Environmental and Social Impact Assessment Project Report

For the Proposed 66/11 kV Dagoretti Substation in Nairobi West District, Nairobi County

GPS coordinates of the proposed substation site
Latitude 1°17'37.95"S
Longitude 36°41'2.93"E

September 2013

Final Project Report
CERTIFICATION:

Client: The Kenya Power & Lighting Company Limited

Assignment: To carry out an Environmental & Social Impact Assessment for the proposed Dagoretti 66/11 kV Sub-station in Mutuini Location, Nairobi West District, Nairobi County.

Project Cost: Kshs. 215,000,000.00

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John Guda - Manager, Safety Health & Environment
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<tr>
<td>BOD</td>
<td>Biological Oxygen Demand</td>
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<tr>
<td>BS</td>
<td>British Standard</td>
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<tr>
<td>CBD</td>
<td>Convention on Biological Diversity</td>
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<tr>
<td>CO₂</td>
<td>Carbon dioxide</td>
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<tr>
<td>CSR</td>
<td>Corporate Social Responsibility</td>
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<tr>
<td>DAO</td>
<td>District Agricultural Officer</td>
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<td>DO</td>
<td>District Officer</td>
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<tr>
<td>DC</td>
<td>District Commissioner</td>
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<td>EA</td>
<td>Environmental Audit</td>
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<td>EHS</td>
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<td>EIA</td>
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<td>ESIA</td>
<td>Environmental &amp; Social Impact Assessment</td>
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<td>EIS</td>
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<td>EMCA</td>
<td>Environmental Management and Coordination Act, 1999</td>
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<td>EMP</td>
<td>Environment Management Plan</td>
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<td>ESMP</td>
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<td>ESMP</td>
<td>Environmental and Social Monitoring Plan</td>
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<td>GHGs</td>
<td>Green House Gases</td>
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<td>Ha</td>
<td>Hectare</td>
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<td>HEP</td>
<td>Hydro Electric Power</td>
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<td>HVF</td>
<td>Heavy Vehicle Fuel</td>
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<td>IDO</td>
<td>Industrial Diesel Oil</td>
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<td>KenGen</td>
<td>Kenya Energy Generating Company</td>
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<td>KPLC</td>
<td>Kenya Power &amp; Lighting Company</td>
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<tr>
<td>kV</td>
<td>Kilo Volt</td>
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<td>KVA</td>
<td>Kilo Volt Amps</td>
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<td>KW</td>
<td>Kilo Watt</td>
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<td>NOx</td>
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EXECUTIVE SUMMARY

Introduction, Study Objectives and Terms of Reference

The electricity demand in Kenya is growing exponentially. To meet projected future electricity demand, The Kenya Power and Lighting Company Limited is planning to strengthen its transmission network by constructing several transmission lines linking main generating facilities with demand centres. The Kenya Power and Lighting Company Limited (KPLC) intend to construct and operate a 66/11kV Substation in Mutu-ini Location, Dagoretti Division Nairobi West District. The proposed 66/11 kV substation will step down the electricity voltage for distribution where the electricity will be distributed to industries, businesses, hotels, homes and social institutions among others in Dagoretti area and its environs. The substations have to be built while maintaining the balance between satisfying the society’s needs and environmental constraints. The proposed substation will increase the power, security of supplying to the surrounding industries, businesses, hotels, homes and social institutions among others.

The study objectives were to:

- Conduct an Environmental Impact Assessment to identify both positive and negative impacts of the proposed project and propose most appropriate interventions during construction, operation and decommissioning of the project;
- Collect baseline socioeconomic data of the project area and potential impact expected from project construction, implementation, operation and decommissioning;
- Develop an Environmental Monitoring Program during construction and operation and present plans to minimize, mitigate, or eliminate negative effects and impacts;
- Describe Environmental Management Plan implementation mechanisms;
- Identify and contact stakeholders to seek the views on the proposed project;

The study terms of reference included:

- Establish the suitability of the proposed location for construction of 66/11 kV substation in 66/11kV Substation in Mutu-ini Location, Dagoretti Division Nairobi West District.
Proposed 66/11 kV Dagoretti Substation

- A concise description of the National Environmental Legislative and Regulatory Framework, Baseline Information, and any other relevant information related to the project.
- A description of the technology, procedures and processes to be used, in the implementation of the project.
- A description of materials to be used in the construction and implementation of the project, the products, by-products and wastes to be generated by the project.
- A description of the potentially affected environment.
- A description of environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated.
- To recommend a specific environmentally sound and affordable wastes’ management system.
- Provide alternative technologies and processes available and reasons for preferring the chosen technology and processes.
- Analysis of alternatives including project site, design and technologies.
- Development of Environmental Management Plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures.
- Provide an action plan for the prevention and management of the foreseeable hazardous activities in the cause of the project cycle.
- Propose measures to prevent health hazards and to ensure security in the working environment for the employees, residents and for the management of emergencies.
- An identification of gaps in knowledge and uncertainties which were encountered in compiling the information.
- An economic and social analysis of the project.

