

ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT



FOR THE PROPOSED CIVIL SERVANTS HOUSING IN MACHAKOS COUNTY

PROJECT PROPONENT:



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CERTIFICATION

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ACRONYMS

EIA-Environmental Impact Assessment

EA- Environmental Audit

EMCA- Environmental Management & Coordination Act

EMP- Environmental Management Plan

NEMA-National Environment Management Authority

OHS- Occupational Health and Safety

PPE- Personal Protective Equipments

MWSC-Machakos Water and Sewerage Company

EXECUTIVE SUMMARY

This study report is undertaken in fulfillment of the requirements of the Environmental Management & Coordination Act and Environmental Impact Assessment and audit regulations (2003).

For a long time the world over, policy makers directed all the efforts in economic development without due regard to the resource base on which the economic development depend on. As a result there has been unprecedented environmental degradation due to lack of environmental conservation resulting to unsustainable development. More recently investors and developers, spurred on by regulators world over, have recognized the need for change in order to safeguard the environment.

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

Pursuant to the prevailing legal requirements as envisaged in the Environmental Management and Coordination Act (EMCA) 1999 and to ensure sustainable environmental management the project proponent undertook this EIA study for the proposed project and incorporated substantial environmental aspects as advised by NEMA. This EIA study report thus provides relevant information and environmental considerations on the project proponent's intention to seek approval from NEMA for the development of the proposed project. Environmental Experts who are registered by the Authority conducted the assessment.

The project involves the construction of civil servants houses in Machakos County by Ministry of Transport, Infrastructure, housing and Urban Development. The houses will be sold to civil servants and others will be rented to civil servants.

The proposed housing project will have a total of 200 houses comprising of 2 blocks of 100-two bedroom houses and 100-three bedroom houses. Each unit block will have ground floor, and 1st-5th floors. Ground floor will comprise of parking space and 1st-5rd floors will have houses. (See attached architectural drawing)

The EIA is carried out to determine the current environmental status of the site and assess the potential environmental impacts that could arise from the implementation of the project.

The methods used to generate the report findings included site visits, photographing, interviews, literature reviews and consultations with council officials, neighbours, workers and the public. Those consulted were supportive of the project and welcome the same given the benefits the project will generate.

Key environmental concerns include ensuring that the construction work does not affect traffic movement along the road of access, health and safety of the construction workers and ensuring smooth upgrading of existing infrastructure to meet the expected increase in demand. Special attention will be directed at ensuring harmony with neighboring plots during both the construction and the operation phase of the project.

The proposed development will have positive impacts to the society and the environment in general. Some of the benefits include the following:

- The optimal use of the land.
- Modern houses for Civil Servants.
- Creation of market for goods and services and especially construction inputs which include raw materials, construction machinery and labour. Secondary businesses are also likely to spring up during the construction phase especially those providing foods and beverages to the construction workers.
- Job opportunities for Kenyans both during planning, construction and operational phases. They include building Contractors, architectural, structural engineers, mechanical engineers, surveyors, environmentalists, security agents, transporters, construction workers, site managers and foremen.
- Increase in revenue for the government.

Against the background of the above positive impacts, there are a few negative drawbacks that are anticipated mostly during the construction of the project. They include the following:

- Waste water management and disposal
- Increased water demand
- Increased power demand
- Oil spills during construction.
- Dust emissions.
- Soil compaction, erosion and pollution
- Safety concern during construction
- Noise and vibrations.
- Increased Population density.
- Air pollution during construction.
- Health and safety for the workers during construction phase

To address all the potential negative impacts, mitigation measures have been suggested and specific action plans suggested. Actors, likely costs and the appropriate implementation timeframes have been suggested.

It is no doubt the project will contribute income and employment creation, generation of government and local authority revenue and help provide modern houses for civil servants.

Since all the environmental concerns have been adequately provided for in the report under the EMP, and given the many positive impacts the project will have on the environment, the project is recommended for approval.

Environmental Impacts and Mitigation Measures

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

Potential Negative Environmental Impacts	Mitigation Measures
<p>1. Disruption of existing natural environment and modification of micro-climate – - Increased development density - Increased glare/solar reflection - Reduced natural ground cover - Obstruction of ventilating wind - Increased surface run-off</p>	<ul style="list-style-type: none"> • Development restricted to follow zoning policy/approved density – building line, plot coverage and plot ratio. • Careful layout and orientation of buildings to respect wind and sun direction. • Adequate provision of green and open space planted with grass, shrub and tree cover. • Minimum use of reflective building material and finishes for roof, wall and pavement.
<p>2. Pollution and health Hazards - Dust and other construction waste - Noise generation from construction activities.</p>	<ul style="list-style-type: none"> • Damping down of site e.g. sprinkling water to dusty areas on construction site during dry seasons. • Containment of noisy operation, including locating noise operations away from sensitive neighbors. • Construction work limited to day time i.e between 8am and 5pm only and take shortest time possible.

<p>3. Increased loading on Infrastructure services;</p> <ul style="list-style-type: none"> - Increased vehicular and/or pedestrian traffic - Increased demand on water, sanitation services etc. - Increase surface runoff 	<ul style="list-style-type: none"> • Have paved local access road and walkway system • Encourage rainwater harvesting • Provision of increased water storage capacity • Provide adequate storm water drainage system
<p>4. Worker accidents and health infection</p>	<ul style="list-style-type: none"> • Employ skilled and trained workers, provide protective clothing. • Prepare clear work schedule and the organization plan. • Have adequate worker insurance cover • Enforce occupational health and safety standards.
<p>5. Increased social conflict</p>	<ul style="list-style-type: none"> • Increased Housing stock in the area and Kenya • Increased economic activities –employment generation, income earnings and housing capital stock formation • Encourage formation of community policing and formation of neighbourhood associations

Conclusions and Recommendations'

The EIA process started early in the pre-feasibility stage and environmental aspects were therefore considered during the project design stages the proposal to have a comprehensive waste reticulation system connected to the Machakos County main sewer line. This proactive approach resulted in many significant environmental impacts being avoided, as the project team was able to amend design in order to manage environmental impacts, rather than manage the environmental impacts of particular designs.

In conclusion, results from EIA study show that the proposed residential apartment blocks development project has significant impacts on the environment. Implementation of an Environmental Management Plan will assist in dealing with environmental issues during the project cycle. There are also guidelines for addressing environmental health and safety. This project is recommendable for approval by the National Environment Management Authority (NEMA) for issuance of an EIA license subject to annual environmental audits after operating for one year. This will be in compliance with the Environmental Management and Coordination Act of 1999 and the Environmental Impact Assessment and Audit regulations, 2003.

CHAPTER ONE: INTRODUCTION

1.1 OVERVIEW

The project involves the construction of civil servants houses in Machakos County by Ministry of Transport, Infrastructure, housing and Urban Development. The proposed housing project will have a total of 200 houses comprising of 2 blocks of 100-two bedroom houses and 100-three bedroom houses. Each unit block will have ground floor, and 1st-5th floors. Ground floor will comprise of parking space and 1st-5rd floors will comprise of houses.

This study report is prepared in fulfillment of the requirements of the Environmental Management and Co-ordination Act of 1999. It will assist the National Environmental Management Authority and other relevant agencies in the making of decisions regarding the suitability of the project.

The report will also provide a framework to guide in the environmentally sustainable implementation and operationalization of the project.

The preparation of this report therefore seeks to obtain project approval from the National Environment Management Authority (NEMA). This approval is expected to culminate in the granting of the environmental license.

1.2 TERMS OF REFERENCE

The following terms of reference define the scope of the exercise

1. To provide a detailed description of the proposed project activities.
2. Examine the socio-economic and biophysical background of the project area.
3. Undertake a detailed land use analysis of neighborhood.
4. Determine whether the project conforms to the current planning and development policies of the neighborhood.
5. Identify the likely potential environmental impacts of the project activities
6. Develop an Environmental Management Plan (EMP) and a monitoring tool in the implementation of the proposed developments.

1.3 SCOPE AND OBJECTIVES OF THE ENVIRONMENTAL ASSESSMENT

The major objective of the EIA study is to evaluate the effects/impacts of proposed development in relation to the environment i.e. physical, biological and socio-economic environments. It aims at influencing the protection and co-existence of the development with the surroundings as well as the compatibility of the proposed development to the area; to ensure and facilitate sustainable environmental management during construction and occupation phases.

The scope of the assessment was to describe the project, document all the baseline information, address both the positive and negative impacts and develop mitigation measures for negative impacts including designing environmental management plan for the project.

The following are areas of concern as well as positive impacts that have been discussed at depth in the report and their mitigation measures outlined. a) Solid and liquid waste generation b) Noise nuisance c) Employment d) dust emissions and air pollution e) occupational, health and safety concerns f) National economic benefits g) energy use h) loss of vegetation i) Soil erosion j) Fire hazards and accidents. The output of the study is the production of an Environmental Impact Assessment study report for submission to NEMA for purpose of seeking an EIA license.

1.4 Methodology

1.4.1 Environmental Screening.

Environmental screening was carried out to determine whether an EIA study is necessary for this project and at what level of evaluation. This took into consideration the requirements of the Environmental Management and Coordination Act (EMCA), 1999, and specifically the second schedule of the same act. From the screening process, it was understood that this project will cause significant impacts on the environment.

1.4.2 Environmental Scoping.

In scoping, focus was on environmental impacts of great concern. Environmental issues were categorized into physical, natural/ecological and social, economic and cultural aspects. Impacts were also classified as immediate and long-term impacts. This will include assessment of the proposed project in respect of but not limited to:

- Project Background: this will give the brief history of the proposed project site, the parties involved and justification of the project in terms of demand or lack of the same, the project area, relevant policy and legislation, identification of any associated project, or any planned projects including products within the region which may compete for the same resources; the project including products, by-products, processes both at implementation and operational level, resources required for successful implementation and operation of the project and the different options considered.
- The proposed project objectives; both in the short and long run; and how they are linked to the overall objectives.
- Present environmental conditions; description of the project site, ecological zoning as well as the state of the environment and its surroundings. Attempts will state if it

is already suffering from degradation, causes of the original degradation if any established.

- Identification of Environmental Impacts; the report will distinguish between significant positive and negative impacts, direct and indirect impacts and immediate and long term impacts which are unavoidable and / or irreversible,
- Community/ Stakeholder Consultations: these will be undertaken to determine how the project will affect the local people / various stakeholders.
- Cost- Benefit Analysis; to evaluate the economics of the project and establish its viability in terms of the expected environmental concerns and measures.
- Development of an Environmental Management Plan (EMP); to mitigate negative impacts, recommending feasible and cost effective measures to prevent or reduce significant negative impacts to acceptable levels,
- Development of a Monitoring Plan; this will be used in monitoring the implementation of the mitigation measures and the impacts of the project during construction and operational phases, including an estimate of capital and operational costs, and Make necessary recommendations pertaining to the proposed development.

