

ENVIRONMENTAL IMPACT ASSESSMENT
STUDY REPORT FOR THE PROPOSED **LIGHT INDUSTRIAL
DEVELOPMENT ON PLOT LR NO 8827/7, KAIHINI AREA, ALONG
THIKA-KANGARE ROAD, KANDARA MURANGA COUNTY**

Proponent,
Brush Manufacturers Limited
P.O. Box 48865-00100
Nairobi- Kenya.

ENVIRONMENTAL EXPERTS:
Environmental Management Consultancy (EMC)
Diamond Plaza,
2nd Floor Suites A8 & A9,
P. O. Box 3891- 00100. Nairobi.
Tel: 020-375 2019 Mobile: 0723114020 / 0734562810

© November 2018

EIA Study Team

No.	Name	Field of Specialization	NEMA Reg.
1.	Vincent Oduor - Lead Expert	Environmental Planning	0346
2.	Nelson Mango PhD.	Social Sciences	
3.	Tom Ouna PhD.	Environmental Sciences	6744
4.	Samuel Odumba	Occupational Health & Safety	2683
5.	Eng. Edwin Omolo	Civil Engineering	
6.	Michael Arunga	Environmental Sciences	0341
7.	Dr. Salmon Owii	Health Economics	
8.	Oscar Naibei	Research Methods	
9.	Flavian Muthusi	Agricultural Engineering	
10.	Dr. Oliver Wasonga Phd.	Drylands Socio-Ecology	
11.	Jackline Oduor	Law	
12.	Shikorire Tom	Environmental Sciences	2724
13.	Dan Ochiri	Environmental Sciences	2338
14.	Michael Mituki	Occupational Health & Safety	2398
15.	Evans Totona	Occupational Health & Safety	8049
16.	Nicholas Owuor	Environmental Sciences	

DECLARATION

Brush Manufacturers Limited

This Environmental Impact Assessment Study report is submitted to the National Environment Management Authority (NEMA) in pursuant to the requirements of the Environment Management and Coordination Act, CAP 387 and the Environmental (Impact Assessment and Audit) Regulations, 2003.

The project is based on the proposed construction and relocation of Brush Manufacturers Limited light industry within the proposed Kandara Business Park and has been conducted to the highest Environmental standards possible.

That during construction and operational phases, the developer will abide by the findings and the recommendations of the study and the EIA license.

NAME:

DESIGNATION:

SIGNATURE and Stamp:

DATE.....

EIA CONSULTANTS:

That the Environmental and Social Impact Assessment (ESIA) study report submitted is based on the proposed construction and relocation of Brush Manufacturers Limited **Light Industry** within the proposed Kandara Business Park;

To my knowledge, all information contained in this document is an accurate and truthful representation of all findings as relating to the proposed project as per projects information provided by the proponent and contractor to the ESIA consultant:

NAME: Vincent O. Oduor (NEMA Registration Number 346)

SIGNATURE:

DATE:

Table of Contents

EXECUTIVE SUMMARY	8
Introduction.....	8
Rationale for the EIA Study.....	8
Public Consultations	8
Environmental, socio-economic impacts and mitigation measures	9
Summary of potential environmental impacts	9
1.0 INTRODUCTION.....	13
1.1 Introduction.....	13
1.2 Project Background.....	13
1.3 Project Objectives	13
1.4 EIAS Objectives.....	14
1.5 Project Scope and Justification	14
2.0 PROJECT DESCRIPTION	15
2.1 Introduction.....	15
2.2 Project Design	15
2.3 Project Establishment.....	15
2.4 Proposed Location.....	16
2.5 Land Ownership.....	18
2.6 Project implementation	18
2.7 Construction Inputs and Activities.....	18
2.7.1 Project Equipment and Activities	18
2.7.2 Landscaping.....	19
2.8 Operation Inputs and Activities	19
2.8.1 General activities	19
2.8.2 Waste Management	19
2.9 Description of the Project’s Decommissioning Activities	19
2.9.1 Demolition works	19
2.9.2 Site Restoration.....	19
3.0 BASELINE INFORMATION.....	20
3.1 Murang’a County	20
3.2 Ecological conditions.....	20
3.3 Physical Environment	20
3.3.1 Climate.....	20
3.3.2 Geology and Hydrology	21
3.3.3 Soils	21
3.3.4 Humidity	21
3.3.5 Water resources	22
3.4 Biological Environment	22
3.5 Infrastructure and services	22
3.5.1 Roads and Accessibility.....	22
3.5.2 Water supply.....	22
3.5.3 Sewer system and sanitation	22
3.5.4 Surface drainage	23
3.5.5 Solid waste management	23
3.5.6 Energy.....	23
3.5.7 Communication.....	23
3.5.8 Security	23
3.6 Socio-Economic Environment	23
3.6.1 Land use.....	23
3.6.2 Population and Housing.....	23
3.6.3 Public Health	24

3.7 Main wildlife	24
3.8 Major Industries	24
3.9 Main Forest types and size of forests	24
4.0 ENVIRONMENTAL LEGISLATIVE AND REGULATORY FRAMEWORK	25
4.1 Legal Framework	25
4.2 Constitution of Kenya (2010).....	25
4.3 Environmental Management Coordination Act (CAP 387)	25
4.4 The Environmental (Impact Assessment and Audit) Regulations, 2003	26
4.5 Environmental Management and Co-ordination (Waste Management) Regulations 2006.....	26
4.6 Environmental Management and Co-ordination (Water Quality) Regulations, 2006.....	26
4.7 Environmental Management and Co-Ordination (E-Waste Management) Regulations, 2013	27
4.8 The Energy (Solar Photovoltaic Systems) Regulations, 2012	27
4.9 Noise and Excessive Vibrations Pollution (Control) Regulations	27
4.10 The Tobacco Control Act, 2007.....	28
4.11 National Environmental Action Plan (NEAP)	28
4.12 The world commission on environment and development–the Brundtland Commission (1987)...	29
4.13 National Policy on Water Resources Management and Development.....	29
4.14 OSHA 2007	29
4.15 The Physical Planning Act (Cap 286)	29
4.16 The County Government Act, 2012	30
4.17 Land Control Act (Cap 302)	30
4.18 Building Code 2000	30
4.19 Public Health Act- (Cap. 242).....	31
4.20 The Water Act, 2002.....	31
4.21 The Penal Code (Cap. 63)	32
4.22 The World Commission on Environment and Development	32
4.23 The Rio Declaration on Environment and Development	32
4.24 Regulatory Institutions	32
4.24.1 National Environment Management Authority	32
4.24.2 Directorate of Occupational Safety and Health Services.....	33
4.24.3 Ministry of Health.....	33
4.24.4 The County Government of Murang’a	33
4.25 Conclusion	33
5.0 POTENTIAL IMPACTS	34
5.1 Positive Environmental and Socio- economic Impacts during construction and operation...	34
5.1.1 Economy	34
5.1.2 Infrastructural development.....	34
5.1.3 Employment.....	34
5.1.4 Market Supply for small traders	34
5.1.5 Provision of social facilities/ welfare.....	34
5.1.6 Improved land utility	35
5.2 Positive environment and socio-economic impacts during decommissioning.....	35
5.2.1 Restoration of disturbed land.....	35
5.2.2 Reduced environmental pollution.....	35
5.2.3 Reduced or no negative impacts of operation.....	35
5.3 Potential Environmental Impacts.....	35
5.4 Negative impacts.....	37
5.4.1 Air quality	37
5.4.2 Soil/ geology	37
5.4.3 Water demand/ Hydrology.....	38
5.4.4 Sewage and effluent.....	38
5.4.5 Noise and Vibrations	39
5.4.6 Occupational Health and Safety (OHS).....	39

5.4.7 Solid waste.....	40
5.4.8 Aesthetic Value.....	40
5.4.9 Security Concerns.....	40
5.4.10 Fire hazards.....	41
5.4.11 Public health and safety.....	41
6.0 PROJECT ALTERNATIVES.....	42
6.1 The Proposed Development.....	42
6.2 Alternative Location.....	42
6.3 ‘No Action alternative’.....	42
6.4 The Comparison of Alternatives.....	42
6.5 Mitigation for the proposed Action.....	42
6.6 Project Decommissioning.....	43
7.0 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN.....	44
7.1 ENVIRONMENTAL MANAGEMENT & MONITORING PLAN FOR DECOMMISSIONING PHASE.....	47
8.0 PUBLIC PARTICIPATION.....	48
9.0 CONCLUSIONS AND RECOMMENDATION.....	48
9.1 Recommendations.....	48

LIST OF ACRONYMS

CBD	Central Business District
CBO	Community Based Organization
CSR	Corporate Social Responsibility
dba	Decibels
EIA	Environment Impact Assessment
EIAS	Environment Impact Assessment Study
EMCA	Environment Management Coordination Act
EMF	Environment Management Facility
EMP	Environment Management Plan
GHG	Greenhouse Gases
m asl	meters above sea level
NCBD	Nairobi Central Business District
NEAP	National Environment Action Plan
NEMA	National Environment Management Authority
PAP	Project Affected Persons
PPE	Personal Protective Equipment
SOPs	Standard Operating Procedures
TOR	Terms of Reference
WHO	World Health Organization

EXECUTIVE SUMMARY

Introduction

Brush Manufacturers Limited which started its operations in 1976 to manufacture brooms and brushes is a privately owned company with its registered office and plant situated along Lunga Lunga Road, Industrial Area, Nairobi, Kenya.

The company's operations have since continued to grow; it distributes the products not only within Kenya but in eighteen countries in East, Central, West and Southern Africa, UAE, UK and USA. In line with the continued growth and expansion, the proponent intends to relocate their **light Industry** to the proposed Kandara Business Park, in Kaihini area of Murang'a County so as to upscale its production capacity. The project which shall be located within the 100 acres of land involves the construction of **four No. go-downs, an office block, a community centre, borehole drilling, installation of underground water storage tanks** and other complementary facilities that will be used for the light industrial facility is the subject of this Environmental and Social Impact Assessment Report which anticipates to secure an Environmental License from NEMA.

The proposed development is to be located in a majorly agricultural land, thus the proponent has acquired a change of use from agricultural to light industry use. Some of the negative impacts that could arise from the establishment of the development include; potential conflicts with the neighbours in regards to the land use, accidents in the work place, occupational hazards, increased population in the vicinity, health and safety aspects that may also arise at any phase of the development, loss of habitat due to vegetation clearing to establish various facilities.

Rationale for the EIA Study

The EIA study was commissioned by the proponent so as to establish the project's compatibility with the environmental resources. The main aim of the EIA activity is to predict all possible positive and negative impacts, which the project may have on both the natural and human environment and to suggest the mitigation measures for the negative impacts before the project is implemented. This project report has been prepared in accordance with Section 58 of the EMCA cap 387 and EIA/A Regulations (2003) which require that all proposed projects listed under the second schedule undergo an E.I.A and the report is thus a culmination of the same.