Study Methodology

This study was carried out through desktop review and field investigations. The experts conducted extensive literature review pertaining to this project. During the field investigation, reconnaissance survey was conducted to gather information on biophysical and socio-economic aspects of the area and its environs.
In order to address these issues the study team adopted a participatory approach where the client and the immediate surrounding communities were consulted in addition to reviews and references to sources of information including legal statutes, design and relevant project documents. Among the key activities undertaken during the assessment are:

(i) Interviews and consultations with the immediate neighbouring land users. A questionnaire was circulated to the people in the neighbourhood to obtain their honest opinion regarding the project (samples have been annexed to this report),

(ii) Review of documents with necessary information on the proposed project details, the site planning and implementation plan as well as the desired nature of the substation,

(iii) Physical inspections of the proposed site and photography,

(iv) Evaluation of the activities around the site and the environmental setting of the wider area, through review of existing information, literature and physical observations,

(v) Reporting, review and submissions.

The Environmental considerations evaluated for the proposed development include: Ecological considerations (biological diversity, sustainable use of ecological resources and ecosystem maintenance), social considerations (economic impacts, social cohesion or disruption, effects on human health, immigration or emigration, communication and effects on culture and objects of cultural value), Landscape considerations (views opened up or closed, visual impacts, compatibility with surrounding areas and amenity opened up or closed) and land use considerations (water sources, effects of proposal on surrounding land use potentials and possibility of multiple uses).

**Project Description**
Dagoretti is situated in Nairobi West District which is one of the districts in Nairobi County. It covers an area of 359.7 km² and its geographical coordinates are longitudes 36° 40' east and 1° 25' south. It borders Kiambu district to the north, Nairobi north to the east, Kajiado District to the South and Nairobi East to the South West. The proposed site is located on about 0.43 hectares of land off Nairobi - Karen road next to the eastern bypass flyover and neighbours deliverance church Dagoretti market Dagoretti division approximately 35 km from Nairobi Town Centre. The proposed project site is registered by the republic of Kenya under the registered land act 300 title number: Dagoretti/Mutuini/557 along Dagoretti -
Karen road, Dagoretti area, Mutuini Location, Nairobi North District in the county of Nairobi Latitude 1°17'37.95"S Longitude 36°41'2.93"E. At the moment, the project site is vacant land used occasionally for cattle grazing by community and playing ground for the community children.

The design of the proposed substation will create a number of separate terraces at different levels as may be required by the topography of the area the platform will be divided up into several different categories including:

- Control building and substation access roads
- Transformer/reactor plinth
- Busbar sections
- Substation yards

The majority of the substation structures will be made up of tubular aluminium conductors, with earth wires. The power lines entering and leaving will be of different heights depending on the voltage they will be carrying. The various stages of the substation construction phases include the following;

- Construction of the substation access road to the substation
- Removal of vegetation within substation footprint
- Terracing and levelling of the site
- Installation of foundations for infrastructure such as transformers, control room and radio tower
- Compaction and filling with gravel of the areas between the foundations
- Creation of formal drainage and storm water control measures
- Delivery and installation of transformer, towers, busbar and associated infrastructure
- Construction of control room and administrative infrastructure
- Redirecting of new 66 kV lines to enter and leave the substation at 11 kV lines
- Connection of the new infrastructure to the proposed 66 kV network
- Construction of perimeter wall fencing and lighting
- Placing of warning signs at the substation

PROJECT POTENTIAL IMPACTS AND MITIGATION MEASURES
Both positive and negative impacts that are associated with the proposed 66/11 kV of the distribution substation in 66/11kV Substation in Mutu-ini Location, Dagoretti Division Nairobi West District during the construction phase, operation phase and decommissioning phase were identified. The following positive and negative impacts are associated with the proposed project.