1.4.3 Desktop Study.

This involved review of project documents, architectural drawings, past EIA, relevant policy, legal and institutional frameworks. Documents containing climatic, demographic and hydrological data for Machakos County were also relied upon.

1.4.4 Site Visits and Public Participation.

Field visits were meant for physical inspections of the project site in order to gather information on the state of environment. Several photos of the project site were taken for inclusion in this report. The study also sought public opinion/views through Consultation and Public Participation (CPP) exercise. Questionnaires were administered to the public and interviews held with neighbours. The questionnaires have been included in this report (annexed).

1.4.5 Reporting.

In the entire exercise, the proponent and EIA experts contacted each other on the progress of the study and signing of various documents. The proponent will have to submit 5 copies of this report alongside a CD to the National Environment Management Authority for review and issuance of an EIA license. All the materials and workmanship used in the execution of the work shall be of the best quality and description. Any material condemned by the architect shall be removed from the site at the contractors cost. Environmental concerns need to be part of the planning and development process and not an afterthought. It is therefore advisable to avoid land use conflicts with the surrounding area through the implementation of the Environmental Management Plan (EMP).

CHAPTER TWO: BACKGROUND INFORMATION

2.1 LOCATION

The project site is located in Machakos County, along prison road next to Machakos school for the deaf, Machakos County workshop, A.I.C Bomani, commercial buildings and residential estates.

The precise site location is between coordinates S 0031.737 and E 037.27134

2.2 PHYSICAL ENVIRONMENT

2.2.1 Climate and physical features

Machakos County has very unique physical and topographical features. Hills and a small plateau rising to 1800-2100m above sea level constitute the Central part of the County. To the West, the County has a large plateau elevated to about 1700m which is Southeast sloping. The County rises from 790 to 1594 m above sea level. In the North West the County has stand-alone hills.

Generally the annual rainfall of the County is unevenly distributed and unreliable. The average rainfall is between 500 mm and 1300 mm. The short rains are expected in October and December while the long rains are expected in March to May. The highland areas within the County such as Mua, Iveti and Kangundo receive an average of 1000mm while the lowland areas receive about 500mm; ideally the rainfall within the County is influence by the latitude. In terms of temperature, July is the coldest month while October and March are the warmest. Temperature varies between 18°C and 29°C throughout the year. Since the County does not experience rain throughout the year it then means that there are months that experience dry spells. These months are mainly February to March and August to September.

2.2.2 Topography

The project area is on a flat land and hence conducive for the proposed developments.

2.2.3 Geology and Soils

The soils are well drained shallow, dark red clay soils particularly in the plains. However the vegetation across the entire County depends on the altitude of any given area/location. The rainfall distribution in the County depends on the topography of the areas. Since some areas of the County are arid while others have hills and volcanic soils and other areas are plains, the rainfall is widely distributed. For instance the plains receives less amounts of rainfall as such the dominate vegetation is grasslands and some sparse acacia trees. The

areas within the County are predominately plains include Mutituni, Mwala, Mua, Iveti Hills and Kathiani.

2.3 BIOLOGICAL ENVIRONMENT

2.3.1 Flora

Agriculture is a main source of job creation. From available statistics, the main cash crops are coffee, French Beans, pineapples and Sorghum which are mainly grown in Kangundo Matungulu, Kathiani, Yatta and Mwala. The County through the department responsible for agriculture seeks to increase the crops grown within the County as well as increasing the productivity of the arable land. The main food crops are maize, beans, Pigeon peas and cassava which are normally grown in small scale. Most of the crops are rain fed and due to the unreliability of the rain there is low production leading to food insecurity

The project area is built up thus limiting the extent of vegetation cover. However there is vegetation in individual plots including tree shrub species. These are both found within plots or along property edges. Flower gardens also contribute to the vegetation cover. The proposed site has vegetation which will be cleared to pave way for the proposed project. Hence the proponent should do vegetative landscaping after completion of the project to replace the vegetative cover which will be removed

2.3.2 Fauna

According to the 2009 Kenya Population and Housing Census, the number of animals bred in the County was 230,891. These include: 126,608 Sheep, and 629,974 Goats. In addition, there are 862,592 indigenous Poultry, 4,026 Pigs, 21,336 Donkeys, 46,370 beehives and 20 Camels. There is growth in this sub-sector because of various government programmes to develop this sector and the ready market by the Kenya Meat Commission in Athi River. In addition there are two livestock markets found in Masii and Masinga where farmers can sell their livestock.

2.4 NEIGHBOURHOOD LAND USE CHARACTERISTICS

The project site is located next to Machakos School for the deaf, Machakos County workshop, A.I.C Bomani, commercial buildings and residential estates.

The general land use of the proposed area is commercial cum residential; the area is zoned for such development and the proposed development will be harmony with other land uses hence there will be no any conflict.



Plate 1 and 2: Residential houses and A.I.C Bamani neighbouring the proposed site

2.5 INFRASTRUCTURE AND SERVICES

The property is located in an area that has adequate supply of basic infrastructure and utilities. These include water, roads, electricity, and sewer system.

2.5.1 Roads

The area is well served and linked to other areas of the Machakos town. The plot is accessed through Machakos road off Prison road.



Plate 2: Access road

2.5.2 Electricity

The property under consideration in Machakos area has power lines running along the road of access. The proposed developments will be connected to the same.



Plate 3: power lines directly opposite the proposed site

2.5.3 Water Supply

The proposed development will use water from Machakos Water and Sewerage Company which is already connected to the site.

2.5.4 Sewer

The area is served by the County Council's sewer network; the proposed development will be connected to the sewer line.

2.5.5 Solid Waste Disposal

The Machakos County Council provides solid waste disposal services in the area with some private refuse collecting firms also operating in the neighborhood.

Most of the waste that will be generated will include office waste papers, food remains, rags and bottles. The proponent will hire the services of a private waste dealer to manage general waste, as they are more efficient. The proponent will be required to adhere to spill control procedure when handling waste.

2.5.6 Storm drainage

Storm drainage will be channeled to the sewer line

CHAPTER THREE: STUDY METHODOLOGY

3.1 METHODOLOGY

The preparation of an Environmental Impact Assessment project report is a multidisciplinary process that requires use of various approaches and data collection methods. In this particular survey, public participation and consultation was widely used. Both scientific and social data collection methods were used and they included the following:

3.2 PRELIMINARY MEETING

A preliminary meeting was held between the proponent, the project architect and the Environmental Impact Assessment experts. At the meeting, the need for the EIA was established and the procedure, time frame, responsibilities and other logistics agreed upon.

3.3 QUESTIONNAIRES

Questionnaires were administered to the locals randomly to seek their opinion on the proposed development. The questions to the respondents, contained in the questionnaire, were asked and responses recorded by the interviewer.

3.4 PHOTOGRAPHY

Photos were taken to show the actual site of the proposed development.

3.5 SECONDARY DATA

The secondary data gathered were from such sources as;

- Environmental Management and Coordination Act No. 8 of 1999.
- Kenya gazette supplement Acts, Physical Planning Act, 1999.
- Kenya gazette supplement No. 56. Environmental Impact Assessment and Audit Regulations 2003.
- Kenya gazette supplement Acts Local Authority Act (cap 265).
- Environmental Management and Co-ordination (Waste Management) Regulations, 2006 Legal Notice No.12
- The Public Health Act, Cap 242
- Occupational Safety and Health Act (OSHA) 2007.
- Noise and Excessive Vibrations Pollution Control Regulations 2009.
- Way leave Act.
- Local Government Act.
- Physical Planning Handbook.

3.6 DRAFT REPORT PREPARATION

This report was then compiled and a draft report discussed with the proponent. It was then forwarded for final submission to NEMA for consideration as stipulated in Environmental Management and Co-ordination Act of 1999.

3.7 EVALUATION OF FINDINGS

Thereafter, findings of the study were discussed among the proponent, the project lead consultant and the EIA experts. This was necessary to appreciate the various responsibilities and modalities of implementing the project.

3.8 FINAL REPORT PREPARATION

The final report was then prepared and submitted to the proponent for endorsement.

3.9 SUBMISSION OF REPORT

Besides the report, the prerequisite submission forms were prepared and the report submitted to NEMA for consideration in the prescribed manner.

CHAPTER FOUR: THE PROJECT DESCRIPTION

4.1 DEVELOPMENT OBJECTIVE

The project proponent wishes to construct civil servant houses in Machakos County. The proposed area to be constructed is an open space with vegetation cover and another section has 11 old houses for civil servants which need to be demolished to pave way for the new development.

The proposed housing project will have a total of 200 houses comprising of 2 blocks of 100-two bedroom houses and 100-three bedroom houses. Each unit block will have ground floor, and 1st-5th floors. Ground floor will comprise of parking space and 1st-5rd floors will comprise of houses.

4.2 LAND OWNERSHIP

The parcel of land belongs to the Government of Kenya which was allocated to Ministry of Transport, Infrastructure, Housing and Urban Development.

4.3 SITE STATUS

Part of site has 11 old houses which need to be demolished and the other section is idle with vegetation cover.



Plate 4: an old house and an idle land for on the proposed site

4.4 DESCRIPTION OF PROPOSED DEVELOPMENTS

The proposed housing project will have a total of 200 houses comprising of 2 blocks of 100-two bedroom houses and 100-three bedroom houses. Each unit block will have ground floor, and 1st-5th floors. Ground floor will comprise of parking space and 1st-5rd floors will comprise of houses.

4.4.1 Construction of the flat

The main facility is the construction of 2 blocks of a six storied building as illustrated in the copies of the attached building plans in the annex.

5.5.2 Ground floors

As earlier stated, ground floor will constitute of parking spaces

5.5.3 First Floor to fifty floors

1st-5th floor; will comprise of a total of 100-2bedroom houses and 100-3bedroom houses.

All these levels will be equipped with fire escapes, passage to exterior spiral stairs, lift and a refuse chute.

5.5.5Roof

This will constitute concrete roofing tiles on galvanized sheets finish to architects approval and the roof part will also constitute an elevated water tank tower.

5.5.5 Gates

The gate will be situated along the road of access to the property.