The project's plans have been approved by the County government of Murang'a which has also issued the approval of the changes in land- use from agricultural to light industry.

Public Consultations

The environmental consultants held discussions with the affected stakeholders (majorly project neighbours) at the area of the proposed project. The main objective of the discussions was to collect the stakeholders' views on the proposed project. The discussions evaluated in depth the proposed project site, the project impacts and mitigation measures for the project impacts. The general response of the stakeholders was that the proposed project is good for the

economic development of the area whereas others felt that they would be adversely affected by the proposed development. The respondents also gave their opinion on issues they would like to be mitigated against in order to ensure sustainability of the project. Some of the issues requiring consideration according to the stakeholders included re-vegetation of the project area, prevention of soil erosion and rehabilitation of the area vegetation affected by the project.

Environmental, socio-economic impacts and mitigation measures

The project has many advantages, including Creation of employment, creation of markets for project development materials, increased revenue to the Government through tax and duty payment, increased visitation to the area, improved community welfare through offered trainings, improved security of the area and enhanced CSR.

The project will also bring with it some negative impacts on the physical, cultural and the socioeconomic environments. In view of this, the proponent has undertaken this Environmental and Social Impact Assessment to address the negative impacts and enhance the positive impacts.

Summary of potential environmental impacts

Design, Planning and Construction Phase

Anticipated Positive impacts

- ❖ Creation of employment
- ❖ Creation of markets for project development materials
- ❖ Increased business opportunities for local traders
- ❖ Increased revenue to the Government through tax and duty payment
- ❖ Area infrastructural development

Anticipated Negative Impacts during Construction

- ❖ Increase in solid waste and effluent waste generation
- ❖ Increase in fossil fuel consumption, spills, leaks from equipment
- ❖ Increase in emissions, dust, Green House Gases (GHG)
- ❖ Increased exposure to hazards leading to accidents
- ❖ Loss of vegetation including crops, grass, trees
- ❖ Degradation of local cultural practices
- ❖ Increase in social vices and infectious disease including HIV/AIDS, STI's and other occupational diseases.
- ❖ Increase in demand of materials including ballast, gravel among others

Operation Phase

Anticipated Positive Impacts during Operation

- ❖ Creation of employment

- ❖ Growth of the economy, both the local county and national economy
- ❖ Improved land utility owing to the development
- ❖ Improved social welfare to the society
- ❖ Enhanced CSR to the local community and public institutions.
- ❖ Improved security to the area owing to security installations
- ❖ Infrastructural development of the area

Anticipated Negative Impacts during Operations

- ❖ Increased traffic to the area.
- ❖ Impacts on resident birds
- ❖ Risks of fire and traffic related accidents
- ❖ Loss of vegetation
- ❖ Potential oil spills and leakages derived from fuelling activities
- ❖ Health and safety risks
- ❖ Increased surface water runoff due to increased paved areas
- ❖ Solid and liquid waste generation
- ❖ Socio-cultural impacts as a result of migration of people to the area.

Decommissioning Phase

Anticipated Positive impacts

- ❖ Creation of employment
- ❖ Increased business opportunities for local traders

Anticipated Negative Impacts during Decommissioning

- ❖ Increase in solid waste and effluent waste generation
- ❖ Increase in fossil fuel consumption, spills, leaks from equipment
- ❖ Increase in emissions, dust, Green House Gases (GHG)
- ❖ Increased exposure to hazards leading to accidents
- ❖ Loss of incomes due to decommissioning activities
- ❖ Degradation of local cultural practices
- ❖ Increase in social vices and infectious disease including HIV/AIDS, STI's and other occupational diseases.

A summary of the potential mitigation measures

The proponent has committed efforts to ensure that the impacts of the proposed project are maintained within the acceptable standards. The mitigations measures for the anticipated impacts have been analyzed separately as those for socio-economic; HSE and Bio-Physical impacts. The mitigation measures for the Bio-Physical impacts have been further categorized as those related to flora and fauna, vegetation, soils and air quality. To ensure sustainability of the project, the proponent should undertake the following mitigation measures:

Bio-Physical; Flora and Fauna, soils and air quality mitigation Measures

- ❖ Re-vegetate the buffer zone between the plant and the residential area by planting trees.
- ❖ Control soil erosion through timely clearing of excavations from project area; develop erosion control structure and excavate new areas only after finishing work at opened segments among other measures
- ❖ Develop afforestation programs in collaboration with the community members;
- ❖ Use clean fuels and equipment dependent on clean energy;
- ❖ Create awareness among drivers and machine operators on practices aimed at reducing emissions;
- ❖ Observe manufacturer machinery and equipment guidelines, procedures with regard to noise as well as oil spill prevention and emergency response;

Socio-Economic Mitigation measures

- ❖ Work within the designated project area in order to reduce the spillover effects of the project to surrounding community member's property and existing social facilities;
- ❖ Work in collaboration with relevant government representatives in the project area; Develop appropriate benefits for non-beneficiary community members residing in the project area. Benefits to include community training through the proposed community centre, employment by giving the locals priority in terms of job allocations especially for activities requiring non-skilled labor. It is recommended that the proponent consider project benefits that are relevant to the community.
- ❖ Conduct workshops at community level to facilitate impact monitoring on the environment, socio-economic and socio-cultural aspects;
- ❖ Enhance security in project area through community policing in collaboration with local community members;
- ❖ Develop programs to enhance cohesion between project employees and the local communities.

Health, Safety and Environment Mitigation

- ❖ Employ trained and certified workers to install, maintain and repair the machinery and equipment;
- ❖ Employ trained and qualified machine handlers and drivers, and also promote frequent training to enhance capacity
- ❖ Ensure strict access and controls to the power facilities
- ❖ Deactivate and ensure live power distribution lines are properly grounded before maintenance work commences
- ❖ Ensure that structures are tested for integrity prior to commencing work;
- ❖ Implement fall protection programs that include training in climbing techniques and the use of fall protection measures.
- ❖ Provide and promote adequate use of PPE for all personnel and visitors to the site.

- ❖ Provide adequate and colour coded waste bins to promote appropriate waste management before disposal.

Environmental Management and Monitoring Plan

The consultants have developed an Environmental Management and Monitoring Plan to guide the project team in eliminating or reducing the project impacts to acceptable minimum/standards. The EMP is based on good environmental practices of project implementation and safety of the operations. The proposed plan can be improved through continuous monitoring and audits during the project implementation. The EMP identifies the anticipated impacts; potential mitigation measures to be undertaken, monitoring indicators, responsible parties and the estimated cost likely to be incurred to undertake the measures.

Conclusions and recommendations

The proposed construction and relocation of Brush Manufacturers Light Industrial Development at the proposed Kandara Business Park comprising of four go-downs is a key infrastructural development that will have several benefits to the local community and the country at large. The implementation of the project will also help the government in the achievement of the **Big Four Agenda** on manufacturing.

However, it is important that all the positive and negative impacts to the physical, biological and socio-economic environment are considered in the implementation of the project so as to promote sustainable development. In recognition of this, the proponent has undertaken this ESIA study so as to help in avoidance, control and mitigation of possible impacts while enhancing the resultant positive impacts. A participatory approach that involved the affected stakeholders and the general public was used in conducting the ESIA study.

The key issues of concern that were raised included changes in land use leading to possible conflicts with residential uses, safety of the development (occasioned by increased traffic), employment opportunities to local population, pollution and environmental degradation, poor drainage and waste management at the project. All the environmental and socio-economic concerns that were raised can be adequately mitigated to promote sustainable development.

It is our recommendation that the project be licensed to go ahead given its numerous environmental and socio-economic benefits both in the short and the long term.

1.0 INTRODUCTION

1.1 Introduction

According to the ministry of industrialization, the role of the manufacturing sector in the Vision 2030 is to create employment and wealth. The sectors overall goal in the Medium Term Plan is to increase its contribution to the GDP by at least 10% per annum as envisaged in the Vision 2030 (*industrialization.go.ke*).

One of the goals in the government's four agenda is on manufacturing. The government through the big four agenda, has been promoting local industrial growth so as to enhance growth of the local economy and to bring about employment creation to eradicate poverty.

With the steady growth in the economic production within the country, local investors have been encouraged to establish developments locally as the returns are favorable thus expanding the manufacturing industry in Kenya.

1.2 Project Background

Brush Manufacturers Limited is a privately owned company with its registered office and plant situated along Lunga Lunga Road, Industrial Area in Nairobi County. The Company started its operations in 1976 manufacturing a very limited range of brooms and brushes for the Kenyan market. Over the years, the company's operations have continued to grow and today the company distributes not only within Kenya but in 18 countries in East, Central, West and Southern Africa, UAE, UK and USA (*brush.co.ke*).

The company that employs a workforce of over 400 employees is involved in the manufacture of high quality brooms and brushes for industrial and home use. In addition to the manufacture of mops, drinking straws, carton strapping band, twisted ply ropes, ball pens, thermal rolls, plastic products, wooden toothpicks and stationery products among other products.

The Company's expansion has seen it grow its production capacity hence necessitating the need to relocate to a bigger facility at the proposed location. The proponent plans to relocate the facility to the proposed Kandara Business Park located along the Thika- Kangare Road.

1.3 Project Objectives

The main objective of the project was to:

- a) Establish go-downs, a borehole and a community centre and the complementary facilities and relocate to the proposed Kandara Business Park so as to accommodate the growing entity.

1.4 EIAS Objectives

The key objectives of the ESIA were to:

- a) Promote development that is sustainable and optimizes resource use and management opportunities
- b) Ensure that environmental considerations are addressed and incorporated into the development decision making process
- c) Establish impacts that are likely to affect the environment before a decision is made to authorize the project
- d) Anticipate and avoid, minimize or offset the adverse significant biophysical, social and relevant effects of development project
- e) Identify and propose the best project alternatives from the available options
- f) Protect the productivity and capacity of natural systems and ecological processes which maintain their functions
- g) Enable information exchange, notification and public consultations between stakeholders, the project proponents and the licensing authority.

1.5 Project Scope and Justification

The scope of the ESIA was to:

- a) Undertake a comprehensive baseline environmental assessment at the proposed project location
- b) Ascertain the expected social and environmental impacts of the proposed project and the magnitude of the impacts
- c) Ascertain and analyze alternatives to the proposed project
- d) Recommend mitigation measures that will be implemented during preparation, construction, operation and decommissioning phases of the project
- e) Develop an all-inclusive EMP with mechanisms for monitoring and evaluating compliance and environmental performance; which shall include the cost of mitigation and the period of executing the measures.

