

3) Minimizing impacts on developing countries by establishing an Adaptation Fund for Climate Change.

4) Accounting, reporting and reviewing in order to ensure the integrity of the Protocol.

5) Compliance: Establishing a Compliance Committee to enforce compliance with the commitments under the Protocol.

PARIS AGREEMENT.

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

The key elements

1. To keep global increase in temperatures "well below" 20 C (3.6F) above pre-industrial times and "endeavor to limit" them even more, to 1.50 C

2. To limit the amount of greenhouse gases emitted by human activity to the same levels that trees, soil and oceans can absorb naturally, beginning at some point between 2050 and 2100

3. To review each country's contribution to cutting emissions every five years so they scale up to the challenge.

4. For rich countries to help poorer nations by providing "climate finance" to adapt to climate change and switch to renewable energy.

SAFETY PROVISION (BUILDING) CONVENTION 1937

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

1. building, including excavation and the construction, structural alteration, renovation, repair, maintenance (including cleaning and painting) and demolition of all types of buildings or structures;

2. civil engineering, including excavation and the construction, structural alteration, repair, maintenance and demolition of, for example, airports, docks, harbors, inland waterways, dams, river and avalanche and sea defense works, roads and highways, railways, bridges, tunnels, viaducts and works related to the provision of services such as communications, drainage, sewerage, water and energy supplies;

3. the erection and dismantling of prefabricated buildings and structures, as well as the manufacturing of prefabricated elements on the construction site;

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

Convention on Biological Diversity (CBD), 1993

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

4.3.3 THE NATIONAL ADMINISTRATIVE FRAMEWORK

THE NATIONAL ENVIRONMENT COUNCIL, (NEC)

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

THE NATIONAL ENVIRONMENTAL TRIBUNAL, (NET)

The National Environment Tribunal (NET) is established under section 125 and Part XII of the Environmental Management and Coordination Act (EMCA) No. 8 of 1999. Its principal function is to receive, hear and determine appeals arising from decisions of the National Environment Management Authority (NEMA) on issuance, denial or revocation of Environmental Impact Assessment (EIA) licenses, among other decisions. Such licenses are, in effect, statutory permission to undertake developments of specified nature. The function arises from EMCA's enumeration (in the Third Schedule) of certain kinds of developments that require EIA and thereafter, NEMA's issuance of EIA license, without which the specified developments cannot proceed.

THE NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY, (NEMA)

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

THE COUNTY ENVIRONMENT COMMITTEES, (CECS)

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

1) Every County Environment Committee shall, within one year of the commencement of this Act and every five years thereafter, prepare a county environment action plan in respect of the county for consideration and adoption by the County Assembly.

2) Every County Environment Committee, in preparing a county environment plan, shall undertake public participation and take into consideration every other county environment action plan already adopted with a view to achieving consistency among such plans.

3) The respective County Executive Committee members of every county shall submit the county environment action plan referred to in subsection (1) to the Cabinet Secretary for incorporation into the national environment action plan referred to in section 37.

4) The Authority shall consider every county environment action plan and either recommend incorporation of such plan into the national environment action plan or specify changes to be incorporated into a respective county environmental plan.

5) The Cabinet Secretary shall, on the recommendation of the Authority, issue guidelines and prescribe measures for the preparation of environmental action plans.

NATIONAL ENVIRONMENTAL COMPLAINTS COMMITTEE, (NECC)

The Committee performs the following functions:

♣ Investigate any allegations or complaints against any person or against the Authority in relation to any environmental condition in Kenya and on its own volition, any suspected case of environmental degradation and to report findings together with its recommendations thereon to the Council.

♣ Prepare and submit to the Council periodic reports of its activities which shall form part of the annual report on the state of the environment under section 9 (3)

♣ To perform such other functions and exercise such powers as may be assigned to it by the Council.