4.5 PROJECT ACTIVITIES

4.5.1 Construction Activities and Inputs

Inputs for the project will include the following among others:

- Construction raw materials including sand, cement, stones, crushed rock (gravel/ballast), ceramics, steel metals, roofing materials (tiles) and painting materials.
- Machinery to be employed in the construction will include trucks, concrete mixers, compressors, cranes for lifting among others
- Labour is an important input in the construction process and will be a mix of skilled and non-skilled manpower.
- Water supply is requisite for any construction undertaking. It will be sourced both commercially from water vendors and from the County mains where the property is expected to be connected.
- Power will obtained from the main national grid.
- Security will be required to watch over the site during the construction period.

The activities during the construction process are as follows:

- Procurement of construction materials from approved dealers
- Transportation of construction materials and debris using heavy and light machinery
- Storage of the construction materials
- Site cleaning/clearing, excavation and filling, laying of foundation, building works, disposal of the resulting construction wastes

- Disposal of the existing debris from the construction site. All this will be dumped on sites approved by the County council.
- Electrical, civil and water engineering and sanitary works. These will be done by registered experts
- Landscaping works and earth works mostly on completion of the project
- Completion of the development and occupation.

4.6 PROJECT BUDGET

The proposed project is estimated to cost approximately seven hundred and six million, five hundred thousand (**Ksh. 706,500,000**)

4.6 PROJECT IMPLEMENTATION PROCESSES

The activities to be undertaken in the implementation of the project processes are broadly grouped into three namely, planning (preparation), construction and operation phases.

4.6.1 Planning

This is the initial phase of the project. The project is presently at this phase. This phase is preparatory and its primary objective is to ensure that the project receives all the necessary approvals before the commencement of implementation.

This phase includes the selection of the members of the various professional fields to be involved in the implementation of the project. Such members are essential in the design of the project as well as in undertaking consultations on the project.

Detailed building plans for the project, have been drawn and copies of the plans are annexed to this report. The preparation of this project report and its submission to NEMA forms an essential step in the project preparation phase.

The final steps of the planning stage will include the tendering of the construction process, which will be followed by the signing of various construction contracts.

4.6.2 Construction Process

This marks the beginning of the implementation of the project. It is at this stage that the contractors come in to carry out the construction work. Activities involved at this phase include site preparation, fencing, excavation, leveling, and erection of the new facilities.

During the construction, there will be regular inspections by the project architect, to ensure that the implementation of the project abides by the set regulations as well as conforming to the approved schemes.

4.6.2.1 Pre-construction activities

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

4.6.2.2 Sourcing and Transportation of Building Materials

Building materials will be transported to the project site from their extraction, manufacture, or storage sites using transport trucks. The trucks for transportation should not exceed weight limits. The trucks will be new and well serviced to be environmentally friendly. The building materials to be used in construction of the project will be sourced from local sources that are quarries and hardware shops. Greater emphasis will be laid on procurement of building materials from within the local area, which will make both economic and environmental sense as it will reduce negative impacts of transportation of the materials to the project site through reduced distance of travel by the materials transport vehicles.

4.6.2.3 Storage of Materials

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

4.8.2.4 Excavation and Foundation Works

Excavation will be carried out to prepare the site for construction of foundations, pavements and drainage systems. This will involve the use of heavy earthmoving machinery such as tractors and bulldozers. It is necessary to remove the black cotton overburden to put up the foundations on the rock.

4.6.2.5 Masonry, Concrete Work and Related Activities

The construction of the buildings' walls, foundations, floors, pavements, drainage systems, perimeter fence and parking area among other components of the project will involve a lot of masonry work and related activities. General masonry and related activities will include stone shaping, concrete mixing, plastering, slab construction, construction of foundations, and erection of building walls and curing of fresh concrete surfaces. These activities are known to be Labour-intensive and will be supplemented by machinery such as concrete mixers and concrete vibrators.

4.6.2.6 Structural Steel Works

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

4.6.2.7 Roofing and Metal Works

Roofing activities will include ceramic clay works, beam metal cutting, raising the roofing materials such as tiles and structural timber and steel to the roof and fastening the roofing materials to the roof.

4.6.2.8 Electrical Work

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

4.6.2.9 Plumbing

Installation of pipe-work for water supply and distribution will be carried out within the office and associated facilities. In addition, pipe-work will be done on the waste water management system from the premise to the sewer system and for drainage of storm water from the rooftop into the natural drainage system. Plumbing activities will include metal and plastic cutting, the use of adhesives, metal grinding and wall drilling among others.

4.6.2.10 Landscaping

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

4.6.3 Completion

This phase will involve the finalization activities of the project. It will also involve statutory inspections and certifications, installation of utility meters and issuance of completion/occupation certificates. This is necessary before the houses are certified appropriate for occupation.

4.6.4 Operation Phase

Once the construction is completed, the houses will be ready to be occupied. The houses and the building is expected to remain in good condition for a long time during which

monitoring; maintenance and waste disposal activities will take place. The operation phase will also be marked by periodic environmental audits. This will be undertaken to ensure that the project remains environmentally friendly.

4.6.5 Decommissioning Phase

This is the ultimate phase of the project and comes at the end of the operation period of the project. With time, the premises shall wear down and need to be demolished or modified to reflect developmental requirements. The need for change will depend on several factors such as the condition of the building, planning and developmental changes and different social and economic priorities prevailing over time.

Strategies to be adopted are given below:

- Periodic assessment of the planning and development policies to determine the appropriate use of the land.
- Assessment of the condition of the buildings to determine appropriate use or disposal of materials.
- Prepare a demolition or alteration plan.
- Apply for approvals to the relevant agencies including the Machakos County.
- Issue relevant notices to all the affected workers.
- Fencing/hoarding of the site.
- Disconnection/removal of utilities e.g. water pipes, electricity and telephone cables
- Remove all the underground facilities like water pipes, sewer lines, electricity and telephone cables
- Manual demolition or alteration of the structures
- Reuse or sell the salvaged materials.
- Trucks should be used to break the material used in construction of the floor
- Disposal of general waste at designated council sites.

CHAPTER FIVE: POLICY, LEGAL AND LEGISLATIVE FRAMEWORK

5.0 ENVIRONMENTAL LEGISLATIVE AND REGULATORY FRAMEWORK

5.1 Environmental management policies and laws

There are a number of policies that govern the protection, conservation, and exploitation of natural resources coupled with provisions for environmental management. These national policies cover forestry, agriculture, water, infrastructure, and health just but to mention a few. The national environment action plan documents cover policy directions regarding integration of environmental concerns including environmental impact assessment into the development planning process

Some of the key national laws that govern the management of environmental resources in the country are hereby discussed, however it is worth noting that wherever any of the laws contradict each other, the Environmental Management and Co-ordination Act 1999 prevails.

5.2 The Environment (Impact Assessment And Audit) Regulations, 2003

On June 13th 2003, the Minister of Environment, Natural Resources and Wildlife promulgated the Environment (Impact Assessment and Audit) regulations 2003 (EIA/EA Regulations) under section 147 of the EMCA. These regulations provide the framework for carrying out EIAs and EAs in Kenya.

Compliance

The proponent has complied to this Act by conducting Environmental Impact Assessment of the proposed project. He shall also commit to implement the Environmental Management Plan laid out in this report and any other conditions laid out by NEMA.

5.3 The Environment Management and Coordination Act (EMCA)-1999

This is an Act of Parliament to provide for the establishment of an appropriate legal and institutional framework for the management of the environment and for matters connected there with and incidental thereto. Part VII on Environmental Audit and Monitoring section 58 specifically detail the need to undertake Environmental Impact Assessment of all projects likely to cause negative impacts to the environment as listed in the second schedule of the ACT. Further, Part V of the Environmental (Impact Assessment and Audit) Regulations 2003; detail the guidelines for Environmental Impact Assessment process. It is therefore mandatory that an Environmental Impact Assessment must be undertaken by all proposed projects to ensure that the activities at their premises comply with all the legal and institutional frameworks that are in place to safeguard the environment, health and safety of the workers.

Compliance

The proponent is committed to implementing the environmental management plan laid out in this report and any other conditions laid out by NEMA, prior to being issued an EIA license.

5.4 Environmental Management and Co-ordination (Waste Management) Regulations, 2006 Legal Notice No.121

(1) No person shall dispose off any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle.

A waste generator shall collect, segregate and dispose such waste in the manner provided for under these Regulations.

5. (1) A waste generator shall minimize the waste generated by adopting the cleaner production methods.

Compliance

The proponent shall observe policy and regulatory requirements and implement the measures proposed in this document in an effort to comply with the provisions of the Regulations.

5.5 The Physical Planning Act (Cap 286)

The Local governments have been empowered under section 29 of the Act to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section, therefore allows for the prohibition or control of the use and development of land and buildings in the interest of proper and orderly development of an area.

Section 24 of the Physical Planning Act gives provision for the development of local physical development plan for guiding and coordinating development of infrastructure facilities and services within the area of authority of County, municipal and town council and for specific control of the use and development of land. The plan shows the manner in which the land in the area may be used.

Section 29 of the physical Planning Act gives county councils powers to prohibit and control the use of land, building, and subdivision of land, in the interest of proper and orderly development of its area.

The same section also allows them to approve all development applications and grant development permissions as well as to ensure the proper execution and implications of approved physical development plans. On zoning, the act empowers them to formulate by-laws in respect of use and density of development.

Section 30 states that any person who carries out development within an area of a local authority without development permission shall be guilty of an offence and the development shall be invalid.

The act also gives the local authority power to compel the developer to restore the land on which such development has taken place to its original conditions within a period of ninety days. If no action is taken, then the council will restore the land and recover the cost incurred thereto from the developer. In addition, the same section also states that no person shall carry out development within the area of a local authority without development permission granted by the local authority.

At the same time, sub-section 5, reinforce it further that, no licensing authority shall grant under any written law, a license for commercial use for which no development permission had been granted by the respective local authority.

Section 36 states that, if in connection with development application a local authority is of the opinion that, the proposed activity will have injurious impact on the environment, the applicant shall be required to submit together with the application an Environmental Impact Assessment report. The environmental impact assessment report must be approved

by the National Environmental Management Authority (NEMA) and followed by annual environmental audits as spelled out by EMCA 1999. Section 38 states that if the local authority finds out that the development activity is not complying to all laid down regulations, the local authority may serve an enforcement notice specifying the conditions of the development permissions alleged to have been contravened and compel the developer to restore the land to its original conditions.

5.6 The County Government Act (2012)

Under the new constitution of Kenya, County Governments have taken over what used to be provided by the function of local authorities. They have been given power to control or prohibit all businesses, factories and other activities including the proposed project which by reason of smoke, fumes, gases, dust, noise or other cause, maybe or become a source of danger, discomfort or annoyance to the neighbourhood and to prescribe conditions subject to which such businesses, factories etc shall be carried.