Pursuant to the prevailing legal requirements and to ensure sustainable environmental management, the project proponent undertook this ESIA and incorporated substantial environmental aspects as advised by the Environmental experts. This ESIA Study report thus provides relevant information and environmental considerations on the project proponent's intention to seek approval from NEMA for the implementation of the proposed project.

2.0 PROJECT DESCRIPTION

2.1 Introduction

The proposed location LR No. 8827/7 along the Thika- Kangare Road which is currently undeveloped covers an area of 100 acres. The land shall host the proposed Kandara Business Park that shall comprise of several industries located within. Currently, the site is under the construction of a boundary perimeter wall that was initially licensed by NEMA. The site is located adjacent to the Thika Greens Phase 1 & 3 and also a host of several entities including the Branan flowers and other agricultural and residential land users.

2.2 Project Design

The proposed project involves the establishment; within a portion of the leased land forming the entire parcel, of a **Light Industrial Plant** that will be housed in **Four No. go-downs** that will be used for the manufacture of several household items including; brushes, Brooms, Folders, Pens, Ropes and thermal rolls among others by the host company; Brush Manufacturers Limited. The project also involves the construction of an office block, drilling a borehole, water storage tanks, establishment of loading bays and the construction of a community centre to be used for the training of the community members. The proposed development shall make use of a sewer treatment plant whose responsibility for construction lies with the main premises owner; Kandara Business Park.

Some of the facilities to be contained in the go-downs include; Administration offices, meeting rooms, A board room, Directors offices, record and archive room, server room, Accounts room, Washrooms & cleaner's rooms, Safe room, Dining room, Kitchen and pastry among others.

In addition, the Community Centre that shall comprise of classrooms, knitting and sewing rooms and other complementary facilities.

Other included facilities include gates, a gatehouse and sentry point, waste yard and disposal areas and a workshop among other facilities.

The proposed project is geared towards the achievement of an environmentally low impact development with pollution prevention measures. Other aspects that have been incorporated to make the development more sustainable include; energy efficiency, use of sustainable materials, design and orientation of buildings taking into account solar access and skylight utilization, water management; waste water disposal; water conservation and management of storm water.

2.3 Project Establishment

The proposed development involves the following activities;

- ❖ Vegetation clearing will be done manually by use of cutlass and slashers. There are no big trees hence portable power saw mills will be not be used, hence minimizing noise

nuisance. The entire project site would be graded, paved, lighted, and surrounded by a perimeter fence. Most existing vegetation within the project site will be removed. Use of paving blocks for some paved sections will allow rain water percolation.

- ❖ The key activities involving initial site preparation including excavating the buildings foundations, assembling of structures, concrete casting and related activities.
- ❖ Modes and quantity of transport vehicles employed in the project will be Lorries and off-road vehicles. Maintenance of these vehicles will be done through licensed garages found in the project area hence there will be no on-site maintenance of vehicles.
- ❖ Some of the powered equipment expected to be used in the construction include power saw mills and compressor to break hard ground (if required).
- ❖ Both skilled and unskilled labour, artisans, technicians and engineers will be engaged in the project.

2.4 Proposed Location

The project site is located within Murang'a County, along the main Thika- Kangare Road. The site can be accessed from Thika using the main Nairobi -Embu highway. The site is located adjacent to Thika greens phase 1 &3 (Waterfalls County homes), Branam Flowers and other agricultural land. The project coordinates are Latitude: 0°58'49.53"S, Longitude: 37° 3'0.80"E.



Fig 2.1: Aerial view of the proposed project site



Fig 2.2; the proposed location where a perimeter wall fence is under construction

2.5 Land Ownership

The parcel of land (LR NO. 8827/7) located along the main Thika- Kangare road is owned by the proponent; Kandara Business Park which has leased a portion of the land to Brush Manufacturers Limited whose address is Po Box 48865-00100, Nairobi.

2.6 Project implementation

The development will be established based on the applicable building standards of Kenya, primarily the building code and the Building Operations and Works of Engineering Construction Rules. Other building standards will be incorporated including the British Building Standards *BS 8110*, *BS 5950*, *BS 4449*, and *BS 4461*. The constructions should incorporate guidelines from the planning department of the local County government, environmental guidelines from NEMA and health and safety measures from DOSHS. These standards should be followed to promote the building's integrity.

2.7 Construction Inputs and Activities

The project Inputs include the following:

- Construction raw materials- including sand, cement, crushed rock (gravel/ballast), steel, wooden fixtures and fittings to be obtained from licensed dealers.
- Construction equipment; these include delivery trucks, concrete mixers, and others that shall be required.
- Construction labor force that is both skilled and unskilled.
- Water for construction will be obtained from local area supply and private suppliers if not adequate.

2.7.1 Project Equipment and Activities

One of the main activities during the construction phase will be excavation activities to establish the buildings' foundation.

The project area is made of predominantly black cotton clay soils with seasonal impended drainage. The excavations will be carried out to establish foundations for erecting the buildings. The excavation and construction of the foundations shall involve the use of both equipment and hand tools like backhoes, excavators, crow bars, mixers, vibrators, trappers but in case of rocky areas compressors and drill will be used.

The equipment to be used in the project construction will require various forms of energy including manpower, charged battery or fossil fuels. Fuel based equipments to be used will include mixers, vibrators, compressors and drills.

The construction of the foundations will involve masonry work and related activities. General masonry and related activities to be undertaken will include concrete mixing, construction of foundations, erection of steel tower and curing of fresh concrete surfaces. These activities shall utilize labor from the neighborhood to supplement some machinery works such as that by the concrete mixers, thus creating employment for the local population.

2.7.2 Landscaping

After the successful completion of the project construction work the project contractor should rehabilitate the project area that could be subjected to clearing by planting indigenous plant species and promote regular vegetation.

2.8 Operation Inputs and Activities

2.8.1 General activities

Activities undertaken during the project operations phase include general maintenance of the facility, delivery of raw materials, transportation of finished products, clearing of overgrown vegetation, general housekeeping and repairs of any defect that can be identified at the facility.

2.8.2 Waste Management

The project proponent will be required to manage the waste generated during the operation phase of the project appropriately. This can be done by providing facilities for temporary storage or handling of the solid and liquid waste generated during the period and once ready, the bins can be emptied by the contracted company for appropriate disposal.

2.9 Description of the Project's Decommissioning Activities

2.9.1 Demolition works

Upon decommissioning, the components of the project will be uninstalled and/or demolished. This will produce a lot of solid waste, which can be reused for other projects and construction works or if not reusable, disposed of appropriately by a licensed waste disposal company to the NEMA recommended waste disposal areas.

2.9.2 Site Restoration

Once all the waste resulting from demolition and dismantling works is removed from the site, the site should be restored through replenishment of the topsoil and re-vegetation using indigenous plant species so as to return the site to its original state.

3.0 BASELINE INFORMATION

3.1 Murang'a County

Murang'a County is one of the five counties in the Central region of the Republic of Kenya. It is bordered to the North by Nyeri, to the South by Kiambu, to the West by Nyandarua and to the East by Kirinyaga, Embu and Machakos counties. It lies between latitudes 0° 34' South and 1° 07' South and Longitudes 36° East and 37° 27' East. The county occupies a total area of 2,558.8Km² (*murang'a.go.ke*).

The county lies between 914m above sea level (ASL) in the East and 3,353m above sea level (ASL) along the slopes of the Aberdare Mountains in the West. The highest areas in the west have deeply dissected topography and are drained by several rivers. All the rivers flow from the Aberdare ranges to the West, South Eastward to join Tana River.

The county is divided into seven constituencies; Kiharu, Kangema, Mathioya, Gatanga, Kigumo, Kandara, and Maragua. The project site lies within Kandara constituency with a population of 156,667 according to the census conducted in 2009.

3.2 Ecological conditions

The county is composed of six agro-ecological zones. Zone 1 consists of the highest potential areas where forestry, tea and tourism industry are the major economic activities. Zones 2 and 3 are the lowlands east of Aberdares, which are generally suitable for both coffee and dairy farming. The flat area of Makuyu division in Maragua constituency is characterized by arid and semi-arid conditions. This forms the agro-ecological zones 4, 5, and 6. In these zones, coffee and pineapple plantations thrive under irrigation

3.3 Physical Environment

The Physical environment can be described as the natural features of a project area. These include the geology, climate, topography and soils among others.

3.3.1 Climate

There are two rainfall seasons in the county i.e. Long rains (March –May) and Short rains (October - November). The highest potential areas receive an average annual rainfall of between 1400mm and 1600mm. Low potential receive rainfall less than 900mm per annum. Rainfall in high and medium potential areas is reliable and well distributed throughout the year and is adequate for cultivation. However on low potential areas rainfall is unevenly distributed and therefore unsuitable for cash crop production. Temperatures vary with altitude.

The mean annual temperature ranges from 13⁰ C -28⁰ C, minimum annual temperatures range between 14°C and 18°C and the mean maximum temperature ranges from 26-30⁰ C ideal conditions for rearing of livestock and farming.

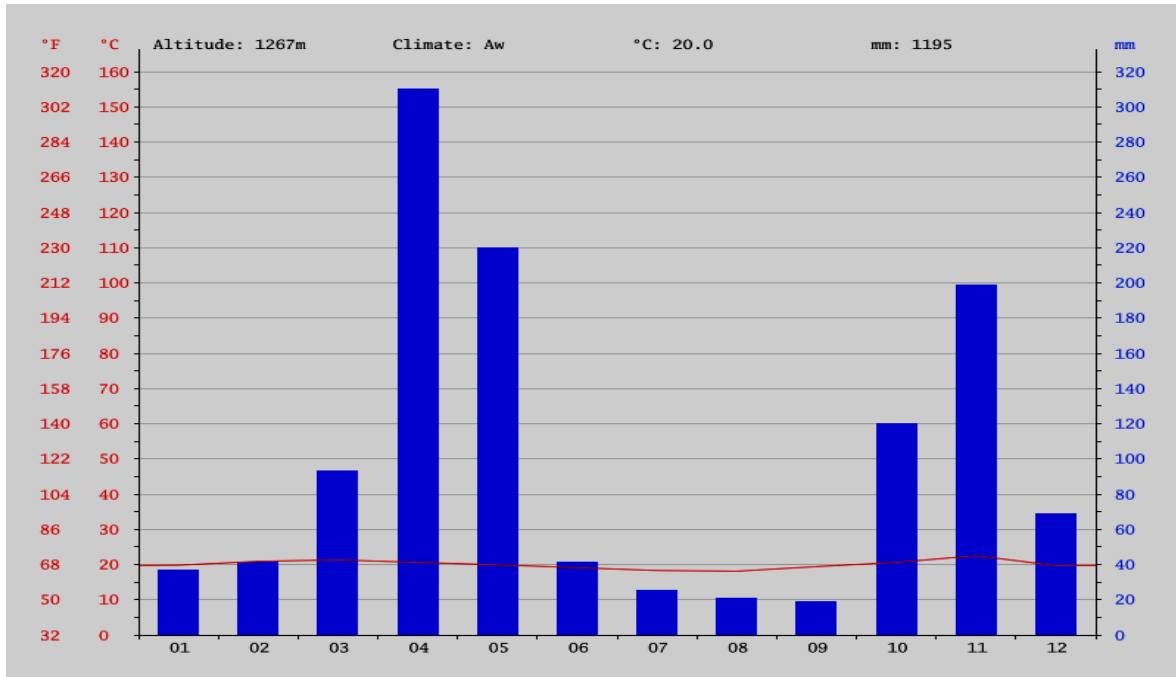


Fig 3.1 Murang'a climate data graph (source; Climate-Data.org)

3.3.2 Geology and Hydrology

The land rises gradually from an altitude of 914m in the East to 3,353m above sea level along the slopes of the Aberdares. The surface water and sub-surface water resources in the Division are adequate. There are a number of springs, wells and boreholes. Reliability of these water sources is very high. A substantial percentage of households in the division also harness rain water through roof catchment. Underground water resources are greatly exploited and boreholes drilled. The depth of groundwater in the proposed site is unknown and in future the industry may decide to drill a borehole to supplement water from municipal council.