Table 3: The regulatory agencies relevant to the project

	Institution	Envisioned role in the proposed project	Project phase required
1	National Environment Management Authority	Issuance of EIA license and Monitoring for Compliance with conditions and environmental law	Construction, operation and decommissioning
2	Machakos County Government	Approval of plans and building inspections, issuance of licenses	Planning and preconstruction
3	Physical Planning Department-Mavoko Subcounty	Building certifications	Planning, pre-construction and construction
4	Directorate of Occupational Safety and Health Services	Ensure safety of workers at construction site	Construction and operation

5	National Construction Authority	Project Registration and Certification	Planning and preconstruction
6	Mavoko Water and Sewerage Company	Permit to connect to the sewer line in the project area	Planning and pre-construct

CHAPTER FIVE: ANALYSIS OF ALTERNATIVES TO THE PROJECT

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

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

5.1 NO PROJECT ALTERNATIVE

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

5.2 ALTERNATIVE SITE

Pursuing a change of site alternative on the other hand requires that the project be implemented at an alternative site other than the one already acquired. This would entail purchasing an alternative

piece of land. Finding and acquiring land to accommodate the scale, type and size of the project and completing official transaction on it may take a long period. The project proponent however has access to only this property for the stated development. The resultant effect of changing the site would be increase in timeframe and resources required to realize the development. The unpredictability of financial resources and the lag time required in acquiring and designing the development may also mean that the project may be unable to break even once implemented. While we appreciate that monetary costs should not be used to justify a wrong project, this would also call extra costs in terms of money and time for example whatever has been done and paid to date would be a direct loss to the proponent. This may also lead to a No Action Alternative situation. The other consequence is that it would discourage both foreign and local investors especially in the housing sector that has been shunned by many public and private investors hence aggravating the housing short fall. In consideration of the above concerns and assessment of the current proposed site, relocation of the project is not a viable option.

5.3 WASTE MANAGEMENT ALTERNATIVE

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

Solid Waste

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

Liquid Waste

Liquid wastes in the facility will be managed through connection to MAVWASCO sewer line during operational phase. As an alternative liquid waste management plan option, we advise the proponent to consider installing an onsite waste water management system on the complex so that

in the event that the municipal sewer system would be dysfunctional or out of operations. This will ensure that the proponent manages its liquid waste in a sustainable manner.

5.4 THE COMPARISON OF ALTERNATIVES

Various alternative designs and technology have been evaluated by the proponent and various professionals involved. After extensive discussions and relevant considerations, the various options were assessed and the most optimal design and technology were agreed as per the proposed plans, materials and technology.

Under the proposed Development Alternative, the project would create more and standard housing stock and business premises and would provide employment directly and indirectly to the public. It would provide jobs for the workers during construction. After completion more jobs would be generated during operations.

Under the No Action Alternative, there would be no development at all. There would be no benefits from the site and neither would there be the insignificant environmental impacts. The layout redesign may perhaps give an optimal design and should be explored for optimization of the benefits and environmental enhancement. However, provided the proposed mitigation measures are implemented as well as adoption of sound construction management practices, the identified negative impacts will be avoided/minimized. The proponent commitments related to development alternative will ensure that potential project impacts are minimized to levels of insignificance as envisaged in the ESMP.

5.5 SELECTED SITE ALTERNATIVE

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

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

conduct public consultations and obtain feedback from the community on their views concerning the proposed project as part of the ESIA exercise.

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

CHAPTER SIX: PUBLIC PARTICIPATION, CONSULTATION AND OCCUPATIONAL HEALTH SAFETY

6.1 CONSULTATION AND PUBLIC PARTICIPATION

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

During ESIA Studies, the Environmental Management and Co-ordination (Amended) Act, Cap 387 requirements read together with EIA/EA Guidelines of 2003 (2018) require that the general public and key stakeholders are consulted on the impacts to the environment that may be occasioned by projects either in the public or private domain. The Constitution of Kenya further provides a strong foundation for participatory governance. While the Constitution does not use the term community engagement, it is replete with provisions on public participation, and establishes public participation as a key value and principle in governance. As per EMCA regulations and NEMA requirements, there are usually two forms of public involvement in the EIA process. The first is direct involvement of the affected public or community in public consultations during the ESIA study. These consultations allow the developer to provide information to the public about the project and to determine what issues the public wishes to see addressed. Community interaction and transparency is a critical area of focus for the success of this development. The extent and results of the consultations undertaken so far have been included in this ESIA report. The second level of involvement is at the discretion of the Authority - NEMA and takes place after the ESIA

Study Report, if any, has been prepared and after the applicant has provided the information needed for adequate review by NEMA and the public. Public disclosure on the other hand is important as it is critical to the effective participation of project affected populations. An informed public is more likely to understand the trade-offs between project benefits and its demerits; be able to contribute meaningfully to project design; and have greater trust in the project proponent.