The new constitution grants county governments the powers to grant or renew businesses licenses or refuse the same. To ensure implementation of the provisions of the new constitution, the county governments are empowered to make by laws in respect of all such matters as are necessary or desirable for the maintenance of health, safety and well-being of the inhabitants of the area. This includes construction and maintenance of water supply, sewage and solid waste management systems.

5.7 Public Health Act (Revised 1986)

Under this Act, every local authority or health authority is mandated to take all lawful, necessary and reasonable practicable measures to prevent all injurious conditions in premises, construction condition or manner of use of any trade premises. Nuisances under this Act include any noxious matter or waste water, flowing or discharged from any premises wherever situated, into any public street, or into the gutter or side channel of any street or watercourse, or any accumulation or deposit of refuse or other offensive matter. Every municipal council and every urban area council may make by-laws as to buildings and sanitation.

Compliance

The proponent shall observe policy and regulatory requirements and implement measures to safeguard public health and safety.

5.8 Building Code of 1971

The Building Code prohibits developers from (1) connecting to the various public services without permit and (2) obstructing public services, for example, by building on top of a sewer line. It also guides on the sizes and nature of the rooms of the proposed buildings. The approval by the Local Authorities means the design has addressed all these issues successfully.

Compliance

The proponent shall ensure that the building code is followed by checking the locations of the various public services e.g. sewer lines & water lines.

5.9 The Way Leave Act

The areas zoned for communication lines, sewer lines, power lines, water pipes etc are known as way leaves. The way leave Act prohibits development of any kind in these designated areas. Thus any developer is bound by this Act to see to it that no development takes place in these areas.

Compliance

The proponent shall ensure that no development is done on the way leave.

5.10 The Water Act 2002

The Act vests the water in the State and gives the provisions for the water management, including irrigation water, pollution, drainage, flood control and abstraction. It is the main legislation governing the use of water especially through water permit system.

Compliance

The proponent shall ensure that the project will not have adverse impact on the local water supply during construction and operation.

5.11 The Public Health Act (Cap. 242)

The Act Provides for the securing of public health and recognizes the important role of water. It provides for prevention of water pollution by stakeholders, among them Local Authorities (county councils). It states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health.

Compliance

The proponent shall observe policy and regulatory requirements and implement measures to safeguard public health and safety.

5.12 Occupational Safety and Health Act (OSHA) 2007.

The Act makes provision for the health, safety and welfare of persons employed in factories and other places of work. The provisions require that all practicable measures be taken to protect persons employed in a factory from dust, fumes or impurities originating from any process within the facility. The provisions of the Act are also relevant to the management of hazardous and non-hazardous wastes, which may arise at a project site.

Compliance

The proponent shall observe health and safety issues of the workers during construction and operational phase.

5.13 Noise and Excessive Vibrations Pollution Control Regulations 2009

This regulation was published as legal Notice No. 61 being a subsidiary legislation to the Environmental Management and Co-ordination Act, 1999. The regulations provide information on the following:

- a) Prohibition of excessive noise and vibration
- b) Provisions relating to noise from certain sources
- c) Provisions relating to licensing procedures for certain activities with a potential of emitting excessive noise and/or vibrations and
- d) Noise and excessive vibrations mapping

According to regulation 3 (1), 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. Regulation 4 prohibits

any person to (a) make or cause to be made excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment; or (b) cause to be made excessive vibrations which exceed 0.5 centimeters per second beyond any source property boundary or 30 meters from any moving source.

Regulation 5 further makes it an offence for any person to make, continue or cause to be made or continued any noise in excess of the noise levels set in the First Schedule to these Regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property. Please see. Table: 1 and 2 below

Table 2: Table showing Maximum Permissible Noise Levels

Zone		Sound Level Limits dB(A) (Leq, 14h)		Noise Rating Level (NR) (Leq,14h)	
		Day	Night	Day	Night
A	Silent Zone	40	35	30	25
B	Places of worship	40	35	30	25
C	Residential: Indoor	45	35	35	25
	Outdoor	50	35	40	25
D	Mixed residential (with some commercial and places of entertainment)	55	35	50	25
E	Commercial	60	35	55	25

Time Frame:

Day: 6.00 a.m. - 8.00 p.m. (Leq, 14 h)

Night: 8.00 p.m. – 6.00 a.m. (Leq, 14 h)

Table 3: Table showing Maximum Permissible Noise Levels for Construction Sites

(Measurement taken within the facility)

Facility		Maximum Noise Level Permitted (Leq) in dB(A)	
		Day	Night
i.	Health facilities, educational institutions, homes for disabled etc	60	35
ii	Residential	60	35
iii.	Areas other than those prescribed in (i) and (ii)	75	65

Time Frame:

Day: 6.00 a.m. – 6.00 p.m. (Leq, 12 h)

Night: 6.00 p.m. – 6.00 a.m. (Leq, 12 h)

Regulation 16 (1) stipulates that where a sound source is planned, installed or intended to be installed or modified by any person in such a manner that such source shall create or is

likely to emit noise or excessive vibrations, or otherwise fail to comply with the provisions of these Regulations, such person shall apply for a license to the Authority.

According to regulation 18 (6) the license shall be valid for a period not exceeding seven (7) days Regulation 19 (1) prohibits any person to carry out activities relating to fireworks, demolitions, firing ranges or specific heavy industry without a valid permit issued by the Authority. According to sub regulation 4, such permit shall be valid for a period not exceeding three months.

Compliance

The proponent shall observe policy and regulatory requirements and implement the mitigation measures proposed in this document in an effort to comply with the provisions of these Regulations on abatement of noise pollution.

5.14 The Constitution of Kenya 2010.

Article 42 of the Constitution states that every person has the right to a clean and healthy environment, which includes the right:

- (a) to have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69; and
- (b) to have obligations relating to the environment fulfilled under Article 70.

Article 69(2) states that every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

Article 70 (1) states that If a person alleges that a right to a clean and healthy environment recognized and protected under Article 42 has been, is being or is likely to be, denied, violated, infringed or threatened, the person may apply to a court for redress in addition to any other legal remedies that are available in respect to the same matter.

Compliance

The proponent shall be in compliance with the constitution of Kenya by ensuring that the environment is conserved and protected.

5.15 Environmental Management and Co-ordination (water quality) Regulations, 2006

This Legal Notice on Water Quality provides that anyone who discharges effluent into the environment or public sewer shall be required to apply for Effluent Discharge License. The license for discharge is Ksh 5,000 while annual license fee for discharge into the environment will be Ksh. 20,000 or Ksh 100,000 depending on the facility. Non compliance with the regulations attracts a fine not exceeding Ksh 500,000 and the polluter pay principle may apply depending on the court ruling. Table 3 below gives Waste Water Discharge Guidelines from NEMA.

Nil means less than limit of detection using prescribed sampling and analytical methods and equipment as determined by the Authority.

And any other parameters as may be prescribed by the Authority from time to time

Compliance

The proponent shall observe policy and regulatory requirements and implement measures to safeguard the quality of water by conducting frequent monitoring of the effluent which may cause health risks and also cause pollution to the underground water.

5.16 The Standards Act (Cap 496)

The Act is meant to promote the standardization of the specification of commodities, and to provide for the standardization of commodities and codes of practice; to establish a Kenya Bureau of Standards, to define its functions and provide for its management and control. Code of practice is interpreted in the Act as a set of rules relating to the methods to be applied or the procedure to be adopted in connection with the construction, installation, testing, sampling, operation or use of any article, apparatus, instrument, device or process. The Act contains various specifications touching on building materials

Compliance

The proponent shall ensure that materials and codes of practice utilized in the project adhere to the provisions of this Act.

5.17 Fire Risk Reduction Rules, 2007 (Legal Notice No. 59)

These rules were promulgated by the Minister for Labour on April 16th 2007 and apply to all workplaces.

Rule 5 requires Proponents to ensure that fire resistant materials are used for construction of new projects.

Rule 6 requires that all flammable materials be stored in appropriately designed receptacles.

Rule 17 requires a Proponent to clearly delineate fire escape exits. The regulation provides for the minimum standards to be applied in marking out all fire escape exits.

Rules 20 – 23 requires a Proponent to have trained firefighting teams within their premises.

5.18 The National Construction Authority Regulations 2014

1. All construction works, contracts or projects either in the public or private sector shall be registered with the Authority in accordance with the Act.

2. An owner shall make an application for registration of a project to the Authority in writing in thirty days from the date on which a tender for construction works, contract or project is awarded to a contractor registered under this Act. (3) The application under this regulation shall be in the prescribed form and shall be made before the commencement of the construction works contract or project together with such fees as the Board may prescribe.

Compliance

The developer will comply with the NCA regulations.

5.19 Policy Framework.

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

policies which the government is working on include; Draft Wildlife Policy; Draft National Land Policy; and Wetlands Management and Conservation Policy among others.

5.19.1 National Environmental Action Plan (NEAP).

National Environmental Action Plan was a deliberate policy effort to integrate environmental concerns into the country's development initiatives/plans. This assumed a consultative and multi-sectoral approach. Such an approach ensured that environmental management and the conservation becomes integral in various decision making platforms. As a result of its adoption and implementation, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been accomplished and/or are in the process of development. Under the NEAP process, Environmental Impact Assessments were introduced targeting the industrialists, business community and local authorities.

5.19.2 National Shelter Strategy to the Year 2000.

Kenya adopted this strategy following the International Year of Shelter for the Homeless in 1987. This advocates for the involvement of various actors to come in and assist the government in providing housing. This took cognizance of the governments' inability to provide sufficient shelter for all its citizens. The government was to simply facilitate other actors such as developers to invest in shelter.

5.19.3 The National Poverty Eradication Plan (NPEP).

The objective NPEP is to alleviate poverty in rural and urban areas by 50 percent by the year 2015; as well as the capabilities of the poor and vulnerable groups to earn income. It also aims to narrow gender and geographical disparities and a healthy, better educated and more productive population. This plan has been prepared in line with the goals and commitments of the World Summit for the Sustainable Development (WSSD) of 1995. Since poor housing is among the indicators of poor societies, pursuits to address it build individuals capacity to relieve poverty.