3.3.3 Soils

Variations in altitude, rainfall and temperature between the highland and lowland coupled with the differences in the underlying geology of both volcanic and basement system rocks give rise to a variety of soil types. Highland areas have rich brown loamy soils suitable especially for tea, Coffee, maize and dairy farming are practiced. Soils in the lower areas are predominantly black cotton clay soils with seasonal impeded drainage. The proposed site is located on an area of medium potential and can be described by above facts.

3.3.4 Humidity

Being some 250 miles from the sea, Murang'a does not experience the rather unpleasant humid heat which is so characteristic of tropical coastal towns, although there is a very marked daily range of relative humidity. In the early mornings the air is frequently at or very close to saturation, but in the afternoons the humidity is usually about 50% and may fall as low as 10% on clear sunny days in February and March.

3.3.5 Water resources

Murang'a County's water resources are rivers, shallow wells, springs, dams, boreholes and roof catchment. There are 10 permanent rivers, 400 shallow wells, 75 springs, 30 dams and 100 bore holes that supply water for domestic and agricultural use in the county. All these sources supply 60 per cent of the county population with clean and safe drinking water.

3.4 Biological Environment

The area has been colonized by trees, grass, weeds and shrubs that will be cleared to give way to this development. Predominant vegetation in the area mainly consists of jacaranda, grivellia, croton megalocarpus, umbrella tree, some grass vegetation and other indigenous vegetation.

The fauna in the area include; a variety of rodents such as rats, squirrel and hare. Reptiles include snakes and lizards, birds such as crows and eagles, insects that include butterflies, grasshoppers, and ants among others.

3.5 Infrastructure and services

3.5.1 Roads and Accessibility

The project site can be accessed through the main access route Thika- Kangare road. The proposed project site is located adjacent to Thika Greens phase 1&3.

3.5.2 Water supply

The county has 27 water supply schemes and about 16 irrigation schemes. Water supply schemes are managed by three different entities. There are some which are managed by the water companies, the department of water and others by the community members through water project committee. The irrigation schemes managed by the community members get funding from community's own initiatives as well as through government and development partners' support.

At the project area, water supply is mainly by the contracting and buying from neighbours however the proponent has harvested rain water by preserving a small spring on the site to provide water during construction. Owing to the foreseen increase in demand from the proposed project especially during operational stages, the proponent intends to drill a borehole and install underground water tanks that will help to supply the entire facility.

3.5.3 Sewer system and sanitation

About 99.78 per cent of the households in the County use toilet facilities. Out of these, 4.97per cent use flush toilets, 3.97per cent use VIP latrines while the others use ordinary pit latrines. The majority of people living in the market and trading centres use ordinary pit latrines.

There is no conventional local authority sewer system that serves the project area. This area lacks the central sewer system hence residents rely on pit latrines and toilets which make use of septic tanks for waste disposal which are then emptied by exhausters and the same septic tank is reused again. The project proponent will install a sewer treatment plant that will serve the entire facility.

3.5.4 Surface drainage

The surface drainage around the project site is poor due to the soil type hence water logging the road especially when raining is anticipated. The project proponent is laying appropriate measures to prevent potential water logging on site. The proponent intend to improve the drainage of the area through construction of drainage system in the site to prevent potential water logging.

3.5.5 Solid waste management

There is no robust solid waste management facility in the County, solid waste management has also not been streamed lined in the area. The County Government's capacity to collect solid waste is limited as they are not able to serve the entire county. Private developers rely on private firms to dispose of the waste at a fee. The proponent intends to contract a NEMA registered waste handler to deal with the waste. A private firm for the waste management at the project site will be sourced. Majority of the waste generated is however recyclable.

3.5.6 Energy

The area is well served by electricity from the national grid. A power line passes next to the proposed site where the project proponent will be able to tap electricity from should there be need to and adequate electrical power supply is available in the area. There are no issues concerning the power supply especially in regards to overload or power surges.

3.5.7 Communication

The area is served with vast communication networks including Safaricom, Airtel and Orange phone networks. Several internet providers are also in the area such as Safaricom, Airtel, Zuku, Orange and others.

3.5.8 Security

The areas proximity to the other commercial and residential facilities such as Thika Green golf club, Thika Green residential, KALRO among others and this has greatly enhanced its security. There no major security issues reported in the project area in recent time. Despite the fact, administration police post is located just adjacent to the site. Furthermore the proponent is going to install security lights and day and night guards at the site will be employed to improve security at the site.

3.6 Socio-Economic Environment

3.6.1 Land use

The prevalent land uses revolve around small scale agricultural activities and residential development. The area is of rural set-up however recently there is much potential in transformation to urban setting.

3.6.2 Population and Housing

The 2009 Population and Housing Census recorded a population of 936,228 persons for Murang'a County consisting of 451,751 males and 484,477 females and a growth rate of 0.4 per cent per

annum. This population is projected to rise to 1,128,177 in 2018; 1,173,602 in 2020 and 1,214,071, persons in 2022 (Murang'a CIDP 2018-2022).

The area is sparsely populated as the residents prefer to stay near the town centers. However, there has been an upsurge of many residents to the area due to new settlements into the area. Demand for housing has been rising with the consequent demand for building materials also increasing.

3.6.3 Public Health

There are no health and safety issues or disease outbreaks around the project area currently. During the construction, the project will not have many people staying within the compound save for the security personnel and the caretaker. However, during the operation phase, the number of resident personnel will increase but this will be dependent on the operation hours of the facility whether during the day or 24hr system. Hygiene at the facility should be a key priority at all times of the project cycle.

3.7 Main wildlife

The main wildlife in the county are elephants. Other wildlife in the county is Columbus monkeys and their related species. Elephants are the major source of human-wildlife conflicts especially in Mathioya and Kigumo constituencies. This is due to the constituencies' proximity to the Aberdare forest which forms the wildlife habitat. Vervet species of monkeys have also created conflicts with humans especially in Gatanga Sub County.

3.8 Major Industries

Most of the industries in Murang'a County are agro-based industries with coffee being the leading followed by tea. Most of the factories produce semi- finished products which are exported to other counties then internationally as raw materials and do not fetch optimum prices. Therefore, there is need for the factories to refine and package the end products so that there is optimum returns and creation of more employment opportunities in the county. Only a few factories like Del Monte and Farm Nut produce finished products and hence are some of the largest employers. The county has potential for more industries especially in mango, banana and milk processing. Pottery remains unexploited, where finished products of clay are exported. However, clay soil is currently exported to other counties.

3.9 Main Forest types and size of forests

The county has five indigenous gazetted forests covering a total area of 254.4 Km². They are Gatare, Karua, Kimakia, Kiambicho and Wanjerere forests. These forests are divided into two zones; the tropical montane forest zone located along the Aberdare ranges and the semi-arid forest zone located in the lower parts of the county. Residents engaged in farm forestry are 282,744, there are 204,557 farm forests, which are privately owned plantations and the average number of trees per farm is 105.

The proposed location does not fall under a gazetted/ un-gazetted forest area.

4.0 ENVIRONMENTAL LEGISLATIVE AND REGULATORY FRAMEWORK

4.1 Legal Framework

There are a number of legislations and regulatory frameworks that the proposed development will have to consider in order for the development to be in full compliance with their guidelines and requirements. This EIA outlines them below and gives suggestions of how the development can comply and steps taken by the proponent in compliance.

4.2 Constitution of Kenya (2010)

Article 42- Environment; Indicates that every person has the right to a clean and healthy environment, which includes the right to –

- Have the environment protected for the benefits of present, future generations through legislative and other measures, particularly those contemplated in Article 69, and
- Have obligations relating to the environment fulfilled under Article 70.

Parliament has established systems for EIA and EA required under Article 69 of the constitution through which environmental protection and sustainability can be enhanced. It is also the duty of the proponent to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

Compliance

- *The proponent will ensure that their activities are conducted in a way that ensures sustainable use of water, energy and other resources.*
- *The proponent will continue to comply with environmental legislations related to their activities notably those that arise from the EMCA CAP 387.*

4.3 Environmental Management Coordination Act (CAP 387)

The EMCA Cap 387, and its Attendant Environmental (Impact Assessment and Audit) Regulations of 2003 Provides for the establishment of an appropriate legal and institutional framework for the management of environment in Kenya. The Act introduces two important aspects of urban environmental management, which are directly related to the project: EIA and EA.

Section 31 (1) has underscored that an EA study shall be undertaken on development activities which are likely to have adverse environmental impacts. Such projects include

- a) Ongoing projects commenced prior to the coming into force of the EIA/EA regulations (that is prior to 1999)
- b) New projects undertaken after completion of an EIA study report.

Section 31 (3) (a) further states that in the case of an ongoing project:

- i. An initial EA study followed by subsequent environmental control audit studies as may be necessary at such times as shall be agreed upon by the Authority and the proponent

- ii. An initial EA to provide baseline information upon which subsequent environmental control audit studies shall be based and
- iii. An EA study based on baseline information provided in the environmental impact assessment report study.