For purposes of the ESIA process, public consultation and disclosure process is conducted for any project to intimate the community about the project, its activities and associated benefits, impacts, risks etc. so that people can participate in the project activities in an informed manner and can raise their concerns to be addressed. This consultation process effectively manages public apprehensions, identifies control measures for these apprehensions in association with the public stakeholder and also facilitates implementation of the identified measures. Public participation tries to ensure that due consideration is given to public values, concerns and preferences when decisions are made. It encompasses the public actively sharing in the decisions that government and other agencies make in their search for solutions to issues of public interest.

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

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

6.2 IDENTIFICATION OF STAKEHOLDERS

As a developer, it is essential to know the people who may be impacted by a project and who may have an influence on its ultimate success. Communities are not homogeneous and are comprised of people with different lived realities and different interests and concerns relating to development. Multiple discussions with other stakeholder groups are critical to triangulate information collected from various tools and resources. As such, discussions with the resident communities and government agencies should be reviewed side-by-side to get the correct picture. The effectiveness

of the ESIA is directly linked to the degree of continuing involvement of those affected directly or indirectly by the project. A stakeholder analysis was undertaken to identify all the potential stakeholders of the project. They included: local administration; Government Agencies; Local Residents and associations; Institutional stakeholders and the general public in the project area. The aim was to ensure that all stakeholder interests were identified and incorporated in project development: at the planning, implementation and operation phases. The stakeholder engagement process was carried out at two levels; local residents and County / National Governing bodies. Different communication methods and time were also framed.

Two main categories of stakeholders were identified, including:

1 **Primary stakeholders**: This group included those who are directly affected by the project either positively or negatively. They included the different residents from the nearby kicheko village and other residents and developers in close proximity to the project site.

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

6.3 APPROACH TO PUBLIC PARTICIPATION AND CONSULTATION

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

The approach undertaken for information disclosure and consultation at the ESIA stage involved the following key processes.

⎪ Mapping and identification of key stakeholders such as primary and secondary and prioritizing them according to their influence;

⎪ Conducting expert consultations, informal interviews and Key Informant Interviews;

⎪ Assessing the influence and impact of the project on these stakeholder groups and vice versa; and

⎪ Summing up of key findings and observations from the consultations.

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

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

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

⎪ Key Informant Interviews;

⎪ Informal Interview sessions/discussions;

⎪ Public Meetings and Consultations as per Covid -19 protocols; and

⎪ Socio-economic/ Household questionnaire administration.

6.4 DISCLOSURE AND CONSULTATION

Public consultations and engagement forums involved disclosing information on the proposed project and the anticipated potential impacts, both negative and positive. Primary and Secondary stakeholders were engaged to establish their view on the proposed project. A number of consultations were conducted during this phase of ESIA preparation. A combination of methods of information disclosure and consultation process was adopted at this stage. The method selected for consultation was adopted keeping in mind the profile of the stakeholders, type of information desired and level of engagement required. The methods used in the consultation process were: Key Informant Interviews; Socio-economic Questionnaires; Public Meetings and a Stakeholder Engagements Forum. The consultation and information disclosure were held in a free and fair environment with giving prior information about the same to the participants.

6.5 MODALITIES OF CONSULTATION AND PARTICIPATION

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

a) Photography and direct observation

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

b) Key Informant Oral Interviews and Questionnaires

Key Informant Interviews were undertaken to obtain qualitative data regarding the proposed project. The Mavoko Sub-County Officials, Kicheko Village Management and Mavoko Water andSewerage Company were engaged and questionnaires completed as annexed in this report.

c) Public Meetings

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

Plate 8: Consultative Public Participation in session

Plate 9: Residents giving their views about the proposed project

d) Environmental Household Questionnaires

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

Table 4 Summary of respondents' feedback

	NAME	CONTACT	POSITIVE IMPACTS	NEGATIVE IMPACTS
1	Tabitha Waithera	0740671753	Creation of employment opportunities.	Vegetation clearing
2	Faith Munyao	0720062353	Enhancement of local growth	Restriction of movement
3	Faith Njeri	0724444784	Optimal utilization of land	Air pollution
4	Joseph Ndete	0716666806	Additional revenues to the local and national authorities	Generation of solid waste
5	John Bosco	0782031617	Creation of market for goods and services.	Land degradation
6	Mercy Emali	0722942764	Promotion of social cohesion	Soil erosion
7	Robert Njoroge	0722533287	Creation of secondary business	Fire risks
8	Collins Kiprop	0724203676	Growth of informal businesses	Soil contamination
9	Brenda Njeri	0701950965	Provision of standard housing	Road damage
10	John Korir	0722482236	Enhanced income generation	Generation of sewer