5.19.4 National Policy on Water Resources Management and Development

While the National Policy on Water Resources Management and Development (1999) enhances a systematic development of water facilities in all sectors for promotion of the country's socio-economic progress, it also recognizes the by-products of this process as wastewater. It, therefore, calls for development of appropriate sanitation systems to protect people's health and water resources from institutional pollution. This implies that Industrial and business development activities should be accompanied by corresponding waste management systems to handle the waste water and other waste emanating there from. The same policy also requires that such projects undergo comprehensive EIAs that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighbourhood and further downstream are not negatively impacted by the emissions. As a follow-up to this, EMCA, 1999 requires annual

environmental audits to be conducted in order to ensure that mitigation measures and other improvements identified during EIAs are implemented.

In addition, the policy provides for charging levies on waste water on the basis of quantity and quality. The “polluter-pays-principle” applies in which case parties contaminating water are required to meet the appropriate cost of remediation. Consequently, to ensure water quality, the policy provides for establishment of standards to protect water bodies receiving wastewater, a process that is ongoing. The standards and measures to prevent pollution to water resources are provided for in the Environmental Management and Coordination (Water Quality) Regulations, 2006 which is a supplementary legislation to EMCA, 1999.

5.19.5 Policy Paper on Environment and Development (Sessional Paper No. 6 of 1999):

The key objectives of the Policy include: -

- (i) To ensure that from the onset, all development policies, programmes and projects take environmental considerations into account,
- (ii) To ensure that an independent environmental impact assessment (EIA) report is prepared for any industrial venture or other development before implementation,
- (iii) To come up with effluent treatment standards that will conform to acceptable health guidelines.

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

CHAPTER SIX: ANALYSIS OF PROJECT ALTERNATIVES

During the course of formulating the proposed development, several alternatives were considered to ensure that the best option of project development was adopted. The consideration of alternatives is one of the more proactive approaches of environmental assessment. This process serves to enhance the project design through an examination of other feasible options instead of only focusing on the more defensive task of reducing adverse impacts of a single design. The project alternatives considered included:

6.1 Project Alternative Site

Alternative site option is one of the alternatives for this project. In this case, the proponent will have to move the project to another site instead of implementing it on the proposed site. This is not however a feasible option considering that:

- ✓ The proposed site was chosen by the proponent after considering all other alternatives sites;
- ✓ At the moment, the proponent has no alternative sites for relocation;
- ✓ Finding and acquiring land to accommodate the scale, type and size of the project and completing official transaction may take longer and delay the project;
- ✓ Even if the land was to be obtained, there is no guarantee that such land would be suitable in terms of environmental, health and safety requirements; accessibility and zoning based on land use; and
- ✓ Even if the land was to be obtained, the proponent will spend another one year on project planning activities to adjust to new site conditions, this will not be cost friendly to the proponent.

6.2 The No Project Alternative

The other best alternative to address the significant impacts is the No project alternative. This alternative will ensure that things remain unchanged. The environment therefore will not be tampered with. This option is not feasible too. This is due to:

- ✓ It results in losses to the project proponent and other stakeholders, society and the Government;
- ✓ The project would not be constructed and there would be no modern houses for civil servants in Machakos County.

- ✓ The land will remain literally idle;
- ✓ Lack of creation of employment, hence, effect on socio-economic empowerment of the society;
- ✓ Local skills would remain under-utilized; and

6.3 Alternative design and technology

The proponent would also have opted to adopt alternative design and technology. This option too is not feasible since the adopted technology in this project is a brain child of various professionals.

6.4 Input Alternatives

The choice of materials and inputs selected for the project was based on the stipulated laws, standards and specifications as commonly applied in a project of such nature. The selection of materials takes into account design specifications and end user consideration.

CHAPTER SEVEN: POSSIBLE ENVIRONMENTAL IMPACTS, THEIR MITIGATION MEASURES

7.1 DEFINITION & CLASSIFICATION OF ENVIRONMENTAL IMPACTS

An environmental impact is any change to the existing condition of the environment caused by human activity or an external influence. Impacts may be positive (beneficial) or negative (adverse). They may also be direct or indirect, long-term or short-term in duration, and wide-spread or local in the extent of their effect. Impacts are termed cumulative when they add incrementally to existing impacts.

In the case of the proposed social hall, potential environmental impacts would arise during the construction and the operations phases of the project and at both stages positive and negative impacts would occur.

7.2 IMPACT SIGNIFICANCE

The purpose of an EIA is to identify the significant impacts related to the project or activity under consideration and then to determine the appropriate means to avoid or mitigate those which are negative, and if possible, enhance any positive effects resulting from the project.

Significant impacts are defined, not necessarily in order of importance, as being those which:

- Are subject to legislative control;
- Relate to protected areas or to historically and culturally important areas;
- Are of public concern and importance;
- Are determined as such by technically competent specialists;
- Trigger subsequent secondary impacts;
- Elevate the risk to life threatening circumstances; and
- Affect sensitive environmental factors and parameters.

7.2.1 Construction Phase Negative Impact

7.2.1.1 Soil erosion - land degradation

Improper location of stockpiles of sand, gravel, cement, etc., at the construction site could also cause fine materials to be washed into the drainage system during heavy rainfall events. This would not only represent a waste of materials but would also contribute blockage of drainage systems.

7.2.1.2 Accumulation of solid waste at the site

Considerable volumes of solid waste will be generated during the clearance and construction works, which would include some vegetation and typical construction_waste such as wasted concrete, steel, wooden scaffolding and forms, pulp and polythene bags, waste earth

materials, etc. This waste will negatively impact the aesthetic value of the site and surrounding environments if not properly managed and disposed off at an approved dumpsite. Solid waste, if allowed to accumulate on the ground, could cause localized pooling and flooding. Pooling of water, in turn, would create conditions conducive to the breeding of nuisance and health-threatening vectors such as mosquitoes. Improper management of construction waste constitutes a short-term negative impact.

7.2.1.3 Construction works noise - auditory nuisance

Although not expected to create a significant negative impact, the use of vehicular activities and heavy equipment during construction and building works will inevitably generate noise, which may create a nuisance for nearby residents, particularly the immediate neighbours. Albeit annoying, this negative impact will be short-term (limited to the construction phase). Noise beyond some level is itself a nuisance and need to be avoided. Such noise emissions should be minimized as much as possible from the source point through appropriate measures.

7.2.1.4 Dust Emission - air quality degradation

During the construction phase, air quality is expected to decline as a result of an increase in levels of fugitive dust from excavation works, the stockpiled earth materials, dusty roads and concrete mixing. Respirable particulates are a public health hazard and may otherwise create considerable nuisances to the public. This is expected to be a short term, reversible impact lasting only for the duration of the construction activity.

7.2.1.5 Spillage of hazardous materials

All sorts of motorized equipment, from generators to trucks, requiring fuel, lubrication and maintenance will be used at the construction site. Many will also be fitted with lead batteries. Spillage of hazardous materials on the ground surface has a potential of contaminating underground water.

7.2.1.6 Fire outbreak - environmental disaster

Some intensive dry processes will be conducted on site. Such a process may result to a fire outbreak within the project site especially if flammable materials such as vehicle fuel will be stored on site. Minor welding works will be carried out on site so as to repair broken down machines or vehicles and this increases the chances of fire outbreak.

7.2.1.7 Construction works induced traffic - traffic congestion

Activities related to construction works will undoubtedly induce uncharacteristic levels of additional vehicular traffic along the road leading to the site. Related issues of vehicle congestion and reckless driving by truck drivers delivering construction materials to the site will be sources of annoyance, if not accidents, to local residents during the construction phase.

7.2.1.8 Construction works water demand - Increased pressure on existing supply

A considerable amount of fresh water will be required during the construction works, especially for use by construction workers (washing), for cement mixing and for wetting of the site to control dust. This may place some amount of strain on water supply.

7.2.1.9 Gaseous emissions

The various materials required for construction and building (e.g. sand, ballast, aggregate, steel, blocks, lumber, asphalt, cement, etc.) will be obtained from sources within and elsewhere and transported to the site. Transportation of these materials, characteristically in over-laden trucks, usually results to gaseous emissions. Other construction equipment including excavators, bull dozers and concrete mixers have also a potential of resulting to air pollution. Emission of gaseous pollutants into the atmosphere represents indirect, short-term, reversible, negative impacts on public health and safety.

7.2.1.10 Disposal of sewage

Lack of or inadequate provision of toilets for use by workers can lead to ad hoc defecation in secluded areas or structures on the site, thus creating unsanitary conditions and sources of fly infestation. This can threaten the health of neighbours and workers themselves. Indiscriminate sewage disposal can also result to contamination of underground water resources.

7.2.1.11 Workers accidents and hazards during construction

During the construction of the proposed office, it is expected that construction workers are likely to have accidental injuries and hazards as a result of handling hazardous waste. Because of intensive engineering and construction activities including erection and fastening of roofing materials, metal grinding and cutting, concrete work, steel erection and welding among others, construction workers will be exposed to risks of accidents and injuries.

7.2.1.12 Extraction and use of building materials

Building materials such as hard core, ballast, cement, rough stone and sand required for the construction of the housing project, will be obtained from quarries, hardware shops and sand harvesters who extract such materials from natural resource banks such as river banks and land. Since substantial amount of these materials will be required for construction of the buildings, the availability and sustainability of such resources at the extraction sites will be negatively affected as they are not renewable in short term. In addition, the sites may be significantly affected in several ways including landscape change, displacement of animals and vegetation, poor visual quality and opening of depressions on the surface leading to several human and animal health impacts.

7.2.2 Construction Phase Positive Impact

7.2.2.1 Employment - socio - economic benefit

Several positive impacts are expected from the development of the project. These include the generation of employment for skilled and unskilled labour in the short to medium term.

7.2.2.2 Improving growth of the economy

Through the use of locally available materials during the construction phase of the project including cement, concrete and ceramic tiles, timber, sand, ballast electrical cables etc, the project will contribute towards growth of the economy by contributing to the gross domestic product. The consumption of these materials, fuel oil and others will attract taxes including VAT which will be payable to the government hence increasing government revenue while the cost of these raw materials will be payable directly to the producers.

7.2.3 Operation Phase Negative Impacts

7.2.3.1 Increased pressure on infrastructure

The proposed development will definitely lead to increased pressure on existing infrastructure such as roads, piped water and other utilities like electricity.

7.2.3.2 Increased generation of solid waste

The quantities of solid waste to be generated by the people who will use the office are expected to be significant. Such waste will include foodstuffs, empty plastic containers, cartons, waste papers, plastic bags, etc. Improper management of solid waste will result to aesthetic degradation and breeding of disease vectors.

7.2.3.2 Increased traffic flow - Increased accidents

The number of vehicles within the area is likely to increase and this may lead to congestion and road accidents along access road.