Compliance

- The proponent will implement the proposed EMP and adhere to the recommendations from the authority.*
- The proponent will continue to adhere to subsequent EMCA legislations such as the noise and waste regulations throughout the cycle of the project.*

4.4 The Environmental (Impact Assessment and Audit) Regulations, 2003

Under these regulations, Section 4, (1) No proponent shall implement a project -

(a) Likely to have a negative environmental impact; or (b) for which an EIA is required under the Act or these Regulations; unless an EIA has been concluded and approved.

Under section 31 (1) an EA study shall be undertaken on the following development activities which are likely to have adverse environmental impacts -

- (a) Ongoing projects commenced prior to the coming into force of these regulations; or
- (b) New projects undertaken after completion of an EIA study report.

Compliance

- The proponent should commence the project once the EIA license has been acquired from the Authority.*

4.5 Environmental Management and Co-ordination (Waste Management) Regulations 2006

These regulations are divided into various sections dealing with different aspects of wastes and facilities. They define the responsibilities of waste generators and define the duties and requirements for transportation and disposal of waste. It provides for mitigation of pollution and provides for hazardous and toxic wastes.

Responsibility of the waste generator

- i. No person shall dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle.
- ii. Any person whose activities generate waste shall collect, segregate and dispose or cause to be disposed of such waste in the manner provided for under these Regulations
- iii. Without prejudice to the foregoing, any person whose activities generates waste has an obligation to ensure that such waste is transferred to a person who is licensed to transport and dispose of such waste in a designated waste disposal facility.

4.6 Environmental Management and Co-ordination (Water Quality) Regulations, 2006

The law is based upon the principle that everybody is entitled to a healthy and clean environment. These Regulations shall apply to drinking water, water used for industrial

purposes, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife, and water used for any other purposes.

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

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

Compliance

The proponent has to strictly adhere to the provisions and requirements of these regulations. They have ensured all applicable water standards are observed to provide clean, safe water for all purposes.

The proponent ensures that water used at the facility for domestic purposes is of required quality

Small quantities of water are only used for cleaning and drinking purposes.

4.7 Environmental Management and Co-Ordination (E-Waste Management) Regulations, 2013

These regulations under section 3 (1) applies to all categories of electrical and electronic equipment as set out in schedule 10 and facilities for transportation, recycling, re-use and recovery as provided for herein.

These regulations under responsibility in section (11) require that the generator of this kind of waste shall ensure e-waste is segregated from other forms of wastes and is taken to licensed refurbishers, collection centres or recyclers.

Under E-WASTE- Control and handling, section 15 (3) Any person importing e-waste referred to under these regulations from within Africa into Kenya shall apply to the Authority for a permit in accordance with the prescribed format upon payment of the prescribed fee set out in schedule 10;

4.8 The Energy (Solar Photovoltaic Systems) Regulations, 2012

According to section 2 (1), these regulations applies to a solar PV system manufacturer, importer, vendor, technician, contractor, **system owner**, a solar PV system installation and consumer devices.

In regards to use and disposal of the solar PV systems and components, section 10. (1) All manufacture, sale, installation, use and disposal of solar PV systems and components shall be in accordance with the provisions of the EMCA, No 8 of 1999 and the OSHA, No 15 of 2007.

4.9 Noise and Excessive Vibrations Pollution (Control) Regulations

Part II section 3 of the regulations state;

i. Except as otherwise provided in these Regulations, no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment .

Compliance

□ *Ensure noisy machinery that exceed recommended levels is fenced during all project's phases, additionally, notices to the public be erected informing of noisy activities at all phases should noise exceed the noise limit levels. Adequate noise control measures should be applied.*

4.10 The Tobacco Control Act, 2007

This is an act of Parliament to control the production, manufacture, sale, labelling, advertising, promotion and sponsorship of tobacco products and use of tobacco products, including exposure to tobacco smoke to provide for the Tobacco Control Board, to regulate smoking in specified areas and for connected purposes. This among other reasons help to;

□ Protect and promote the right of non-smokers to live in a smoke-free environment;

Section 32 provides for the right to a smoke free environment;

(1) Every person has a right to a clean and healthy environment and the right to be protected from exposure to second-hand smoke.

(2) Every person has a duty to observe measures to safe guard the health of non-smokers.

Whereas section 33, prohibits smoking in certain areas;

(1) No person shall smoke in any public place among other places and facilities as listed in subsection 2.

Section 34 calls for the display of notices.

(1) The manager or owner of a prohibited smoking area shall cause to be displayed therein, clear and prominent notices in both English and Kiswahili, stating that smoking is prohibited and the prescribed penalty therefore.

Section 35 calls for establishment of specially designated smoking areas;

(1) Notwithstanding the foregoing provisions of this Part, the manager or owner of a prohibited smoking area may provide specially designated smoking area within such place:

Compliance

The proponent should have written notices informing the persons in the area not to smoke in undesignated areas.

4.11 National Environmental Action Plan (NEAP)

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

Compliance

The proponent has achieved compliance through the EIA process and by engaging NEMA lead experts to advise on the process.

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

The Brundtland Commission addresses the environmental aspects of development. It has emphasized on sustainable development that produces no lasting damage to the biosphere and to particular ecosystems. In addition to environmental sustainability is the economic and social sustainability. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resource.

The proponent should be committed to adhere to the proposed EMP to ensure environmental enhancement and this would first be monitored through the initial environmental audit.

4.13 National Policy on Water Resources Management and Development

It enhances a systematic development of water facilities in all sectors for the promotion of the country's socio-economic progress, and recognizes the by-products of these processes as wastewater. It calls for development of appropriate sanitation systems to protect people's health and water resources from pollution.

The proponent has conducted a detailed analysis of the hydrology and water resources in the area, the project shall make use of the STP.

4.14 OSHA 2007

The Act aims at making provision for the health, safety and welfare of persons employed in factories and other places of work. Section 13 states that every factory shall be kept in a clean state and free from effluvia, arising from any drain, sanitary convenience or nuisance. Effective and suitable provisions is also proposed for securing, maintaining by circulation of fresh air in each workroom, the adequate ventilation of the room. Section 36 provides for precautions with respect to explosive inflammable dust or gas. The Section is specific that where in any building, if dust that could escape to work man's room and explode by ignition, steps must be taken to prevent such an explosion.

Section 41 compels that in every factory; there shall be maintained fire extinguishers, which shall be adequate and suitable in case of fire out breaks. Similarly, it mandates every factory to provide adequate means of escape in case of fire outbreak for the employees. The Act further requires that if a factory worker is employed in any process involving exposure to wet or to any injurious or offensive substance, suitable protective clothing must be provided by the employer.

Compliance

The proponent will appoint a reputable contractor who will be responsible for enforcing the requirements during construction and subsequent repairs and maintenance after project completion to safeguard the safety of all workers. All personnel should be provided with adequate personal protection.

4.15 The Physical Planning Act (Cap 286)

This is the principle Act governing land use planning in Kenya. The Physical Planning Act (Cap. 286), which commenced on 29 October 1998, aimed at developing a sound spatial framework for co-existence, through plan proposals that enhance and promote integrated spatial/ physical development of socio-economic activities. Because building/construction of residential houses

constitutes making of material change to land, the activity constitutes “development”, hence need to be controlled by local authorities. From the foregoing, the Physical Planning Act (Cap. 286) has made specific provisions in respect to the mandate of local authorities in the need for physical planning.

The project proponent is required to acquire approvals from the relevant institutions as set out in the Act and the architectural drawings of the proposed project have been approved by the County government of Murang’a.

4.16 The County Government Act, 2012

The County Government Act was enacted in 2012 to give effect to chapter eleven of the constitution of Kenya (2010) and to provide for county governments powers, function and responsibilities to deliver services and for connected purposes. The county government act repealed the Local Government Act and transferred the functions of the defunct Local Authorities to the County Government.

In compliance, the proponent should adhere to the County Government By-Laws, requirements, approvals and licenses.

4.17 Land Control Act (Cap 302)

Section 6(1) – Each of the following transactions;

- a) The sale, transfer, lease, mortgage, exchange, partition, or other disposal of or dealing with any agricultural land which is situated within a land control area;
- b) The division of any such agricultural land into two or more parcels to be held under separate titles, other than the division of an area of less than twenty acres into plots in an area to which the Development and Use of Land (Planning) Regulations, 1961 for the time being apply;
- c) The issue, sale, transfer, mortgage or any other disposal of or dealing with any share in a private company or co-operative society which for the time being owns agricultural land situated within a land control area; is void for all purposes unless the land control board for the land control area or division in which the land is situated has given consent in respect of that transaction in accordance to this Act.

Kandara Business Park, who is the owner of the land has acquired approvals for the grant of lease to the proponent in the proposed development. The necessary transfer documents have been signed between the current land owner and previous land owner

4.18 Building Code 2000

In recognition of the role of local authorities as lead planning agencies, the adoptive by-law compels any potential developer to submit development application to relevant local authority for approval. The local authorities are empowered to disapprove any plan submitted if it is not correctly drawn or do not provide sufficient information that complies with the by-law. Any developer, who intends to erect a building such as a residential block, must give the concerned local authority a notice of inspection, before the erection of the structure. After erecting the

building, a notice of completion shall be issued to the local authority to facilitate final inspection/approval. No person shall therefore occupy a building whose certificate of completion has not been issued by the local authority. As a precaution against fire breakout, the by-law states that the walls of any premise shall be non-combustible throughout, similarly, in every building, other than a small house, which comprises more than one storey, shall have fire resistance. The by-law, in Section 214 indicates that in any public building where floor is more than 20 feet above the ground level, the council may recommend the provision of firefighting equipment that may include one or more of the following: hydrants, hose reels and fire appliances, external conations, portable fire appliances, water storage tanks, dry risers, sprinkler, drencher and water spray spring protector system.

All approvals should be sought before commencement of the work and regular monitoring follow to ensure compliance with set standards and conditions.

4.19 Public Health Act- (Cap. 242)

Environmental degradation may pose a health hazard to the general public. This is among the factor considered by the Public Health Act to constitute “nuisance”. For the interpretation of the Act, Section 15 (IX) indicates that any noxious matter or wastewater discharged from any premise, such as a building constitutes nuisance. Any premise not kept in a clean and free from offensive smell such as gases which are injurious to health such as those from commercial establishments shall therefore generate nuisance. The act therefore stresses that no person shall cause a nuisance to exist on any land or premise occupied by him. Because of the above, the Act acknowledge that it shall be the duty of all local authorities to take all lawful measures for maintaining its district at all times in a clean and sanitary condition for remedy of any nuisance or condition liable to be injurious to health. To safeguard against this, Part X of the Public Health Act states that where in the opinion of the Health Officer that food stuff within a warehouse, or a building are insufficiently protected, the owner shall be compelled to observe regulations else he shall be guilty of an offense.