**Positive Impacts**

The following are positive impacts associated with the proposed 66/11 kV of the distribution substation in 66/11kV Substation in Mutu-ini Location, Dagoretti Division Nairobi West District:

- Reliable supply of electrical energy.
- Direct and indirect skilled and non-skilled employment opportunities.
- Gains in the local and national economy and increase in revenue.
- Provision of market for supply of building materials.
- Informal sectors benefits.
- Optimal use of land.
- Improvement in security as a result of lighting.
- Improvement in social infrastructures.
- Acceleration of the investment process in the region.

**Negative Impacts**

Against the background of the above positive impacts, there will be negative impacts emanating from the construction and subsequent operation activities of the facility. The negative impacts will include:

**Air Emissions:** Dust will be generated during construction. This will affect construction staff as well as the neighbours. The impact will be direct, temporary and minor.

**Noise Pollution and increased vibration:** The proposed civil works and operation of the facility will bring about an increase in cumulative noise levels. Noise pollution from the proposed development during construction noise will be generated from the construction machines and construction workers during day time. Considering the existing background noise level, the operations activity
during daytime is not expected to seriously affect the noise level in areas adjacent to the project site.

**Fire Hazards:** Potential adverse impacts related to fire hazards remain a main feature of this project. The substation will deal with combustible products like the transformer oil and the risks associated with fire hazards form a significant adverse impact on the human health and environment.

**Soil Erosion:** There is a likelihood of localized soil erosion during the civil works which entail compacting, earth excavations and moving works. However, these impacts will be largely localized to the project area and will only occur during the construction phase.

**Oil Spills:** The refilling and emptying of the transformer oil can lead to accidental oil spills. There is a possibility of oil leaking from the transformers can lead to oil spills. This may lead to potential contamination of surface and groundwater as well as soil.

**Increased transformer oil Consumption:** The proposed 66/11 kV Dagoretti distribution substation shall consume good amount of transformer oil in the process of step up and step down of the electric voltage for use. Since transformer oil is produced mainly through non-renewable resources, this will have adverse impacts on these non-renewable resources base and their sustainability.

**Liquid Waste Generation:** Since the substation’s transformers will use transformer oil to step up and step down of the electric voltage for use, some effluents will be generated. Waste oil is also an output of the project that poses potential environmental hazard in case of poor handling and disposal methods. This may affect the environment through water and soil contamination. The liquid waste to be generated is hazardous hence may cause long-term injurious effects to the environment. The waste would consist primarily of spent lubricants and transformer oil.

**Increase in Traffic flow:** During the construction phase, heavy vehicles moving in and out of the project site are likely to increase traffic along the main road near the project site and could cause congestion. Deliveries of transformer oil by road during project operation will also increase the amount of traffic flow in the project area.
**Strain in local resources:** The proposed development is likely to strain the resources available like water in the area in the short term mostly during the construction phase. This is as a result of increased population in the project without commensurate services and facilities.

**Occupational Health and Safety:** There will be potential risk of occupational hazards that could lead to occupational accidents during construction and operation of the project. Adverse impacts on the workers’ health and safety is likely to occur especially through workers interaction with the equipments and machines during construction and operation of the substation. Accidents, injuries and diseases are likely to occur during project construction and operations and this could potentially harm the health of the employees.

**Solid waste generation:** Solid waste materials during construction and solid waste during operation are likely to be encountered. The waste will include soil, construction materials and office papers.

**Visual Intrusion:** The proposed project will change the natural appearance of the project area landscape.

**PROPOSED MITIGATION MEASURES**

**Air Emissions Mitigation Measures**
- Drivers of construction vehicles must be supervised so that they do not leave vehicles idling, and they limit their speeds so that dust levels are lowered.
- Maintain all machinery and equipment in good working order to ensure minimum emissions including carbon monoxide, NOx, SOx and suspended particulate matter;
- No burning of any waste materials whatsoever should be permitted within the site both during construction and operation;
- Use of low sulphur fuel for SO2 where available or installing desulphurization equipment;

**Dust Emission Mitigation Measures**
- Fugitive emissions from site work to be eliminated or minimized by applying water on a need to need basis to unpaved surfaces and exposed construction areas during the dry season;
Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard.

- During construction, where water is available, sprinkle the construction area with water to keep dust levels down.
- Construction trucks removing soil from the site, delivering sand and cement to the site should be covered to prevent material dust into the surrounding areas;
- During construction, any stockpiles of earth should be enclosed / covered / watered during dry or windy conditions to reduce dust emissions;
- Masks should be provided to all personnel in areas prone to dust emissions throughout the period of construction.