7.2.3.3 Effluent Disposal

The project is expected to generate huge amounts of effluent to the environment. Proper management of the effluent will ensure a clean environment for the residents of this area. The effluent from the proposed construction will be discharged into the sewer line.

7.2.4 Operation Phase positive Impacts

7.2.4.1 Availability of modern houses for civil servants

One of the positive aspects of project is that it will contribute to provision of sufficient and modern houses for civil servants in Machakos County.

7.2.4.2 Employment opportunities

Employment opportunities are one of the long term impacts of the proposed project. Potential beneficiaries will include security guards, waste transporters, cleaners and gardeners.

7.2.4.3 Optimal use of land

By putting up the proposed development on the plot, the proponent would have utilized it optimally.

7.2.5 Decommissioning phase negative impacts

During the decommissioning phase, another comprehensive EIA study based on the intended new use of the site will be conducted.

7.2.5.1 Noise and Vibration - Audible nuisances

The demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas. This will be as a result of the noise and vibration that will be experienced as a result of demolishing the proposed project.

7.2.5.2 Solid Waste Generation

Demolition of the residential development and related infrastructure will result in large quantities of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. There is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. In addition, even the generally non-

toxic chemicals such as chloride, sodium, sulphate and ammonia which may be released as a result of leaching of demolition waste, are known to lead to degradation of ground and surface water quality.

7.2.5.3 Dust emission

Large quantities of dust will be generated during demolition works. This will impact negatively on the demolition staff as well as the neighbouring residents.

7.2.6 Decommissioning phase positive impacts

7.2.6.1 Employment opportunities

For demolition to take place properly and in good time, several people will be involved. As a result several employment opportunities will be created for the demolition staff during the demolition phase of the proposed project.

7.3 MITIGATION MEASURES

7.3.0 Mitigation measures for impacts in the construction phase

7.3.1 Controlling soil erosion

- Stage site clearance works so as to minimize the area of exposed soil at any given time.
- Monitor areas of exposed soil during periods of heavy rainfall throughout the construction phase of the project to ensure that any incidents of erosion are quickly controlled.
- Channeling the storm water into the existing storm water lines.
- Building of physical barriers to prevent mass movement where necessary.
- The stockpiling of construction materials should be properly controlled and managed. Fine-grained materials (sand, marl, etc.) should be stockpiled away from any surface drainage channels and features.
- Low bumps should be placed around the piles of sand and marl and/ or tarpaulin used to cover open piles of these materials to prevent them from being washed away when it rains heavily.
- Safe storage areas should be identified and retaining structures put in place prior to the arrival
- Materials to be delivered on site in installments to avoid stockpiling and possible wastage.

7.3.2 Management of Construction Waste

- A site waste management plan should be prepared by the contractor prior to commencement of construction activities. This should include designation of appropriate waste storage areas, collection and removal schedule, identification of approved disposal site, and a system for supervision and monitoring.
- Preparation and implementation of the plan must be made the responsibility of the building contractor with the system being monitored independently.
- Special attention should be given to minimizing and reducing the quantities of solid waste produced during site preparation and construction.
- Any combustible waste must not be burned on the site.
- Reusable inorganic waste (e.g. excavated sand/soils) should be stockpiled away from drainage features and used for in filling where necessary and/or possible.
- Unusable construction waste, such as damaged pipes, formwork and other construction material, must be disposed of at an approved dumpsite.
- Provide solid waste receptacles and storage containers, particularly for the disposal of plastic bags, boxes, so as not to block drainage system and to prevent littering of the site.
- Make arrangements for the daily collection of litter from the site and appoint a NEMA licensed solid waste transporter to collect and transport it for dumping at approved site.

7.3.3 Control of Construction works noise

- Restrict noisy construction activities to normal working hours (8am - 5pm).
- Inform local residents beforehand, via notices and advisories, of pending noisy periods and solicit their tolerance well before the commencement of piling works.
- Workers operating equipment that generate noise should be equipped with noise protection gear including ear muffs and plugs. Workers operating equipment generating noise levels greater than 80 dBA continuously for 8 hours or more should use earmuffs whereas those experiencing prolonged noise levels of 70 - 80 dBA should wear earplugs.
- Limit pickup trucks and other small equipment to an idling time of five minutes, observe a common-sense approach to vehicle use, and encourage workers to

switch off vehicle engines whenever possible.

- All construction equipment should be regularly inspected and serviced.

7.3.4 Control of Dust Emissions

The main contractor will be required to train workers on appropriate methods for minimizing dust emission during construction phase. Proposed methods for minimizing dust emission include;

- Covering of all haulage vehicles carrying sand, aggregate and cement.
- Stockpiles of fine materials (e.g. sand and ballast) should be wetted or covered with tarpaulin during windy conditions.
- Workers in dusty areas on the site should be issued with dust masks during dry and windy conditions
- Providing appropriate enclosure for the concrete mixer and
- Use of dust nets at high levels of the building.

7.3.5 Managing Spillage of Hazardous Materials

Spillage of hazardous materials shall be managed by implementing the following measures;

- Refueling and maintenance of large vehicles will not take place at the construction site
- All hazardous materials to be stored in appropriately bonded containers and placed on concrete floor
- Maintaining spill response kits at the site office
- Prepare and display on site spill response procedures and
- Training of workers on spill response and management

7.3.6 Containing Fire outbreak

Fire incidents shall be managed by implementing the following measures;

- Provide adequate number of appropriate firefighting equipment and Post 'No smoking signs' where flammable materials will be stored.
- Organize for inspection and maintenance of fire equipment at least once in a period of six months.
- Train staff on the use of the available firefighting equipment.
- At least one person trained on handling fire fighting techniques should be available

through-out the construction phase of the project.

- Develop and post at the site, fire emergency and evacuation procedures.
- Maintain on site telephone contacts for fire brigade, G4S fire brigade and St. Johns ambulance service provider.

7.3.7 Control of Traffic

- Issue notices/advisories of pending traffic inconveniences and solicit tolerance by local residents before the commencement of construction works.
- As far as possible, transport of construction materials should be scheduled for off-peak traffic hours. This will reduce the risk of traffic congestion and of road accidents on the roads leading to the site.
- Appropriate traffic warning signs, informing road users of a construction site entrance ahead and instructing them to reduce speed, should be placed along the main road in the vicinity of the entrance to the site during the construction period.
- Flagmen should be employed to control traffic and assist construction vehicles as they enter and exit the project site.
- Train drivers on road safety.
- Maintain on site a record of incidents and accidents.

7.3.8 Management of water demand

The proposed development will increase water demand throughout the construction phase. Increase in water demand can be minimized by;

- Providing adequate water storage reservoirs at the construction site to meet project needs during periods of high demand externally and refill
- Engaging water supply tankers in case of total supply failure.
- Implementing appropriate water conservation measures

7.3.9 Management of sewage

- Providing adequate sanitary facilities for workers with appropriate sanitary arrangement to prevent runoff.
- Sensitize workers on the rationale of using the sanitary facilities.

7.3.10 Control of gaseous emissions

Gaseous emissions will be managed by:

- Proper engine tune up
- Regular inspection and maintenance of construction equipment
- Reduce machines and vehicles idling time
- Avoid burning of solid waste at the site

7.3.11 Workers Health & Safety

- Engaging only those workers that are trained to operate specific machines and equipment.
- Proper signs on site to warn workers of safety requirements as regards machines with moving parts and other equipment at site.
- Provide a First Aid box and have a trained person to handle site emergencies and incidences.
- Display in the site telephone numbers of ambulances or provide a site vehicle to specifically transport the injured to hospital.
- Provide fire-fighting mechanism at site. Display emergency call numbers that can be used in case of a site fire.
- Provide safe scaffoldings and railings at heights.
- Provide washing (enclosed bathroom) and toilet facilities at site with both drinking and washing water. The number of workers engaged determines the number of the toilets and bathrooms provided.
- Providing safety helmets, safety masks (welders), safety shoes (loaders), uniforms and hand gloves to the workers.
- Using well-maintained equipment by qualified personnel.

Mitigation measures at operational phase impacts

7.4.1 Reducing pressure on infrastructure

Relevant authorities such as the Kenya Power and other utility providers should be informed of the capacity of expansion and are aware of the necessary requirements concerning the project.

However, the proponent will install water-conserving automatic taps and toilets, as well as energy saving electrical fittings to optimize use of public resources. Moreover, any water leaks through damaged pipes and faulty taps will be fixed promptly by a licensed plumber.

In addition, the occupants of the office will be sensitized to conserve energy and water. It will be important for the proponent to monitor water and energy use during the operation phase of project and to set targets for their efficient use.

7.4.2 Proper solid waste management

The proponent will be responsible for proper management of solid waste generated from the office during operation phase. In this regard, they are required to contract a private waste handler who is licensed by NEMA for waste disposal.

7.4.3 Control of traffic flow

The proponent will be required to implement the following measures in order to control flow of traffic during operational phase.

- Appropriate traffic warning signs instructing occupants and visitors to reduce speed, 'should be placed at the vicinity of the entrance to the site
- Security guards should be instructed to control traffic along the private road leading to the site and assist vehicles as they enter and exit the project site.
- Security guards should maintain a record of incidents and accidents at the site
- Contacts of emergency service providers including St. Johns ambulance, breakdown vehicle and traffic police, should be displayed at the main entrance area

7.4.4 Management of Fire Incidents

Fire incidents shall be managed by implementing the following measures;

- Install firefighting equipment prior to occupation of the buildings.
- Ensure firefighting equipment are inspected and serviced at least once in a period of one year.
- Identify and mark conspicuously an emergency assembling point.
- Conduct an annual fire audit for the buildings.

7.4.5 Effluent disposal

Effluent from the proposed development will be disposed into the sewer line

7.5. Mitigation measures for impacts in the decommissioning phase

7.5.1 Proper solid waste management

A site waste management plan should be prepared by the contractor prior to commencement of demolition activities. This should include designation of appropriate

waste storage areas, collection and removal schedule, identification of approved disposal site, and a system for supervision and monitoring.

- Any vegetation and combustible waste must not be burned on the site.
- Demolition debris should be stock piled at a safe place
- Reusable materials like doors, windows and timber should be sold to licensed scrap dealers
- Provide solid waste receptacles and storage containers, particularly for the disposal of plastic bags, boxes, so as not to block drainage system and to prevent littering of the site.
- Make arrangements for the daily collection of litter and demolition debris from the site by a licensed solid waste transporter for dumping at approved site.