The sewerage system should be connected properly for effluent discharge within the project. The solid waste should be handled by a NEMA registered garbage collector on regular basis and disposed appropriately as per regulations. Sanitary facilities should be in conformity with MOH standards and installation of standard fittings.

4.20 The Water Act, 2002

Part II, section 18, of the Water Act, 2002 provides for national monitoring and information systems on water resources. Section 73 of the Act allows a person with license (licensee) to supply water to make regulations for purposes of protecting against degradation of water sources. Section 75 and sub-section 1 allows the licensee to construct and maintain drains and other works for intercepting, treating or disposing of any foul water arising or flowing upon land for preventing pollution of water sources within his/her jurisdiction.

The proponent shall tap the local authority water and upper storage water tanks a borehole will be provided for emergency water uses in future.

4.21 The Penal Code (Cap. 63)

The chapter on “Offences against Health and Conveniences” contained in the Penal Code enacted in 1930 strictly prohibits the release of foul air into the environment, which affects the health of other persons. Any person who voluntarily violates the atmosphere at any place, to make it noxious to health of persons in general dwelling or carrying out business in the neighbourhood or passing along public ways is guilty of misdemeanor, i.e. imprisonment not exceeding two years with no option of fine. Under this code, any person who for the purpose of trade or otherwise makes loud noise or offensive awful smell in such places and circumstances as to annoy any considerable number of persons in the exercise of their rights, commit any offence, and is liable to be punished for a common nuisance, i.e. imprisonment not exceeding one year with no option of fine.

4.22 The World Commission on Environment and Development

The commission commonly referred to as “the Brundtland Commission” focused on the environmental aspects of development, in particular, the emphasis on sustainable development that produces no lasting damage to biosphere, and to particular ecosystems. In addition, environmental sustainability is the economic and social sustainability. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resources. While social sustainable development maintains the cohesion of a society and its ability to help its members work together to achieve common goals, while at the same time meeting individual needs for health and well-being, adequate nutrition, and shelter, cultural expression and political involvement.

4.23 The Rio Declaration on Environment and Development

Agenda 21- Principle No. 10 of the declaration underscored that environmental issues are best handled with participation of all concerned citizens at all the relevant levels. Effective access to judicial and administrative proceedings, including redress and remedy shall be provided. The foregoing discussion is relevant to the proposed development because EMCA demands that the public must be involved before any development project that is likely to have adverse impacts to the environment is initiated by a proponent. The Act has further established Public Complaints Committee (PCC) where the issues raised by the public in regard to any proposed development can be addressed.

4.24 Regulatory Institutions

4.24.1 National Environment Management Authority

The Authority is established to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment. Its mandate includes implementation of various Legal Notices and regulations.

4.24.2 Directorate of Occupational Safety and Health Services

The department is mandated to implement all rules pertaining to the protection and prevention of workers from occupational hazards and ensure safe working environment. The Directorate implements the OSHA, 2007 and various rules made there under.

4.24.3 Ministry of Health

The mandate of the MoH is to support the attainment of the health goals of the people of Kenya by implementing priority interventions in public health, guided by various implementation plans and the wider health sector. The ministry is involved in prevention of communicable and non-communicable diseases, health promotions, and curative services at all levels. The department of environmental health and sanitation aims to reduce disease burden arising from environmental pollution, by preventing disease transmission from general environmental health pollutants

4.24.4 The County Government of Murang'a

The County government of Murang'a is the principle lead agency on all matters pertaining to planning within the proposed site. The County Government Act (Cap 265) clearly defines the functions of this key institution. Section 166 empowers them to be responsible for local planning and development control in the region. The Physical Planning Act (Cap 286) also confers upon County Governments the powers to control development in their areas of legal jurisdiction. Section 29 (a) has granted all County Governments in Kenya, the local county government being no exceptions, the power to prohibit or control the use and development.

4.25 Conclusion

By carrying out this ESIA, the proponent has complied with the EMCA CAP 387 which require that an ESIA is carried out for a project of such magnitude. Others include the permits issued by the local authority i.e. County Government of Murang'a and has proposed effective mitigation measures as provided in the environmental management and monitoring plan and the environmental management framework in this report in compliance with the County Government Act. The proponent should dump the waste in NEMA approved sites. The proponent has conducted public consultations with the affected neighbours especially those in the vicinity of the proposed development likely to be directly affected and the questionnaires are annexed in the report.

5.0 POTENTIAL IMPACTS

5.1 Positive Environmental and Socio- economic Impacts during construction and operation

The development of this project will have a number of significant positive impacts both locally to the projects neighbours and nationally to the public.

5.1.1 Economy

The project will introduce a significant amount of money, into the economy directly and much more indirectly over time. During the construction phase, a certain percentage of the total project cost will go into wages and salaries. That will increase capital flow in the economy. In effect, this will support economic empowerment, domestic investment and poverty alleviation in Kenya particularly in the neighborhood and Murang'a County in general. The supporting local domestic investment is vital as this is an important step towards self-sufficiency and poverty alleviation. The project supports domestic investment and wealth creation.

5.1.2 Infrastructural development

The road infrastructure leading to the site has been improved. This shall not only benefit the project proponent but also neighbours since the driveway to the site serves other businesses in the area. The road infrastructure will be developed by the proponent so as to deliver construction materials.

5.1.3 Employment

The project will directly create employment to a large number of people both directly and indirectly in the construction, operation and decommissioning phases. The ripple effect will mean a significant number will improve their lifestyle and living conditions and that of their dependents. Benefit is also bound to trickle down to service providers and producers (of materials and construction products). The result is a multiplier effect to the development of the local economy and the Kenyan economy. During the operation phase, there will be a significant increase in the people working in the area and this will promote the economy of the country both directly and indirectly. The Government is committed to providing sufficient jobs annually especially for its urban populations. At the moment, unemployment stands out as a major problem in Kenya.

5.1.4 Market Supply for small traders

Once there are workers in the facility, there shall be demand for the local produce who shall act as source of income to the local traders. A market that was not available shall thus be availed by the new facility. At construction, food suppliers will deliver food to the site workers. There will be an increased demand for residential houses when the project begins operations.

5.1.5 Provision of social facilities/ welfare

The proposed development will establish a community centre that will be used to build capacity for the local population for various activities. This shall go a long way in promoting the welfare of the local community through undertaking various economic activities. This shall also lead to avoidance of social evils hence grow the economy of the local community.

5.1.6 Improved land utility

The land utility of the area will be improved in comparison to the present state owing to the proposed development. In addition, the general appearance of the site will be changed. The project proponent should ensure there is landscaping at the end of the construction exercise so as to further beautify the site.

5.2 Positive environment and socio-economic impacts during decommissioning

5.2.1 Restoration of disturbed land

Rehabilitation of the project site will be carried out to restore the site to its original status or to a better state than it was originally. This will include replacement of topsoil and re-vegetation, which will lead to improved visual quality of the project sites.

5.2.2 Reduced environmental pollution

Decommissioning will obviously lead to reduced air, water, soil and general environmental pollution that is associated with the projects operation phase.

5.2.3 Reduced or no negative impacts of operation

All the negative impacts will cease after decommissioning of the project.

5.3 Potential Environmental Impacts

<i>Checklist identifying potential impacts from the project</i>					
Impacts generated on;	Project stage				
	Design	Construction	Operation	Decommissioning	Remarks
Water -Pollution -Water balance/ hydrology -Surface flow/ Site drainage		* * *	* *	* *	There is no effect to the orientation of the general area and obstruction to the flow of both surface & ground water as they are non-existent. The project will increase the proportion of paved surface due to increased parking space and access carriage ways, the paved surfaces may negatively affect water infiltration and this will result in heavier run off when it rains as little water will be absorbed into the ground. This may to a small extent interfere with the drainage cycle of the area. In addition, runoff will result from increased impervious surfaces such as roofs, & paved areas. Use of rainwater harvesting and suitable storage will reduce runoff and improve surface drainage. There will be increased abstraction of water which may reduce the underground water level. Hence there is need to monitor ground water level and encourage staff to use water sparingly. The proponent has included landscaped gardens into the design which are positive.

Air -Air pollution, -Increased noise Pollution and dust generation		*	*	*	During construction & decommissioning, dust and exhaust emissions from machinery may affect air quality. Hooting and vibrations will increase noise levels. The project activities will increase the amount of garbage produced and should be handled well by the council and a private garbage handling firm contracted by the project proponent. Planting trees in the buffer zone with the residential area will be a major advantage to positive air quality.
Climate -Temperature change -Increased evaporation			*	*	Clearance of vegetation for the construction may negatively affect the ecology of the project site due to reduced water percolation and reduced vegetation on site.
Soil -Soil loss -Dunes Toxicity/contamination -Compaction		*	*	*	Earthworks during construction and decommissioning will have an impact on soil erosion. Use of defective machinery might result in oil spills, polluting the soil. Incorporating appropriate soil conservation measures and proper drainage will mitigate this. Avoidance of off road driving and controlled earthworks will help to mitigate any negative impacts.
Bio- diversity -Loss of flora -Loss of fauna -Extinction of species -Habitat alteration		*		*	There is no vegetation at the site or fauna that is threatened with extinction, Impact will hence be minimal. There are minimal trees on site and there is need to landscape the area with as much as probable vegetation so as to promote the ecology of the area. The proponent has intentions to have landscaped gardens which are good in the promotion of the hydrological cycle.
Population -Cultural alterations -Pollution -Diseases -Quality of life -Social		*	*	*	There will be an increase in dust, noise & activities that could impact negatively on public health of neighbouring residents during the construction and decommissioning phases. New people at the site might introduce different cultural beliefs and habits too. Increased populations will increase levels of interaction among new people and may also lead to competition of the resources in the area. The living standards of the locals will improve owing to creation of employment opportunities.
Others -Landscape -Environmental Opportunities -Economy		*	*	*	Construction activities will create jobs during the construction period and improve on the economic and social welfare. This will lead to new businesses hence more employment opportunities. During construction, visual intrusion is attributed to construction but will be cleared after and landscaping done to improve the aesthetic value. Planting trees in the buffer zone with the residential area will be a major advantage in improving the aesthetics. Revenue will also increase to the proponent, workers, transporters, hardware dealers and the government.

* A symbol denoting an impact.

Negative environmental impacts and mitigation measures

5.4 Negative impacts

The proposed development may produce few minor negative impacts to the environment necessitating appropriate mitigation measures. This is at the initial site preparation, construction and decommissioning phases. These impacts arise majorly from the implementation of the project.