6.6 ENVIRONMENTAL OCCUPATIONAL, HEALTH AND SAFETY IMPACTS

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

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

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

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

6.7 COVID-19 PREVENTION AT THE WORKPLACE

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

CHAPTER SEVEN: IDENTIFICATION OF POTENTIAL IMPACTS AND PROPOSED MITIGATION MEASURES

7.1 INTRODUCTION

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

7.2 CLASSIFICATION OF ENVIRONMENTAL IMPACTS

Impacts may be categorized into the following:

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

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

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

7.3 IMPACT SIGNIFICANCE AND SEVERITY

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

7.4 IMPACTS IDENTIFICATION, DESCRIPTION AND MITIGATION

7.4.1 POSITIVE IMPACTS

Creation of employment opportunities

This project will create job opportunities in the project area. This include direct and indirect job opportunities to a significant number of the population during construction, occupational and decommissioning phases thus reducing the unemployment and, in the process, provide livelihood. Direct job opportunities are available for high calibre professionals including architects, engineers,

civil works contractors and consultants. The project will also offer direct or indirect employment opportunities to semi-skilled and unskilled labourers such as foremen, security guards, housekeepers, shopkeepers, clerks and drivers.

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

- Ensure compliance with the Employment Act, 2007 and Regulation of Wages (General) (Amendment)order, 2009.

- During employment of semi-skilled and unskilled labour, priority should be given to the local residents and immediate community;

- Gender Equity should be considered when employing labour so as to ensure a balance between the two sexes is almost equal and there should be no bias towards the male; and

- The contractor should inform workers that the employment opportunity is short term so as to prepare them in case employment comes to an end due to reduction in work.

Enhancement of local economic growth and Additional Revenues

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

Provision of standard housing and income generation

Housing is a basic good and a major contributor to productivity. Supply of standard and affordable housing has always lagged behind demand for the same and the proposed project has a contribution towards reducing the deficit. The proposed project shall lead to an increase in housing units

through the provision of precast products. This is in line with the government policy of providing standard and affordable housing infrastructure to the society through the Big Four Agenda. The proposed project will lead to housing developments which will give an opportunity for people to acquire shelter easing housing problems. The project will further form a well-planned project and shall include key services, infrastructure and amenities. The project will also include provision of infrastructure including driveway and parking, storm water drainage, outdoor lighting, sewerage and water to local authority 's adoptive standards.

Optimal utilization of the land

The opening up of the area by the planning policy and the rush for the plots by commercial developers has led to a sharp increase in land values in the area and in the neighborhood due to the potential high returns after development. This has also led to attraction of middle-income groups with improved economic status. The proposed use also conforms to the area's planning policy and is not unique in the neighbourhood. Currently there are other high-rise developments adjacent to the site.

Creation of market for goods and services and secondary businesses

The proposed project shall consume various materials during construction such as stones, cement, sand, glass, steel products, wood products, PVC products, ceramic products etc. Various professionals have and shall continue giving their services during both the construction and operational phases and thus enhancing livelihoods. Those doing commercial activities in the neighbourhood shall also have their market widened by the occupants and workers. Many secondary businesses are also likely to spring up during the construction phase especially those providing foods and beverages to the construction workers.

Creation of employment opportunities

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

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

- Ensure compliance with the Employment Act, 2007 and Regulation of Wages (General) (Amendment)order,2009.

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

Enhancement of local economic growth and Additional Revenues

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

7.4.2 NEGATIVE IMPACTS DURING CONSTRUCTION AND OPERATION PHASES

Vegetation clearing and restriction of movement

Construction Phase:

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

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

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

Mitigation measures

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

• Fence the site to restrict movement.

• Modifications to the design of the development to ensure spaces are left to allow for regeneration of vegetation.

• Restriction of construction activities to defined project areas.

• After completion of soil work, grasses are to be planted to minimize soil erosion.

• No vehicle shall be allowed access onto the stockpiles after they have been placed. • Stockpiles shall not be allowed to become contaminated with oil, diesel, petrol, garbage or any other material, which may inhibit the later growth of vegetation.

• Soil conservation measures would be taken to the stockpiles to prevent erosion. This can include the use of erosion control fabric.

• Soil stockpiles shall not be higher than 2.5 m or stored for a period longer than 2 months.

7.5 DECOMMISSIONING PHASES IMPACTS DISCUSSION

Environmental Emergency and Response

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

Fire hazards and Management

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

Recycling and Reuse

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

Reinstatement and Rehabilitation

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

7.5.1 POSITIVE IMPACTS DURING DECOMMISSIONING

Rehabilitation of the site

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

Employment opportunities

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

decommissioning shall therefore provide a positive socio-economic impact but on a short-term basis.