7.5.2 Control of dust emission

High levels of dust concentration resulting from demolition or dismantling works will be minimized by implementing the following measures;

- Covering of all haulage vehicles carrying debris for dumping at approved sites
- Stockpiles of fine materials should be wetted or covered with tarpaulin during windy conditions.
- Workers should be issued with proper protective equipments.
- Proper hording (fencing with three metre high galvanized iron sheets) of the site prior to demolition

7.5.3 Minimization of noise and vibration

Significant impacts on the acoustic environment will be mitigated as described below;

- Restrict demolition activities to normal working hours (8am - 5pm).
- Inform local residents beforehand, via notices and advisories, of pending noisy periods and solicit their tolerance well before the commencement of demolition works.
- Workers operating equipment that generate noise should be equipped with noise protection gear including ear muffs and plugs. Workers operating equipment generating noise levels greater than 80 dBA continuously for 8 hours or more should use earmuffs whereas those experiencing prolonged noise levels of 70 - 80 dBA should wear earplugs.
- Limit pick up trucks and other small equipment to an idling time of five minutes,

observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible.

- All demolition equipment should be regularly inspected and service.

7.6 Environmental Audit and Monitoring

Environmental Auditing will be done yearly and reports presented to NEMA for review.

7.7 Social Impacts Assessment

7.7.1 Positive Social Impacts for the proposed project

The proposed development will have positive impacts to the society and the environment in general. Some of the benefits include the following:

- The optimal use of the land.
- Availability of modern houses for civil servants in Machakos County.
- Creation of market for goods and services and especially construction inputs which include raw materials, construction machinery and labour. Secondary businesses are also likely to spring up during the construction phase especially those providing foods and beverages to the construction workers.
- Job opportunities for Kenyans both during planning, construction and operational phases. They include building Contractors, architectures, structural engineers, mechanical engineers, surveyors, environmentalists, security agents, transporters, construction workers, site managers and foremen.
- Increase in revenue for the government.

7.7.2 Negative Social Impacts for the proposed project

Against the background of the above positive impacts, there are a few negative drawbacks that are anticipated mostly during the construction of the project. They include the following:

- Waste water management and disposal
- Increased water demand
- Increased power demand
- Oil spills during construction.
- Dust emissions.
- Soil compaction, erosion and pollution
- Safety concern during construction
- Noise and vibrations.
- Increased Population density.
- Air pollution during construction.

- Health and safety for the workers during construction phase

7.7.3 Mitigation Measures for Negative impacts

One of the objectives of the environmental assessment has been to identify measures to be taken by the proponent to mitigate environmental impacts. These will include:

- A code of practice to minimize construction noise, vibration, dust and disturbance on the site.
- Application of soil conservation measures to reduce surface runoff during wet seasons and especially during construction phase.
- Recovery of all debris generated and reuse of materials where possible e.g. the stone chippings which can be used as hardcore.
- Recycling and reuse of appropriate materials.
- Provision of security measures to deter intruders and protect them from the risk of injury; and fitting of noise mufflers on generator exhausts.
- Installation of oil/diesel separators on site to keep oils from storm runoff.
- predetermined route to the site, oil spillages will be minimized by using right machinery that are regularly serviced and operators who are qualified following the operations instructions strictly.
- The contractor and the proponent/management will ensure effective wastewater management, maintain equipment to avoid leaks.
- Drainage structures will be installed properly, loose soils will be compacted, landscaping.
- The contractor will ensure management of excavation activities, activities will be controlled especially if construction will take place during rainy season.
- After construction the proponent shall rehabilitate the land by removing any unnecessary materials that shall be covering the land and preventing the natural biodiversity.
- Sensitize drivers of construction machinery on effects of noise; billboards will be suitably erected on the start of the project to psychologically prepare the people in the vicinity.
- Signs must indicate and inform the public when the works starts and when it will be completed, construction activities to be restricted to daytime to avoid accidents and possible harm to construction crew.
- Install a project signboard as per Ministry of Works standards, approved by council indicating names and addresses and telephone no. of developers' contractors and project consultants.
- Workers in the vicinity of high-level noise to wear safety and protective gears, provide barriers such as walls around site boundaries to provide some buffer against noise propagation.

- Vehicle speeds in the construction area will be limited to minimize dust in the area, discourage idling of vehicles i.e. vehicle and equipment engines will be turned off when not in direct use to reduce exhaust emissions.
- Regular maintenance of construction plant and equipment, engage sensitive construction workers,
- Provide Personal protective Equipments such as nose masks to the workers on site; the construction contractor will water the site with exposed soil surfaces twice each day during dry weather.
- All residual waste materials to be recycled sold or disposed in an environmentally friendly manner. Wastes will be properly segregated and separated to encourage recycling of some useful wastes; dustbins will be provided at the construction site.
- A First Aid Kit will be provided within the site and it will be fully equipped at all times.
- Sanitary facilities will be provided for each gender, local individuals preparing food for the workers at the site will be controlled to ensure that food is hygienically prepared.
- Construction crew at the site will be sensitized on social issues such as drugs, alcohol diseases, ensure proper solid waste disposal and collection facilities, ensure effective wastewater management.
- Provision of safe drinking water, contractor to take an insurance cover for workers incase of major accidents on site.
- Unauthorized persons will be restricted from construction site, enforce speed limits for construction vehicles especially along roads leading to the site, provide bill boards at the site/entrance to notify motorists about the development, put up warning signs like “speed limit 40kph”, “heavy vehicles” etc

CHAPTER EIGHT: ENVIRONMENTAL MANAGEMENT PLAN (EMP)

From the analysis provided, implementation of the project has the potential to generate various impacts on the environment. Some of the negative impacts need mitigation measures to prevent or subdue their occurrence. The mitigation measures have been translated into action plans (EMP) that need to be part of the project implementation program. The environmental management plan (EMP) has been developed to assist in prioritizing the key findings of the EIA, suggesting necessary mitigation actions and allocating responsibilities.

A schedule for the project implementation has been drawn that takes into consideration all issues that could develop into serious risks to environment, health and safety when the project operations start.

Finally management reviews and continuous improvement determines which of the issues require to be revisited and at what times. Based on the policy guidelines and development of the EMP, there are other recommended actions to be undertaken by the management in the implementation of the project. These include:

8.1 Environmental Management & Monitoring plan for demolition and site preparation phase

ENVIRONMENTAL MANAGEMENT PLAN IMPLEMENTATION PHASE

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	MONITORING MEASURES
Commissioning of the Construction Works	Site hand-over and Ground breaking	Project team (Lead Consultant/Architect, contractor /proponent)	Part of/Covered in the Project Cost	Presence of the project Team
Securing the Construction Site	Construction of Perimeter Wall and Hoarding	Contractor	Part of/Covered in the Project Cost	Presence of Perimeter Fence
Housing for Construction/ Site staff	Construction of Labour Camp	Contractor	200,000	Presence of Labour Camp
Security for Construction Material	- Construction of Site Stores - Construction materials to be delivered in small quantities to minimize storage problems	Contractor	100,000	Presence of Site store
Extraction and Use of Building Materials	- Availability and sustainability of the extraction sites as they are non renewable in the short term - Landscape changes e.g. displacement of animals and vegetation,	Contractor/Proponent/project team	Part of/Covered in the Project Cost	Material site rehabilitation

	poor visual quality and opening of depressions on the surface			
Collapse of Building during Construction	<ul style="list-style-type: none"> - Ensuring Building Strength and stability - Use of appropriate construction materials and reinforcements as per specifications - Ensuring building components are as per designs - Proper supervision - Ensure proper timelines are followed e.g. curing time 	Contractor/project team	Part of/Covered in the Project Cost	Presence of the project Team
Disturbance of Traffic flow during construction	<ul style="list-style-type: none"> - Proper signage - Awareness creation - Education to truck drivers 	Contractor/Project team and general public	450,000	<ul style="list-style-type: none"> - Presence of site Notice Board /Hoarding - Presence of Security guards to control traffic - Presence of warning signs and education materials

CONSTRUCTION PHASE

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	MONITORING MEASURES
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Soil Excavation leading to site disturbance	<ul style="list-style-type: none"> - Excavate only areas to be affected by buildings - Dumping of excess excavated materials to sites designated by NEMA and Council - Restoration of sites Excavated 	Contractor	2,000,000	Landscaping after completion of construction
Soil Erosion	<ul style="list-style-type: none"> - Create and Maintain soil traps and embankments. - Landscaping after completion of construction 	Contractor/Proponent Architect/Site engineer Landscape Architect	400,000	Lack/Absence of Soil Erosion
Noise Pollution and Vibration	<ul style="list-style-type: none"> - Ensure use of serviced and greased equipment - Switch off engines not in use - Construction work to be confined to between 8am to 5pm - Ensure use of earmuffs by machine operators 	Proponent and Contractor	Part of Routine operation procedure	Lack of complaints
Air Quality	<ul style="list-style-type: none"> - Water sprinkling of driveways or the use of biodegradable hydrant e.g. Terrasorb polymer will reduce dust emission during 	Proponent and Contractor	Part of Routine operation procedure	<ul style="list-style-type: none"> - Lack of complaints - Workers wearing protective clothing and earmuffs

	<p>construction</p> <ul style="list-style-type: none"> - Ensure servicing of vehicles regularly 			
Risks of Accidents and Injuries to Workers	<ul style="list-style-type: none"> - Education and awareness to all construction workers - Ensure use of appropriate personal protective clothing - Provide First Aid Kits on site - Ensuring Building Strength and stability - Proper supervision 	<p>Proponent</p> <p>Contractor</p>	<p>Part of Routine operation procedure</p>	<ul style="list-style-type: none"> - Presence of well equipped First Aid kit - Presence of Security Guards on site - Presence of a register on the site
Health and Safety	<ul style="list-style-type: none"> - Provide First Aid Kits on site - Proper signage and warning to public of heavy vehicle turning - Ensuring Building Strength and stability - Provide clean water and food to the workers - The contractor to abide by all construction conditions especially clause B12 which stipulates health safety and workforce welfare 	<p>Proponent</p> <p>Contractor</p>	<p>Part of Routine operation procedure</p>	<ul style="list-style-type: none"> - Presence of well equipped First Aid kit at the site - Presence of Security Guards on site - Presence of a register on the site

Solid Waste Generation	<ul style="list-style-type: none"> - Ensure waste materials are disposed of on Council and NEMA approved sites - Ensure re-use of materials that can be re-used - Use of the 3rs – Reduce, Re-use, Re-cycle 	<p>Proponent</p> <p>Contractor</p>	400,000	<ul style="list-style-type: none"> - Absence of Solid waste on the site
Energy Consumption	<ul style="list-style-type: none"> - Use electricity sparingly since high consumption of electricity negatively impacts on these natural resources and their sustainability - Use of Standby Generators 	<p>Proponent</p> <p>Contractor</p>	800,000	<ul style="list-style-type: none"> - Presence of KPLC power lines - Presence of Generators
Excessive Water Use	<ul style="list-style-type: none"> -Excessive water use may negatively impact on the water source and its sustainability 	<p>Proponent</p> <p>Contractor</p>	900,000	<ul style="list-style-type: none"> - Presence of MWSC water lines - Metering of water - Bore-hole