The impacts include the following;-

5.4.1 Air quality

The dust and suspended matter from the site preparation and construction process will affect the air quality in the project site by generation of dust. This will be at its peak during the site preparation and at the decommissioning phase. This may spread to the nearby vegetation and buildings. This might lead to an increase in respiratory problems and incidences of flu among children especially those in the neighboring homesteads in the adjacent premises that are occupied. This impact is short term and will last with the construction process of the project; the overall outcome is largely beneficial however.

Other emissions that may get into the environment include Sulfur Oxides (SO_x), Nitrogen Oxides (NO_x), Carbon Oxides (CO_x), lead and cadmium from motor vehicles and other equipment that will be used to deliver raw materials. The exhaust from construction machinery will be the main contributor of this during the construction phase. The magnitude of these emissions will not be significant, as they lie below the mean concentration limits of the WHO.

Potential Mitigation Measures

- Carryout regular maintenance on all plants components of construction equipment to minimize generation of hazardous gases and other suspended particulate matter.
- Locate haul-roads, and stockpiles away from sensitive receptors consider prevailing wind directions
- Consider installation of a dust screens if the problem persists
- The project proponent should spray water during the construction work for dust suppression
- The speed and movements of construction vehicles need to be controlled so as to reduce dust.
- Plant trees in the buffer zone with the residential area
- Provide PPE and materials/ clothing and others and train the workforce on how to use them

5.4.2 Soil/ geology

The geology of the site is not likely to be impacted significantly. Initial assessments indicated that the ground is suitable for construction of buildings and sewage systems. Impacts on soil will include soil erosion especially during decommissioning and construction. Minimal soil will be blown by the wind in the form of dust owing to the nature of the activities. It however is likely that some soil will be lost through erosion during the construction especially before the new vegetation has colonized the environment. The erosion will be aggravated by the removal of vegetation, which helps keep the soil intact, and acts as a windbreaker. Soil compaction through vehicles delivering raw materials is likely to occur at the site during decommissioning and construction- reducing soil air content, water infiltration and plant root penetration. Oil from the

heavy machinery is also likely to contaminate the soil but only if it is not in good condition. The magnitude of this impact will depend on the machinery condition largely and storage of petroleum products on site.

Potential Mitigation Measures

- Provision of soil conservation structures on erosion prone areas of the site
- Manage storm water effectively to avoid the erosion of loose soil
- Re-surface open areas after completion of the project and introduce vegetation after completion
- All machinery should be keenly maintained not to allow leakages of oil to the ground.
- All oils should be stored and sold to recyclers such as timber yards to treat timber against termites
- Ornamental trees need to be planted to improve the aesthetic quality of the project site
- If and where possible, the existing natural vegetation should be retained as part of the built landscape

5.4.3 Water demand/ Hydrology

The proposed development will result in an increased water use especially during the construction and operation. Water is a major issue of concern in most areas but an evaluation of the amount of water available *vis-à-vis* the demand expected on the site reveals that there will be sufficient supply of water for the activity. Much of the water will be required during the construction period hence a borehole will be drilled at the site to meet this demand. Lack of vegetation to hold the soil particles together will lead to soil erosion during the construction period.

Potential Mitigation Measures

- Encourage water reuse during construction and decommissioning phases
- There should be enough water storage facilities in the project site.
- Drill own borehole at the site

5.4.4 Sewage and effluent

Effluent waste water resulting from the construction activities is of significant concern with respect to the environment. The groundwater is of relatively good quality and is safe for drinking purposes hence the waste should not be allowed to contaminate it. Much of the waste water generated should be recycled to avoid waste. The quality of groundwater should be promoted as it is a major source of water to several residents.

Potential Mitigation Measures

- There should be proper collection and direction of waste water to the waste collection point.
- There should be drains that provide the proper direction of storm water to the main sewer line
- There should be proper decommissioning of waste water

- There should be incorporation of absorption pits during landscaping to allow for water percolation

5.4.5 Noise and Vibrations

This project is going to produce relative low noise due to its nature. Much of the noise is going to be concentrated during the construction phase and raw materials delivery. The nuisance caused by the noise levels produced during these phases will depend on the duration of construction and of the decommissioning phases, the time of day when activities are undertaken, the attitude of the contractor and the receivers of the noise. Adequate care should be taken as the area has other neighbours who may be disrupted if noise is not contained.

Potential Mitigation Measures

- Suppressors or silencers on equipment and noise shields such as iron sheets around the site
- Construction work should be restricted to the day i.e. 8.am to 5.pm
- Machineries should be maintained regularly to reduce noise resulting from inefficiencies
- Unnecessary noise should be reduced e.g. unnecessary hooting and shouting
- Heavy machinery and equipment be fitted with noise suppressors
- Temporarily fencing off noisy machineries such as concrete mixers.
- Workers to be provided with PPE such as earmuffs when operating noisy machinery

5.4.6 Occupational Health and Safety (OHS)

The project workers will be affected in some way during all phases of the development. There will be an increase in dust and minimal noise pollution. Accidents are also prone to occur in such construction scenes if not well managed and if protective gear is lacking. Food sold to the construction workers is often unhygienic and residues disposed of indiscriminately.

During the construction phase, noise and dust is likely to affect the neighbors. The use of heavy machinery on the site and Lorries transporting material to and from the site will also cause an inconvenience to neighbors but this will be minimal due to the number of machinery expected on site. The increase in noise is not expected to be too much so as to disrupt normal activities. The impacts at this stage will be direct, short term and temporary only occurring during the actual activities.

Potential Mitigation Measures

- There should be proper hoarding of the site to control movement of the public into the area
- The project site should be well sprinkled with water so as to reduce the dust that is produced
- Establish an assembly area for all workers in case of an accident and maintain a record of all works at the site, in addition workers need to be sensitized on construction safety measures
- Fully equipped first aid kits should be provided at the site and first aid training given to the supervisors for handling potential casualties
- The contractor should have workmen's compensation cover to avoid liability in cases of serious accidents which can bring the construction work to a halt

- Clean sanitary facilities and clean drinking water should be provided at the site as well
- Lunch breaks should be provided, food is set to be served at the site
- Construction work should be carried out only during the day i.e. 8.am to 5.pm
- Warning signs should be erected warning of construction activities and machinery on site
- Risky areas such as deep pits should be covered or fenced off to avoid accidents
- Skilled workers also need to be involved in the project will provide skilled labour
- Climbing and other support structures such as ladders need to be of good and stable form to avoid falls
- Workers should be sensitized on issues to do with drugs, AIDs and disease spread
- All workers should be provided with full protective gear ensure there is proper use of PPEs.

5.4.7 Solid waste

Solid waste resulting from the construction and decommissioning phase should be handled appropriately to avoid pollution. Such waste materials include construction debris, stones, timber off-cuts, metal rods and spoilt nails among other.

Potential Mitigation Measures

- Waste generation should be minimized during construction phase through reuse and recycling
- Reuse and recycle of construction debris and other material should be encouraged. The old building blocks should be used to pave the road among other uses.
- Waste should only be transported by licensed waste transporters and dumping of unusable materials done at the recommended and licensed dumping sites.
- Trucks should ensure that their tyres do not leave much mud on the main road

5.4.8 Aesthetic Value

The landscape can be considered a place of scenic beauty that appeals to the visual quality of a situation. The improvement of the aesthetic value should be carried out to mitigate the visual impacts expected during construction.

Potential Mitigation Measures

- Plant trees in the buffer zone with the residential area
- Off-road driving by heavy commercial vehicles accessing the site needs to be discouraged
- Earthworks should be controlled to prevent disfiguring the visual quality of the site

5.4.9 Security Concerns

The project area is largely seen as an insecurity prone area. The likelihood of insecurity increasing in the project area due to the proposed development cannot be overlooked. The project proponent should ensure that all security measures are put into place to safeguard the project workers and the property.

5.4.10 Fire hazards

Fire outbreaks are common and apart from the losses the proponent might incur in case of one, there is detrimental effect to the environment and tenants/ employees as they will suffer from both economic and social losses.

Potential Mitigation Measures

- Conduct regular fire drills especially to the project's supervisors and sensitize workers on fire safety
- Ensure that there is a fire assembly area at the site to gather people in case of fire outbreaks.
- Provide fire hazard signs especially next to fuels, inflammable materials and electric wires. Also ensure that all electric wires are well insulated and installed by a qualified technician
- Acquire firefighting equipment and ensure that they are regularly examined and maintained
- Install a fire alarm system for the entire project
- Inflammable substances such as petroleum products should not be stored at the project site

5.4.11 Public health and safety

There is an apparent need for the care and concern of the public interest as they will be affected by the project's activities including those that are directly involved in the project construction and to the neighbours. This is going to be through such activities as the movement of heavy machinery in the area and other vehicles that access the site during the construction period. There is a need to have a barricade that will fence off the development once the activities are ongoing so as to prevent falling debris from injuring the public.

Potential mitigation measures

- The use of iron sheets to fence off the area so as to protect the public
- Operation of noisy machineries during construction should be restricted to day time periods only
- Provision of warning signs be made at the gate warning of construction activity and heavy machinery
- Workers on site should go for regular health check-ups to promote health;
- Construction to be carried out between 8.am and 5.pm when most neighbours are out of to work
- Place signs of 'No hooting' on site within the vicinity of the construction site so as to reduce unnecessary noise and being nuisance to neighbours,
- The speed needs to be moderate as the road serves a host of many road users hence bumps should be introduced along the main highway.
- Proper handling and disposal of solid and liquid waste in the area to prevent harmful effects to residents
- Provision of adequate toilets facilities to the construction workers, they should be mobile as pit latrines will tend to contaminate ground water in the area
- Adequate water should be supplied to the site so as to prevent possible spread of communicable diseases especially after using the toilets.

6.0 PROJECT ALTERNATIVES

6.1 The Proposed Development

The EIA report explains the proposed project and examines its effects to the environment. Substitutes include an alternative site, products, materials, technology and waste management procedures. The report gives a description of the project area, technology, resources and other inputs to be used to promote the best working model that could be adopted to prevent injurious activities to the supporting resources, the personnel involved and the general public. This is presented to NEMA to review for licensing for the project to commence.

6.2 Alternative Location

It is vital that a proponent considers an alternative site so as to promote the integrity of the supporting resources. Some development projects could be considered site specific if they intend to serve a particular purpose in a particular area. There is need to address issues that are raised by the project neighbours including increased dust, noise, air quality and others. Relocation to a different site is an option for the proponent but they have to look for another available parcel of land and complete all the transactions required including building approvals.

6.3 ‘No Action alternative’

This implies that no development goes on at the proposed site or any other location. This option is the most suitable alternative from an extreme environmental perspective as it ensures preservation of resources. This option however involves several losses not only to the project proponent but the public and the government. The public will suffer from lack of employment, whereas the government will not generate revenue. This project alternative is not ideal to the proponent, the public and government.