**Noise Abatement Measures**

- All construction equipments and machinery to be used must be tested to verify if they are compliant with Kenya and the internationally acceptable standards of noise. Tested noise levels should be recorded as baseline and used for future monitoring.
- Noise emitting equipment should be properly maintained.
- All workers in the project site must be equipped with suitable and adequate Personal Protective Equipment (PPE) for hearing protection.

**Soil Erosion Mitigation Measures**

- Excavations of the site will be confined only on the sections of the substation where structures and equipment shall be located.
- Excavated earth will be held away from the drains and on locations of the site not susceptible to surface runoff of storm water,
- The earth removed for external disposal will require to be deposited on sites without the risk of being washed down during rains and where it will not compromise other land use activities in those areas,
- Caution will be required during construction at times of heavy rains.
- Re-vegetate exposed areas around the site so as to mitigate erosion of soil by storm water runoff.
- The final site grade should facilitate drainage and avoid flooding and pooling. A site drainage plan should be developed to protect against erosion.
- Protecting stockpiles through the use of silt fencing and reduced slope angles should be used to minimize soil erosion during construction.
- Installation of drainage ditches, construction of runoff and retention ponds is necessary. Minimization of disturbances and scarification of the surface should be observed to reduce erosion impacts.
- All slopes and working surfaces should be returned to a stable condition.
- Topsoil on the final site would be graded and planted as appropriate.

**Oil Spill Mitigation Measures**

- To prevent oil spills and environmental contamination, the substation should be designed with spill prevention and detection systems to protect the environment especially where the transformers will be located.
- Need to design appropriate protection devices against accidental discharge of transformer oil substances.
- Storage and liquid impoundment areas for fuels, raw and in-process material solvents, wastes and finished products should be designed with secondary containment to prevent spills and the contamination of soil, ground and surface water.
- The substation design should provide adequate storage areas for the transformer oil.
- Frequent inspection and maintenance of the transformers should be done to minimize spilling.
- A written substation response plan should be prepared and retained on the site and the workers should be trained to follow specific procedures in the event of a spill.
- Constructing and maintaining facilities should be done so as to enable the easy removal of rainwater from the secondary containment structures and proper removal of oil from the surface of the accumulated storm water.
- The substation operator should ensure the proper containment or collection and disposal for the used transformer oil. In the Environmental Management Plan (EMP), disposal of used oil will be the responsibility of the project operator.
- All waste oils from maintenance of transformers and other associated equipments should be segregated and disposed properly by a reputable/registered waste handler in accordance with the waste disposal plan.

**Solid waste generation**

- The solid waste would consist primarily of packaging materials for lubricants, used oil filters and used rags.
Proposed 66/11 kV Dagoretti Substation

- Contractor should develop a solid waste disposal plan which includes the provision of receptacles at strategic points within the site, recycling programmes for recyclable wastes.

- Solid wastes must be segregated and labelled to separate hazardous from non-hazardous waste. The substation should be provided with an inbuilt solid waste collection bin with compartments for recyclable materials, biodegradable materials and hazardous materials.

- The most appropriate options in waste management are identification of the waste types, segregation into the various categories and establish suitable mechanisms of collection, storage, transfer and final disposal. The ultimate destination for each of the waste categories should also be known.

- The contractor and project operator should engage a refuse handling company to remove the wastes from the site to the recommended waste management site.

- Warning signs against littering and dumping wastes in wrong places within the project site should be erected.

- Earth excavated from the construction site should be used as land fill in quarries or other excavated sites within or outside the project site. It is suggested that the contractors identify suitable land fill sites.

- Solid waste audit should be an integral section of the annual environmental audit of premises upon commissioning.

Hazardous waste

- The amount of hazardous waste generated will be very low and possibly originate from maintenance sources.

- Hazards on the site should be clearly marked and the entire workforce trained to recognize the hazards and familiarize themselves with procedures to be followed before entering hazardous areas.

Fire Prevention Measures

- The project site must have in place appropriate and adequate fire fighting equipments of recommended standards and in key strategic points.

- A fire alarm system should be installed in the substation.

- A fire evacuation plan must be posted in various points of the project site including procedures to take when a fire is reported. All workers must be trained on fire management and fire drills undertaken regularly.