Informal Business Growth

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

7.5.2 NEGATIVE IMPACTS DURING DECOMMISSIONING

Noise and vibration

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

Mitigation measure will include:

- Scheduling all the decommissioning works within the normal working hours of between 8am and 5pm.

- Provision of screening around the site when the demotion works is on-going to reduces the impact of noise by cordoning the area.

- Adherence to the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

Air pollution

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

Mitigation measures include:

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

Solid Waste

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

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

Mitigation Measures:

- The contractor shall put in place a Waste Management Plan aimed at minimising the production of all wastes and maximize on resource recovery.
- Where possible measures will be put in place to recycle materials such as metal off-cuts, some plastics and clean paper/ cardboard utilizing existing specialist recycling firms in Nairobi.
- A suitable location within site for placing concrete and foundations removal and washing down equipment will be undertaken with no discernable impact.

- Other non-recyclable materials should be segregated and stored in plastic bins, collected and disposed of through the Mavoko sub-county disposal site.
- Disposal bins should be provided at designated areas at the project site to help in waste segregation to encourage recycling.
- Prepare a contaminated land assessment which identifies all areas of contaminated land, the nature of the contamination and the necessary measures to contain and rehabilitate these sites.

- Enforce regular collection and disposal of garbage by the project contractor through licensed NEMA waste handler in the entire decommissioning process.
- Prepare an inventory of all hazardous materials and wastes to be disposed of and specify the method of disposal in accordance with the MSDS and current NEMA‘s legislation.

CHAPTER EIGHT: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

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

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

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

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

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

- Air pollution control and management.
- Water pollution control and management

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

Table 5: Environmental and Social Management Plan

Environmental /Social impact	Proposed mitigation and aspects for monitoring	Responsibility for intervention and monitoring during design, construction and defects liability period	Responsibility for mitigation, monitoring and/or maintenance after defects liability period	Estimated cost (Kshs)	Monitoring means	Recommended frequency for monitoring and indicators
Vegetation clearing	**Construction phase** • Incorporation of natural vegetation into site landscape design. • Stockpiles shall not be allowed to become contaminated with hazardous materials. • Soil stockpiles shall not be higher than 2.5 m or stored for a period	KQ Concrete Ltd	KQ Concrete Ltd	250,000	Inspection & Routine maintenance Observation	One off, before Construction works

	longer than 2 months • The proponent should fence the site					
	<u>Operation phase</u> • No vegetation clearance impacts hence no mitigation. Clear all the soil debris cleared at the site.	KQ Concrete Ltd	KQ Concrete Ltd	30,000 Monthly	Routine maintenance	Continuous
Land Degradation	**Construction phase** • Strictly source material from NEMA authorised dealers or quarries • Backfilling of opened up borrow pits, borrow pits and quarries	KQ Concrete Ltd	KQ Concrete Ltd	50,000	Observation	Weekly

	• All wastes should be segregated and appropriately stored on site before final disposal. **Operation phase** • No negative impact on land quality.					
Solid waste management	**Construction phase** • Efficient use, re-use and re-cycling of materials to minimise on solid waste. •Good housekeeping to ensure no littering	KQ Concrete Ltd	KQ Concrete Ltd	400,000	Inspection & Routine maintenance Observation	Weekly

	from packaging materials. • Segregation of waste before appropriate disposal • The contractor should prepare a Waste Management Plan for management of solid waste management. • Disposal of solid waste that accumulate at the construction site should be properly disposed in NEMA licensed landfill in accordance with NEMA regulations.					

	Operation phase • Adopt sound waste management system to ensure proper solid waste disposal and collection facilities as per the prevailing NEMA regulations • Provision of waste collecting bins.	KQ Concrete Ltd	KQ Concrete Ltd	100,000 Monthly	Routine maintenance	Continuous
Water resource supply and use	**Construction phase** • Appropriate containment structures should be provided to store contaminated	KQ Concrete Ltd	KQ Concrete Ltd	200,000	Inspection & Routine maintenance Observation	Daily

	water from the construction site. • Disposal of construction debris in approved areas. • Avoid excessive use of the water supplied by the MAVWASCO. • Roof catchments should be provided with gutters to facilitate collection of the run-off.					
	Operation phase • Management of water usage and avoid unnecessary wastage. • Use hydro pneumatic system	KQ Concrete Ltd	KQ Concrete Ltd	100,000 Monthly	Routine maintenance	Continuous