6.4 The Comparison of Alternatives

Under the proposed development alternative, the project would enhance expansion of commercial facilities and would provide employment both directly and indirectly to the Kenyan population in all phases. The design has also been made aesthetically pleasing hence will improve the general outlook in the area. Under the ‘*No Action alternative*’, there would be no development at all, no impacts on the environment and serious losses to the project proponent and the employment losses to the general public. Provided that the environmental impact mitigation measures are implemented and sound construction measures adopted, negative effects on water, soil, air, sound and sewerage systems will be avoided.

6.5 Mitigation for the proposed Action

Mitigation measures include proper handling of the generated waste material. The application or adoption of standard construction management practices is fundamental so that adverse effects of the project do not occur. Conflicts arising from unforeseen negative impacts will be solved by following the prescribed mitigation measures and through consultations with the relevant authorities and the public. The mitigation measures are designed and implemented to protect the

environment. The proponent should consider the appropriate technology that does not undermine the integrity of the supporting resources.

6.6 Project Decommissioning

The main objective is to ensure the site occupied by the proposed development is restored to its original or better condition upon decommissioning. Decommissioning occur either due to recommendations from authorities in case of poor workmanship, change of user of the land or expiry of lease period.

In case of decommissioning the exercise should be carried out systematically to ensure that generation of waste and/or destruction of materials are minimized and the materials are re-used such as stones, steel, tiles, pipes, cables, water pipes. The rabbles should be collected off at a licensed site. It should be noted that at the time of decommissioning a separate decommissioning plan will be necessary to be carried out at least three months before the activities commence.

7.0 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

Environmental monitoring involves measurement of relevant parameters, at a level of details accurate enough to distinguish the anticipated changes. Monitoring aims at determining the effectiveness of actions to maintain and improve environmental quality. EMP and the EMF outlined addresses the identified issues of concern and mitigation measures as well as roles, costs and indicators that can be monitored. This covers the project from the inception to decommissioning.

Social and Environmental Impact	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention, monitoring and mitigation during inception, construction, occupation and decommissioning	Cost (Kshs)	Monitoring	Monitoring Indicator	Frequency
Air Pollution	<ul style="list-style-type: none"> • Sprinkle water during the construction and decommissioning • Re-vegetate the area after construction and decommissioning with indigenous species • Plant trees in the buffer zone with the residential area 	• Contractor	100,000	C & D	-Bowser trips made -vegetation	Daily
		• Contractor	Nil	C & D		After construction & Decomm. phase
		• Contractor / Proponent	100,000	C & D		
Noise pollution and vibrations	<ul style="list-style-type: none"> • Construction to be restricted to between 8.am and 5.pm on weekdays & 9 am to 1 pm on Saturdays • Prohibit unnecessary hooting, shouting and idling of equipment • Maintain construction and decommissioning equipment in good working order and use of equipment designed with noise control elements, such as silencers • Noisy machines be fenced off temporarily and excellent machines be sourced so as to reduce noise and smoke emissions. 	• Contractor / Proponent	100,000	C & D	- No. of complaints - No. of Complaints - Complaints	Daily
		• Contractor	Nil	C & D		Daily
		• Contractor / Proponent	300,000	C & D		Daily
		• Contractor	150,000			

Biodiversity	<ul style="list-style-type: none"> • Landscape the area after construction and decommissioning with as many indigenous species as possible • Manage the introduced vegetation on completion of development and at decommissioning • Where possible, natural vegetation should be maintained as part of the aesthetic environment • Establishment of flower gardens and other ornamental trees along the fence and within the buffer zone 	• Contractor	200,000	C & D	-Vegetation	After completion
		• Proponent	10,000	C& D	-Vegetation	Periodic
		• Contractor/ Proponent	Nil	C & D	-Vegetation	Periodic
		• Contractor/proponent	50,000	O	-Vegetation	After completion
Soil erosion & Water pollution	<ul style="list-style-type: none"> • Compact loose soil during construction and decommissioning • Provide for storm drainage and water overflow facilities • Ensure minimal area of significant vegetation is cleared • Encourage water re-use during construction and decommissioning 	• Contractor / Proponent	100,000	C & D	-Soil erosion	After excavation
		• Contractor / Proponent	100,000	C & D		Daily
		• Contractor / Proponent	Nil	C & D	- Storm drainage	Daily
		• Contractor / Proponent	Nil	C, O & D	- Vegetation - Water use records	Daily
Public health and occupational safety	<ul style="list-style-type: none"> • Ensure all workers are provided with full protective gear • Maintain employees records, a fire assembly area, first aid kits and fire marshals • Erect warning signs of construction activities • Sensitize workers on HIV/ AIDS and other communicable diseases • Barricade of the area and the area under construction • Inform project neighbours of ongoing constructions • Erect speed bumps along the major highway 	• Contractor/ Proponent	100,000	C & D	-PPE usage	Daily
		• Contractor/ Proponent	100,000	C & D	-F.A kits, Assembly pt	Daily
		• Contractor/ Proponent	100,000	C & D	- signage	Daily
		• Contractor	100,000	C & D	-HIV/AIDS	Regularly
		• Contractor	100,000	C & D	cases	
		• Contractor			- Barriers	Before commence
Fire hazards and outbreaks	<ul style="list-style-type: none"> • Provide fire hazard signs such as no smoking especially next to flammable materials and electric wires • Adopt emergency response plans such as a fire assembly point, install firefighting equipment and sensitizing workers on fire safety • Keep a well-stocked first aid box and ensure that there is a trained first aider on site 	• Contractor/ Proponent	100,000	C & D	- Signages	Regularly
		• Contractor	100,000	C & D	--F.A kits, Assembly pt	Initial
		• Contractor/ Proponent	100,000	C,O & D	- F.A Kit	Regularly

Effluent & Solid Waste	<ul style="list-style-type: none"> • Install a waste treatment plant at the facility and recycle all waste water. • The design of the waste system to take into account the estimate discharges of the entire project. • Waste generated should be collected by licensed waste collectors to be taken for recycling and dumping at NEMA licensed sites 	<ul style="list-style-type: none"> • Contractor/ Proponent • Contractor 	As per BQ 100,000	I & C C, O & D	- Sewer system -NEMA waste licenses	Once Regularly
Security	<ul style="list-style-type: none"> • Ensure a 24 hour security to the site during construction and occupation of the project • Install fire alarms that can act as security alarms as well • Ensure security lighting is installed strategically to prevent incidences of theft 	<ul style="list-style-type: none"> • Contractor/ Proponent • Proponent • Contractor/ Proponent 	120,000 300,000 250,000	C, O & D C & O I & C	- Security guards - Alarms - Lighting	Daily After completion At construction

7.1 ENVIRONMENTAL MANAGEMENT & MONITORING PLAN FOR DECOMMISSIONING PHASE

Expected Impacts	Recommended mitigation measures	Responsibility	Time Frame	Estimated costs (Kshs)
Construction Machinery/ structures and wastes				
Scrap materials and debris	<ul style="list-style-type: none"> • All unused building materials to be reused in other buildings or sold • Unrecyclable material if any to be transported by licensed waste transporters and disposed on NEMA approved dump sites, • Encourage re-use of construction debris 	Contractor/ Proponent	Once	Nil
		Contractor/ Proponent	Periodically	150,000
		Contractor	Once	Nil
Rehabilitation of project site				
Land	<ul style="list-style-type: none"> • Soil erosion prevention measures to be taken at decommissioning such as embankments • Addition of fertilizer and manure to aid vegetation re-growth • Direct waste water to storm drainage to avoid soil erosion 	Contractor/ Proponent	Once	50,000
		Contractor/ Proponent	Periodic	100,000
		Contractor/ Proponent	Once	200,000
Vegetation	<ul style="list-style-type: none"> • Re-vegetate the project site with as much indigenous vegetation as possible • Discourage off-road driving to prevent harming the aesthetic value of the site 	Contractor/ Proponent	Once	200,000
		Contractor	Periodic	Nil
Safety of the project				
Accidents and occupational hazards	<ul style="list-style-type: none"> • Ensure safety precautions have been observed at decommissioning especially in regard to scattering debris, fire outbreaks e.t.c. • Erect warning signs at construction and decommissioning • Sprinkle water to the project site to reduce dust • Ensure work done from 8am to 5pm • Deep pits and other risky areas should be covered with the material debris 	Contractor/ Proponent	Once	Nil
		Contractor	Once	50,000
		Contractor/ Proponent	Regularly	500,000
		Contractor/ Proponent	Always	Nil
		Contractor	Once	100,000
Social Economic Impacts				
Loss of Income and benefits	<ul style="list-style-type: none"> • Assist with redeployment of workforce to other construction sites after decommissioning • Ensure safety of workforce at decommissioning 	Contractor/ Proponent	Once	Nil
		Contractor	Periodic	200,000

8.0 PUBLIC PARTICIPATION

The EMCA, CAP 387 calls for effective stakeholder participation and public consultation in the entire ESIA process. Public consultations ensure that the views of the affected and interested parties are incorporated as early as possible in the entire process and especially in the design to avoid future project rejection. During the stakeholder consultation process, questionnaires were administered to the affected stakeholders and the general public so as to collect views concerning the development of the project in the area that would then be incorporated in the design stage. Some of the positive gains that were identified include;

- ✓ Creation of employment opportunities
- ✓ Increase of security in the area due to the influx of resident people into the area
- ✓ Infrastructural development of the area through the road network improvement
- ✓ Income generation to the local residents by provision of market for the locally available raw materials

However, there were some issues of concern especially from the local stakeholders that were raised by the respondents that would need to be considered in the project. These include;

- Concerns over the land use changes in the area
- Concerns for public safety resulting from the activities.
- Increased solid and liquid waste production during construction and occupation
- Increased demand for resources such as water, electricity and land among others
- Concerns for insecurity owing to an increase in population at the site
- Disruptions due to increased noise pollution during construction and decommissioning of the project

All of these concerns have been adequately addressed in the EMP and so the proponent needs to pursue these measures so as to promote the integrity of the environment and the welfare of the local residents.

9.0 CONCLUSIONS AND RECOMMENDATION

It is our considerable opinion that the proposed development is timely owing to the probable positive effects. In respect to this, the proposed project is anticipated to provide direct employment to a large number of people while supporting the construction industry.

9.1 Recommendations

Avoidance of negative environmental impacts should be the Proponent's priority. Impacts can be avoided completely by a "no-project" alternative, but with this option has consequent cons; these impacts can increase over time with economic growth and development, however their effect on the environment may be reduced by maintenance, rehabilitation, design and construction actions and with strict adherence to the EMP proposed.

All due procedures and permit conditions from the engineers, architects, County government, NCA and other relevant authorities should be followed to the letter.