- A fire assembly point must be identified and labeled accordingly.
Public and Workers Health and Safety Mitigation Measures

- All workers entering the construction site must be equipped with Personal Protective Equipment (PPE) such as ear muffs, safety footwear, overalls, gloves, dust masks, among others. The PPE’s should be those that meet the international standards.
- Personal protection gear must be provided and its use made compulsory to all. The entire workforce of the substation should be trained in the use and care of protective gear and in all relevant safety measures.
- Restricted ‘ENTRY’ signs should be installed to keep away unauthorized persons from access to restricted areas.
- Machines and Equipments must be operated only by qualified staff and a responsible person should be on site at all times to ensure adherence to safety requirements.
- The contractor and operator must develop a workplace Safety and Health Policy Manual which should be communicated to all persons at the site.
- The contractor and operator should develop a Substation Response Plan for handling any emergencies arising thereof during the construction.
- During construction, temporary washrooms should be constructed with soak-pits that can be easily exhausted.
- A well-equipped first aid kit and a person who has been trained in first aid should always be available at the site.

Visual Impact

- Structures at the site should be designed in such a way that they will improve the beauty of the surroundings.
- Restore site area through backfilling, landscaping and planting of trees, shrubs and grass on the open spaces to re-introduce visual barriers,
- Landscaping and planting of trees at the site would also serve to mitigate any perceived negative visual impacts

Economic and Social Impact

- The Proponent should continually participate in community development activities where possible as part of their corporate social responsibility.
- Casual labourers should be sourced from the local community to boost them economically and create employment for the youth.

Minimization of increased Water Demand
The proponent of the proposed 66/11 kV distribution substation in 66/11kV Substation in Mutu-ini Location, Dagoretti Division Nairobi West District shall ensure that water is used efficiently at the site by sensitizing construction staff to avoid irresponsible water use during construction.

**Public Consultation**
Consultations were also undertaken as part of the EIA in order to obtain the views of immediate community, interested groups, stakeholders and affected groups within the site’s immediate area of influence. The consultation was done with the immediate neighbourhood of the proposed site and involved use of a semi-structured public participation form. In general the project is acceptable and no objections were raised concerning the proposed 66/11 kV distribution substation.

**Conclusion**
From the study it is evident that the construction and operation of the proposed 66/11 kV distribution substation in Mutu-ini Location, Dagoretti Division Nairobi West District will bring positive effects in the project area including improved supply of electricity, creation of employment opportunities, gains in the local and national economy, provision of market for supply of building materials, Informal sectors benefits, Increase in revenue, Improvement in the quality of life for the workers, Optimal use of land and Improved security. However, although the project will come with various positive impacts, negative impacts will also be experienced hence the need to also look at them.

The proposed Dagoretti Substation site has low environmental sensitivity from a botanical, archaeological and avi-fauna perspective. Social impacts are expected to be of low significance with a good chance of mitigation, largely due to the fact that the proposed activity is in line with the existing land uses since there is an existing substation near the proposed project site. Visual impacts of the construction are expected to be minimal due to the fact that the proposed substation will not interfere with the general landscape of the proposed project site, and the viewing audience is minimal due to the peri urban/ rural nature of the site. The height of the new structures is similar to that of those already existing at the other substation.

No objections to the proposed construction and operation of the substation were received during the public consultation process.
An Environmental Management Plan (EMP) outline has been developed to ensure sustainability of the site activities from construction through operation to decommissioning. The plan provides a general outlay of the activities, associated impacts, mitigation action plans and appropriate monitorable indicators. Implementation timeframes and responsibilities are defined, and where practicable, the cost estimates for recommended measures are also provided.

A monitoring plan has also been developed and highlights some of the environmental performance indicators that should be monitored. Monitoring creates possibilities to call to attention changes and problems in environmental quality. It involves the continuous or periodic review of operational and maintenance activities to determine the effectiveness of recommended mitigation measures. Consequently, trends in environmental degradation or improvement can be established, and previously unforeseen impacts can be identified or pre-empted.

It is strongly recommended that a concerted effort is made by the site management in particular, to implement the Environmental Management and Monitoring Plan provided herein. Following the commissioning of the 66/11 kV distribution substation, statutory Environmental and Safety Audits must be carried out in compliance with the national legal requirements, and the environmental performance of the site operations should be evaluated against the recommended measures and targets laid out in this report.

Considering the proposed location, construction, management, mitigation and monitoring plan that will be put in place, the project is considered important, strategic and beneficial and may be allowed to proceed.
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6.1 INTRODUCTION

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Title Deed

Title Number DAGORETTI/MUTUINI/557

Approximate Area 0.43 HA.

Registry Map Sheet No. 3 & 4

This is to certify that THE KENYA POWER AND LIGHTING COMPANY LIMITED, P.O. BOX 30099, NAIROBI

is (are) now registered as the absolute proprietor(s) of the land comprised in the above-mentioned title, subject to the entries in the register relating to the land and to such of the overriding interests set out in section 30 of the Registered Land Act as may for the time being subsist and affect the land.