	with variable frequency drive for the water supply system. •Ensure (consistently) good water quality through regular water analysis to ascertain compliance to public health standards. • Supplement MAVWASCO water supply with water from other sources with necessary approvals					
Wastewater management	**Construction phase** • A temporary pit latrine shall be constructed on the	KQ Concrete Ltd	KQ Concrete Ltd	300,000	Inspection & Routine maintenance Observation	Monthly

	site during construction phase for use • The proponent shall connect the sewerage effluent to the MAVWASCO sewer in the area.					
	Operation phase • Connect sewerage effluent to the MAVWASCO sewer system and have an onsite sewer treatment plant	KQ Concrete Ltd	KQ Concrete Ltd	200,000 Monthly	Routine maintenance	Monthly
Air pollution control and management	**Construction phase** •Regularly sprinkle water to	KQ Concrete Ltd	KQ Concrete Ltd	100,000	Inspection & Routine maintenance Observation	Weekly

	reduce dust on site and access roads. • Ensure strict enforcement of on-site speed limit regulations. • Avoid excavation works in extremely dry weather. • Provide dust nets to prevent the spread of dust. • Ensure all trucks delivering construction materials are properly covered. • Implement a dust control program. • Provide PPE such as nose					

	masks to the workers.					
	Operation phase • Erect engine anti-idling warning signs in the parking lots • Encourage use of clean fuels	KQ Concrete Ltd	KQ Concrete Ltd	50,000 Monthly	Routine maintenance	Quarterly
Noise control and management	**Construction phase** • Schedule noisy activities during the normal working hours of between 8am to 5pm. • Put off machines and equipment when not in use. • Ensure machinery is well	KQ Concrete Ltd	KQ Concrete Ltd	100,000	Inspection & Routine maintenance Observation	Weekly

	maintained to reduce noise emitted. • Provide workers with appropriate PPEs. • There should be no unnecessary horning of the involved machinery and vehicles.					
	Operation phase	KQ Concrete Ltd	KQ Concrete Ltd	50,000 Monthly	Routine maintenance	weekly
Storm water management	**Construction phase** • Installation of proper drainage structures • Install cascades to break the impact	KQ Concrete Ltd	KQ Concrete Ltd	500,000	Inspection & Routine maintenance Observation	During construction and on completion of the structure

	of water flowing in the drains • Install oil/grease interceptors on the drainage channels.					
	Operation phase •Ensure efficiency through sound maintenance of drainage channels.	KQ Concrete Ltd	KQ Concrete Ltd	50,000 Monthly	Routine maintenance	Daily
Visual impacts	**Construction phase** • Erect a suitable perimeter wall • Clear all solid waste and debris from the site • Landscaping and planting of vegetation on the site.	KQ Concrete Ltd	KQ Concrete Ltd	500,000	Inspection & Routine maintenance Observation	Monthly

	Operation phase • There are potential no further visual impacts at the operation phase.	KQ Concrete Ltd	KQ Concrete Ltd	Nil	None	None
Occupational health and safety	**Construction phase** • Register the workplace with DOSHs. • Contract a qualified Health and Safety Advisor to conduct training • Provide a standard First Aid Kit and train workers on the same. • Workers should be inducted with	KQ Concrete Ltd	KQ Concrete Ltd	200,000	Reports	Continuous

	training on health and safety. • Provide and enforce the use of PPE. • Erect safety and informative signage for hazardous conditions. • Maintain an incident/ accident register, in accordance with the Occupational Safety and Health Act, 2007, and report incidences to DOSHS.					
	Operation phase • Maintain an incident/ accident register, in accordance with	KQ Concrete Ltd	KQ Concrete Ltd	500,000 monthly	Number of OHS related illnesses Reports produced	Random Weekly reporting

	the OSHA, 2007, and undertake audits as appropriate.					
Fire safety and preparedness	**Construction phase** • Install fire-fighting equipment as approved in the designs. • Conduct training on fire-fighting, evacuation and emergency response to workers. •Maintain/ service fire-fighting machinery regularly and conduct drill for preparations.	KQ Concrete Ltd	KQ Concrete Ltd	200,000	Installed Equipment	On Completion