OCCUPATION PHASE

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	MONITORING MEASURES
Architectural incompatibility leading to distortion of neighbourhood aesthetic image	<ul style="list-style-type: none"> - Harmonize building scale with existing developments in neighbourhood. - Harmonize detail, material and finishes for 	<p>Architect</p> <p>Proponent</p> <p>Contractor</p>	Part of/Covered in the Project Cost	<ul style="list-style-type: none"> - Compatibility with the neighbourhood

	roofs and walls with existing development in the neighbourhood.			
Solid Waste Generation and Management	<ul style="list-style-type: none"> -Regular inspection and maintenance of the waste disposal systems during operation phase - Establish a collective waste disposal and management system - Provide waste disposal bins to each house well protected from adverse weather and animals - Ensure waste materials are disposed of on Council and NEMA approved sites - Use of the 3rs – Reduce, Re-use, Re-cycle 	Proponent Estate Managers	800,000	<ul style="list-style-type: none"> - Presence of NEMA registered waste management companies - Presence of waste handling bins - Absence of wastes
Liquid Waste Generation and Management	<ul style="list-style-type: none"> - Regular inspection and maintenance of the waste disposal systems during the operation phase - Connection to Sewer system/septic tank 	Proponent Estate Managers	800,000	<ul style="list-style-type: none"> -Conventional sewer line and or septic tank - Presence of waste handling bins - Absence of wastes
Increased loading on Infrastructure	-Have paved local access	Contractor	900,000	-Absence of run-off

services - Increased vehicular and/or pedestrian traffic - Increased demand on water, sanitation services	road and walkway system - Encourage rainwater harvesting - Provision of increased water storage capacity - Provide adequate storm water drainage system	Proponent Estate Managers		- Presence of good roads - Pavements and drainage channels
Traffic	-Provide adequate parking facilities within the project site	Contractor/Proponent Residents	Routine operation procedure	- Presence of ample parking in the premises
Increased social conflict	-Increased Housing stock in the area and Kenya - Increased economic activities – employment generation, income earnings and housing capital stock formation - Encourage formation of community policing and formation of neighbourhood associations	Contractor Proponent Neighbourhood associations Estate Managers		
Storm Water impacts	- Provide roof gutters to collect and direct roof water to drains - Construct drains to standard	Proponent Contractor	340,000	Absence of Flooding and dampness in the building

	<p>specifications</p> <ul style="list-style-type: none"> - Develop a storm water drainage system and linkage to natural drains 			
<p>Disruption of existing natural environment and modification of micro-climate –</p> <ul style="list-style-type: none"> - Increased development density - Increased glare/solar reflection - Reduced natural ground cover/surface run-off - Obstruction of ventilating winds 	<ul style="list-style-type: none"> - Development restricted to follow zoning policy/approved density – building line, plot coverage and plot ratio. - Careful layout and orientation of buildings to respect wind and sun direction. - Adequate provision of green and open space planted with grass, shrub and tree cover. - Minimum use of reflective building material and finishes for roof, wall and pavement. 	<p>Project team (Contractor Proponent, Architect or Lead Consultant, etc)</p>	<p>1,200,000</p>	<p>Proper orientation Planted trees/Landscaping</p>
<p>Insecurity</p>	<ul style="list-style-type: none"> -Ensure secure perimeter wall where applicable - Have a single entry point that is manned 24 hours 	<p>Contractor, Proponent, Neighbourhood associations , Estate manager</p>	<p>200,000</p>	<ul style="list-style-type: none"> -Presence of perimeter wall -Presence of day and night security guards

DECOMMISSIONING PHASE

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	MONITORING MEASURES
Building Safety	Assess the condition of buildings to ascertain usefulness	Engineer/Proponent	600,000	Engineer and Tests on the building
Land and Building use	Ascertain the Planning development policy	Local Authority Physical Planner	650,000	Consultants present
Accidents/Injuries	Securing the Site by fencing off	Contractor/Proponent	1,000,000	Presence of perimeter fence
Un-disconnected Services e.g. Power, Water, telephone, sewer etc	Ensure disconnection of all services Remove all surface and underground cables and wiring	contractor	600,000	Absence of cabling
Solid Waste Generation (demolition waste)	- Ensure waste materials are disposed of on Council and NEMA approved sites - Ensure re-use of materials that can be re-used -Use of the 3rs – Reduce, Re-use, Re-cycle	Proponent/Contractor	200,000	Absence of Debris
Noise and Vibration	- Ensure use of serviced equipment - Switch off	Proponent/Contractor	80,000	Lack of complaints from the neighbours

	engines not in use - Demolition work to be confined to between 8am to 5pm - Ensure use of earmuffs by workers			
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CHAPTER NINE: PUBLIC PARTICIPATION AND CONSULTATION

9.1 INTRODUCTION

This chapter describes the process of the public consultation and public participation followed to identify the key issues and impacts of the proposed project. Views from the local residents and any other affected parties surrounding the proposed project were sought through interviews as stipulated in the Environment Management and Coordination Act, 1999.

9.2 OBJECTIVES OF THE CONSULTATION AND PUBLIC PARTICIPATION

It is important that the general area residents be made aware of the proposed housing project and submits their opinions at the initiation stage. The public awakening was facilitated through consultations and discussions (more participatory, interactive and intensive processes of stakeholder engagements) undertaken in the neighbourhood of the proposed development site (Machakos School for the Deaf). The objectives of the public consultation were to inform the stakeholders in the area about the project; gaining their views, concerns and values, taking account of neighbours and general public inputs in decision making; obtaining local knowledge, reducing conflict, improving transparency and accountability in decision making, and increasing public confidence and awareness. It was relatively easy to acquire the reservations of the community since these kinds of developments are welcome. The community could therefore understand easily the potential impacts that could result from the implementation of the project i.e. through comparative analysis. The public participation was facilitated through a public meeting on site and interviews. The key respondents included among others the neighbours and individuals who would directly or indirectly be affected by the implementation of the proposed project. The participants were various stakeholders within the area and at the proximity of the proposed development site including the area assistant chief.

Issues discussed

1. Benefits of the project

The community was happy with the proposed development and outlined the following as the main benefits;

- i. Employment to the youth and residents in general during the construction phase
- ii. Boost to both new (secondary) and existing businesses
- iii. Decent housing to civil servants
- iv. Compound and street lighting to improve security
- v. To contribute positively to Machakos county economy
- vi. CSR projects to benefit local community
- vii. A big population of workers will lead to increased employment opportunities for house helps, plumbers, etc during the operation phase

viii. Farmers to get market for their produce

2. Concerns/ Appeals

- i. Give priority to locals when employing
- ii. Light up the whole street leading to the site to boost security
- iii. Machakos Water and Sewerage Company to Increase water supply to avoid shortages
- iv. The county government to improve garbage collection
- v. Ensure proper connection to the sewer line to avoid pollution
- vi. The contractor was asked to take care of the environment e.g. not to cut trees unnecessarily, avoid damage to the roads
- vii. The implementing ministry was requested to do CSR projects in the area starting with the school for the deaf
- viii. The locals requested that the project security team to be incorporated in the community policing program

The local community was represented by village elders from the following villages:

- a) Mjini
- b) Hospital ward
- c) Kimutwa
- d) Eastleigh
- e) Grogan
- f) Kariobangi
- g) Muumbuni
- h) Kathembani
- i) Nthenge

Conclusions

- The participants were taken through the questionnaires and then filled individually
- They unanimously supported the project and returned a No objection verdict

(Attached at the appendix are the minutes of the meeting, attendance list and filled questionnaires)

CHAPTER TEN: DECOMMISSIONING STAGE

10.1 Decommissioning

Decommissioning is a controlled process used to safely retire a facility that is no longer needed. During decommissioning, facilities or structures are cleaned or secured so that the facility does not pose a risk to public health or the environment now or in the future.

Following completion of the operation of the Project or the project phase, any areas of land used for the project should be re-instated for sustainable future use. The proponent should ensure;

- Termination of power supply to the development.
- Termination of water connections.
- Provision of Personal Protective Equipments (PPEs) to the workers who will participate in the demolition exercise.
- Waste from the site to be disposed in an environmentally friendly manner.
- Rehabilitation of land by removing any unnecessary materials that shall be covering land and preventing the natural biodiversity.
- Landscaping and re-vegetation of all disturbed areas.
- Building materials that cannot be recycled should be disposed off by a registered waste handler recognized by NEMA in relation to Environmental Management and Co-Ordination (Waste Management) Regulations, 2006 Legal NoticeNo.121 and on council disposal sites.

CHAPTER ELEVEN: CONCLUSION

From the findings obtained, it has been noted that the activities to be undertaken from the construction, operation and decommissioning phases of the project will have significant impacts whose scale of magnitude is appreciable. Various mitigation measures have therefore been put in place to help in managing the environment throughout the entire project cycle. An Environmental Management Plan (EMP) has been developed and it's hoped that upon its implementation there will be minimal adverse impacts on the environment.

This Environmental Impact Assessment report indicates that the proponent has made reasonable efforts in upholding the fundamentals of striving towards achieving sustainable development and environmental conservation. The report has recommended the management interventions; time frame and the responsible actors to ensure the measures are in place.

It's hoped that the project will be approved and a license issued to enable the proponent commence with the project implementation.

REFERENCES

- Kenya gazette supplement Acts 2000, Environmental Management and Coordination Act No. 8 of 1999.
- Kenya gazette supplement Acts, Physical Planning Act, cap 286
- Kenya gazette supplement No. 56. Environmental Impact Assessment and Audit Regulations 2003.
- Kenya gazette supplement Acts Local Authority Act (cap 265).
- United Nations, 2000, Millennium Development Goals
- ACTS press, UNEP-ACTS, 2001, The Making of a Framework Environmental Law in Kenya.
- Environmental Management and Co-ordination (Waste Management) Regulations, 2006 Legal Notice No.12
- The Public Health Act, Cap 242
- OSHA 2007
- Way leave Act cap 292
- Urban Areas and Cities Act No. 13 of 2011

APPENDIX

1. Minutes of public participation meeting
2. Attendance list
3. Filled questionnaires
4. Architectural drawings