GIVEN under my hand and the seal of the NAIROBI District Land Registry
this 28TH day of SEPTEMBER 20 12

Land Registrar

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CHAPTER ONE: INTRODUCTION

1.1 Project Background

The interconnected power system has an effective generation capacity of 1,375 MW comprising of 757 MW of hydro power, 279 MW thermal, 163 MW geothermal, 26 MW cogeneration, 0.4 MW Wind and 150 MW emergency diesels. The current power demand is 1071 MW at a system load factor of 75%. Electricity is generated by KenGen and some Independent Power Producers. Transmission is done by KETRACO and KPLC. Distribution and retail supply is done exclusively by KPLC.

This power is transmitted countrywide through the transmission network which comprises of 1,323 km 220 kV and 2,122 km 132 kV lines transmission lines, and 632 km of 66 kV sub-transmission lines. Kenya is currently interconnected with Uganda through a 132 kV double circuit line rated at 2x86 MVA. The distribution network comprises of 11,163 km 33 kV, 21,918 km 11 kV and 29 km 40 kV lines. The 40kV is being converted to 33kV.

The existing transmission system capacity is constrained particularly during peak hours when system voltages in parts of Nairobi, West Kenya, Coast and Mt. Kenya drop below acceptable levels, occasioning load shedding despite availability of generation capacity. The problem is partly due to inadequate reactive power supply in major load centres and also transmission bottlenecks particularly in Nairobi, Coast and West regions. To address the bottlenecks a number of projects have been identified and at various stages of development. These projects address power transmission to bulk supply centres in the country, the main load centre in the country but do not address transmission and distribution of the power within the coast region. This has created a gap in planned power system development which now needs to be addressed.

The proposed 66/11 kV substation will step down power for distribution to smaller substations, industries, businesses, hotels, homes and social institutions among others in Dagoretti and its environment. KPLC has to supply power reliably to meet the increasing needs and demands of end-users. The substations have to be built while maintaining the balance between satisfying the society’s needs and environmental constraints.

The Kenya Power and Lighting Company Limited (KPLC) intends to construct and operate 66/11 kV substation for power distribution develop in Dagoretti area and
its environments. The plan entails construction of substation and distribution lines for Dagoretti area and its environments in order to improve the quality of electricity. This is because the existing distribution capacity is constrained particularly during peak hours when system voltage in parts of Dagoretti area and its environments drop below acceptable levels, occasioning load shedding despite availability of generation capacity. KPLC proposes to construct a 66/11 kV substation in Dagoretti with the aim of increasing the security of supply to the surrounding industries, businesses, homes, hotels and social institutions among others.

1.2 Scope and Objectives of the Study
The Kenyan Government Policy on all new projects, programs or activities requires that an Environmental Impact Assessment is carried out at the planning stages of any proposed undertaking that is likely to harm the environment to ensure that significant impacts on the environment are taken into consideration during the design, construction, operation and decommissioning of the proposed development.

1.2.1 Scope
The main objective of this assessment was to identify significant potential impacts of the project to environmental and social aspects, and formulate recommendations to ensure that the proposed project takes into consideration appropriate measures to mitigate any adverse impacts to the environment and people’s health through all phases of its implementation.

The assessment was undertaken in full compliance with the Environmental Management and Coordination Act 1999 and also the Environmental Impact Assessment and Audit Regulations, 2003. In addition, appropriate sectoral legal provisions touching on such projects have also been referred to for the necessary considerations during the construction, commissioning and operation of the proposed 66/11 kV of the distribution substation.

Specific objectives of the study included the following:
ɾ Present an outline of the project background,
ɾ Establish the environmental baseline conditions of the project area and review all available information and data related to the project,
Identify key areas for Environmental, Health and Safety concerns as well as the anticipated impacts associated with the proposed project implementation and commissioning,

Establish a comprehensive environmental management plan covering the construction, operation and decommissioning phases of the project,

Preparation of a comprehensive Project Report in accordance with the local environmental legislation and submission to NEMA for further instructions and/or approval.

The EIA scope largely covered the following areas:

(1) Baseline Conditions:
   - Environmental setting (climate, topography, geology, hydrology, ecology, water resources, sensitive areas, baseline noise levels, air quality and soil quality measurements etc.),
   - Socio-economic activities in the surrounding areas (land use, human settlements, economic activities, institutional aspects, water demand and use, health and safety, public amenities, etc.),
   - Infrastructural issues (roads, water supplies, drainage systems, power supplies, etc.).