	Operation phase •Provide appropriate firefighting equipment i.e. fire hydrants and extinguishers within the complex.	KQ Concrete Ltd	KQ Concrete Ltd	100,000 monthly	Number of extinguishers Audits of the fire equipment Observation	Random Quarterly Reporting
Energy resources	**Construction phase** • Maximize the use of natural lighting through design. • Install an energy-efficient lighting system for the development. • Use of clean fuels e.g. unleaded and de-	KQ Concrete Ltd	KQ Concrete Ltd	Energy costs	Inspection/ observation/ records	Monthly

	sulphurized fuels in vehicles.					
	Operation phase • Ensure electrical equipment, appliances and lights are switched off when not being used • Design to provide for adequate natural lighting. • Install energy saving bulbs at all lighting points. • Install solar systems to complement heating and lighting	KQ Concrete Ltd	KQ Concrete Ltd	500,000	Inspection/ observation/records	Weekly

	• Encourage use of natural lighting during the day.					
Materials management to minimise the impact of material delivery and waste disposal	**Construction phase** Develop materials delivery and waste disposal handling plan. • Develop safety measures to avoid loss of load from trucks. • Implement methods to reduce dust emission from the loads e.g. covering of trucks.	KQ Concrete Ltd	KQ Concrete Ltd	100,000 monthly	Inspections	Daily
Security	**Construction and operation phase** • Provide security guards and facilities during	KQ Concrete Ltd	KQ Concrete Ltd	100,000 monthly	Inspections	Daily

	the entire project lifecycle.					
Socio-economic impacts	**Construction and operation phase** • Employ workers from the immediate area • Establish a code of conduct for the workers. •All communications with the community should be documented. •Display communicative posters within site on HIV/AIDS related messages. • Avail literature on HIV/AIDS awareness to staff.	KQ Concrete Ltd	KQ Concrete Ltd	To be determined	Employment contract	Weekly

Covid – 19 prevention and mitigation	**Construction and operation phase** The Workplace shall develop and implement action plans to prevent and mitigate COVID-19. • The action plan and preventive measures should be regularly monitored and updated. • Observe preventive measures at the workplace including Thermal screening of workers, sensitization of the need to wear facemasks, regular hand washing with soap or sanitizing	KQ Concrete Ltd	KQ Concrete Ltd	200,000	Reported cases on site	Daily screening of project workers

	and social distancing as per Ministry of Health and World Health Organization Protocols					

Table 6: Environmental and Social Management Plan during Decommissioning

Expected Negative Impacts	Recommended mitigation measures	Responsibility party	Time frame	Cost (Ksh)
Scraps and construction debris	• The proponent shall put in place a waste management plan aimed at minimising the production of all wastes and maximize on resource recovery. • Where possible measures will be put in place to recycle materials such as metal off-cuts, concrete blocks, some plastics and clean paper/ cardboard utilizing existing specialist recycling firms in Kenya. • A suitable location within site for placing concrete and foundations removal and	KQ Concrete Ltd Project Manager	One-off	1500,000

	washing down equipment will be undertaken with no discernable impact. • Other non-recyclable materials should be segregated and stored in plastic bins, collected and disposed of. • Disposal bins should be provided at designated areas at the project site to help in waste segregation to encourage recycling. • Enforce regular collection and disposal of garbage by the project contractor through licensed NEMA waste handler in the entire decommissioning process. • Prepare an inventory of all hazardous materials

	and wastes to be disposed of and specify the method of disposal in accordance with the MSDS and NEMA's legislations. • Remove and dispose of all demolition waste at an appropriate authorized waste disposal site.			
Air pollution	• Water spraying to suppress dust especially where dusty activities are taking place. • Providing workers involved with appropriate PPEs such as dust masks or respirators.	KQ Concrete Ltd Project Manager	One-off	500,000
Occupational hazards	• Ensure that safety measures have been effectively integrated and positioned in respective areas of the	KQ Concrete Ltd Project Manager	One-off	250,000

	project to control and manage health and safety hazards.			
Noise and Vibration	• Scheduling all the decommissioning works within the normal working hours of between 8am and 5pm. • Provision of screening around the site when the demotion works is on-going to reduces the impact of noise by cordoning the area. • Adherence to the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.	KQ Concrete Ltd Project Manager	One-off	300,000