(2) Legal and policy framework:
   - Focusing on the relevant national environmental laws, regulations and by-laws and other laws and policies focusing on allied activities relative to the project in question.

(3) Interactive approach was adopted for the immediate neighbourhood in discussing relevant issues including among others:
   - Land use aspects,
   - Neighbourhood issues,
   - Project acceptability,
   - Social, cultural and economic aspects,

(4) Environmental impacts:
   - Physical impacts,
   - Biological impacts,
1.2.2 Terms of Reference (TOR) for the EIA Process
The ESIA Experts were assigned the task of carrying out Environmental and Social Impact Assessment of the proposed 66/11 kV substation in Dagoretti. The scope of the assessment covers construction works of the proposed development which include ground preparation, civil works, structural works, fencing the substation, installation of the circuit breakers, transformer, installation of service lines as well as the utilities required by the 66/11 kV of the distribution substation. The output of this work is a comprehensive Environmental and Social Impact Assessment report for the purposes of seeking a NEMA licence that will approve the project construction and operation.

The ESIA experts conducted the study by using the following terms of reference:

- Establish the suitability of the proposed location of the proposed 66/11 kV of the distribution substation in Dagoretti.
- A concise description of the National Environmental Legislative and Regulatory Framework, baseline information, and any other relevant information related to the project.
- A description of the technology, procedures and processes to be used, in the implementation of the project.
- A description of materials to be used in the construction and implementation of the project, the products, by-products and waste to be generated by the project.
- A description of the potentially affected environment.
- A description of environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated.
- To recommend a specific environmentally sound and affordable wastewater management system.
- Provide alternative technologies and processes available and reasons for preferring the chosen technology and processes.
- Analysis of alternatives including project site, design and technologies.
- Development of an Environmental Management Plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures.
- Provide an action plan for the prevention and management of the foreseeable accidents and hazardous activities in the course of project construction, operation and decommissioning.
- Propose measures to prevent health hazards and to ensure safety in the working environment for the employees and the neighbouring community.
- An identification of gaps in knowledge and uncertainties which were encountered in compiling the information.
- An economic and social analysis of the project.

1.2.3 EIA Approach and Methodology
The approach to this exercise was structured such as to cover the requirements under the EMCA, 1999 as well as the Environmental Impact Assessment and Audit Regulations, 2003. It involved largely an understanding of the project background, the preliminary designs and the implementation plan as well as commissioning. In addition, baseline information was obtained through physical investigation of the site and the surrounding areas, informal interviews with a random sample of people from the surrounding community, use of public participation forms, site checklist, photography, and discussions with other stakeholders.

The key activities undertaken during the assessment were:

- Continuous discussions with the stakeholders and accessing other sources of information on the proposed project details, the site planning and implementation plan,
- Physical inspection of the proposed site, photography, and interviews with people in the immediate neighbourhood. A public participation form was used to record their opinion regarding the project (refer to annex VII of this report).
- Evaluation of the activities around the site and the environmental setting of the wider area. This was achieved through existing information, literature and physical observations,
- Review of available documentation,
- Reporting, review and submissions.

Below is an outline of the basic ESIA steps that were followed during this assessment:

Step 1: Screening
This was the first stage when the proposed project was evaluated, guided by EMCA (1999). Electricity development activities are listed under schedule 2 of EMCA, 1999 among projects requiring EIA before commencement. In addition, other considerations taken into account during the screening process included the physical site location, zoning, nature of the immediate neighbourhood, sensitivity of the areas surrounding the site and socio-economic activities in the area, among others.

**Step 2: Desk Study**
Documentation review was a continuous exercise that involved a study of available documents on the project including the project set-up plans and architect’s statement, land ownership documentation, environmental legislation and regulations, district development plans, location maps, etc.

**Step 3: Site Assessment and Consultations**
With the background obtained from the site investigation, discussions held, and the documentation review, the proposed project was evaluated and an assessment made on the potential environmental and social impacts. Consultations were made with the Proponent, the Architect, as well as selected members of the surrounding community.

**Step 4: Establishment of Baseline Conditions**
Physical inspections and observations constituted the main baseline survey activities. It was considered unnecessary to carry out environmental sampling and analysis (e.g. air, water, noise, soil) because the proposed development will not have hazardous emissions or residuals from the anticipated activities after commissioning; it will therefore not have any economic benefit to the client neither would it add any value to the report to analyse environmental parameters that are not expected to be adversely impacted by project activities.