CHAPTER NINE: CONCLUSIONS AND RECOMMENDATIONS

The Environmental and Social Impact Assessment study findings has established that the proposed development project of precast and blox is a worthy investment by the proponent and will contribute significantly to the economic development of the area and the country. This will be achieved through the outlined preliminary positive impacts namely; growth of the economy, boosting of the informal sector during the construction phase, provision of market for supply of building materials, employment opportunities, increase in government revenue and optimal use of land among others. The studies conducted shows that the project will pioneer housing development in the area. However, the ESIA analyses have established that the proposed project will also come along with some negative impacts. The negative environmental impacts that will result from establishment of the proposed project will be minimal and manageable through regular monitoring of the environment in line with the propose EMP. Noise pollution which would mostly be affecting the local residents living nearby the project. However, the operation will be limited to the time when people are away from their homes for schools, work and other affairs. Other impacts may include dust emissions which will be managed through regular watering, minimal waste will also be generated, increased in water demand on the construction sites as well as upon the project operation, generation of exhaust emissions mostly emanating from the vehicular operations, workers accidents and hazards during construction, possible exposure of workers to diseases. The proponent is committed to enforce full government protocol on health and safety issues including the use of PPE.

However, with proper implementation of the outlined environmental and social management plan as well as the environmental and social monitoring plan the above issues can be sufficiently mitigated to safeguard on the environmental and social aspects surrounding the implementation of the proposed road project. In handling the ongoing COVID-19 pandemic, the proponent shall be tasked to follow the guidelines issued by the ministry of health on combating the spread of the disease and ensuring the health safety of the workers at site. It is our prayer that the Environmental Management and Monitoring Plan will be executed and implemented fully. The ESIA consultant take this early opportunity to encourage the proponent to be prepared to adhere to all relevant national and international environmental, health and safety standards, policies and regulations that govern establishment and operation of such project in Kenya.

. In conclusion the following are recommended

1. Institute effective communication, education and awareness towards the project beneficiaries for enhanced acceptability and social harmony.

2. Integrate suitable mitigation measures as outlined in this report in the designs for all sections of the project road for implementation during construction and use of the road.

3. Consult the local communities and other stakeholders, particularly property owners, to the extent possible on planning the works, especially where property, inhabitations and other aspects of social interest are concerned,

4. Collaborate with various institutions including the national irrigations board considerations during all the phases of the road so as to develop suitable alternatives and ensure agricultural lands are not affected

5. Implement the environmental management plan throughout the project implementation

6. With assistance of appropriate expert including development and implementation of HIV/AIDS, COVID-19 and other communicable diseases program and guidelines in conjunction with line ministries.

REFERENCES

Government of Kenya (2000): Kenya gazette supplement Acts, Environmental Management and Coordination Act Number 8 of 1999.

Government printer, Nairobi, Kenya. Government of Kenya (2001): Pollution prevention and abatement handbook – Part III. Nairobi, Kenya.

Government of Kenya (2002): Kenya gazette supplement Acts Water Act, Government Printers, Nairobi, Kenya.

Government of Kenya (2003): Kenya gazette supplement number 56. Environmental Impact Assessment and Audit Regulations, Government Printers, Nairobi, Kenya.

Government of Kenya (2005): Noise Prevention and Control Rules, Legal Notice no. 24, Government Printers, Nairobi, Kenya.

Government of Kenya (2006): Kenya gazette supplement number 68, Environmental Management and Coordination (Water Quality) Regulations, Government printer, Nairobi

Government of Kenya (2006): Kenya gazette supplement number 69, Environmental Management and Coordination (Waste management) Regulations, Government printer, Nairobi, Kenya.

Government of Kenya (2007): Kenya gazette supplement number 57, Environmental Management and Coordination (Controlled Substances) Regulations, Government printer, Nairobi, Kenya.

Government of Kenya (2007): The Occupational Safety and Health Act, Government Printers, Nairobi, Kenya.

Government of Kenya (2009): Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, Government printer, Nairobi, Kenya.

Government of Kenya (2010): The Land Adjudication Act, Government Printer, Nairobi, Kenya. Government of Kenya (2011): The Environment and Land Court Act, Government Printer, Nairobi

Government of Kenya (2012): The Land Act, Government Printer, Nairobi, Kenya. Government of Kenya (2012): The Land Registration Act, Government Printer, Nairobi

Government of Kenya (2012): The National Land Commission Act, Government Printer, Nairobi, Kenya. Government of Kenya (2013): The Wildlife Act, 2013. Government Printer, Nairobi, Kenya.

Government of Kenya (2011): The National Gender and Equality Commission Act, 2011. Government Printer, Nairobi, Kenya.

Government of Kenya, Kenya gazette supplement Acts Penal Code Act (Cap.63) Government Printers, Nairobi, Kenya.

ANNEX 1