**Step 5: Reporting**
Specific issues covered in the project report include but are not limited to:

- Name of the proponent, address and contact person
- Title of the project
- Objectives and scope of the project
- Nature of the project;
Proposed 66/11 kV Dagoretti Substation

- Location of the proposed project, including the physical area that may be affected by the project’s activities;
- Types of activities that will be undertaken during the project construction, operation and decommissioning phases;
- Design of the project;
- Proposed Project budget;
- Materials to be used, products and by-products, including waste to be generated by the project and the method(s) of their disposal;
- Potential environmental impacts of the project;
- Economic and social impacts to the local community and the nation in general;
- Views of the public/potentially affected people about the project; and
- An Environmental Management Plan (EMP) for the entire project cycle to include mitigation measures to be taken during and after implementation of the project and an action plan for the prevention and management of foreseeable accidents during the project cycle.
CHAPTER TWO: PROJECT DESCRIPTION

2.1 Site Location Characteristics

Dagoretti is situated in Nairobi West District which is one of the districts in Nairobi County. It covers an area of 359.7 km² and its geographical coordinates are longitudes 36° 40’ east and 1° 25’ south. It borders Kiambu district to the north, Nairobi north to the east, Kajiado District to the South and Nairobi East to the South West. The proposed site is located on about 0.43 hectares of land off Nairobi - Karen road next to the eastern bypass flyover and neighbours deliverance church Dagoretti market Dagoretti division approximately 35 km from Nairobi Town Centre. The proposed project site is registered by the republic of Kenya under the registered land act 300 title number: Dagoretti/Mutuini/557 along Dagoretti - Karen road, Dagoretti area, Mutuini Location, Nairobi North District in the county of Nairobi Latitude 1°17’37.95”S Longitude 36° 41’2.93”E. At the moment, the project site is vacant land used occasionally for cattle grazing by community and playing ground for the community children.

The proposed site for Dagoretti substation (Latitude 1°17’37.95”S Longitude 36° 41’2.93”E)

2.2 Nature of the Project

A sub-station is an important element of an electricity generation, transmission and distribution system. Its function is to transform voltages from high to low or
the reverse, using transformers and other heavy-duty electrical switchgear. The electrical feed to the different destinations is fed into common distribution conductors called busbars. From these busbars, electricity is then fed onto dedicated distribution lines running to specific geographic areas where the power is needed. Any of the lines in question can also be isolated in the high voltage yard.

The proposed 66/11 kV substation in Dagoretti will have the following components namely; line bays, transformer bays, 33 kV bays, switch gears, busbars and control panels among others. The transformer will be using oil for its cooling purposes. The transformer oil will be delivered to site using road transport and will be packed in drums.

The substation site installations will include:
- Reactors
- Transformers
- Disconnect Switches
- Bushings
- Surge Arresters
- Standoff Insulators and
- Earthing switches
- Lightning Arresters
- An open area for electrical equipment such as the air-cooled reactors, typically about 4.5m high, and switchgear, typically about 5m high.
- An auxiliary services building which will be built in the same style as the National Grid switchgear building.
- Fire deluge pump house and tank.
- Lighting
- Fencing
- Air break switches
- Voltage regulators
- Control house
- Cut-off switches
- Metal clad switch gear
- Battery room among other components and facilities

**Main sub-station switchgear**
Power is brought to the sub-station on 66 kV sub transmission lines that end on a large steel structure called a terminal tower. Power is then transferred into the main electrical switchgear inside the sub-station perimeter.

**Transformers**

KPLC is planning to install transformers at the Dagoretti Sub-station. The main purpose will be to boost the electrical power supply within the neighbourhood. The windings of such large transformer are immersed in transformer oil. It is a highly refined mineral oil that is stable at high temperatures and has excellent electrical insulating properties. Its functions are to insulate, suppress corona and arcing, and to serve as a coolant. Also, because it provides part of the electrical insulation between internal live parts, it must remain stable at high temperatures over an extended period.

Great care will be taken in the construction and operation of sub-station and transformer, in particular, to ensure that there is no uncontrolled release of transformer oil into the environment. It is proposed that transformer plinths are surrounded by bund walls and potential spillages are drained into sumps as shown below.

A typical Transformer and bund wall and oil holding dam

**Buildings**
When operational, the sub-station will be manned on a 24-hour basis. Extensive buildings and service facilities are, therefore required. The main facilities to be provided include a small office, workshop areas and storage space and a control room to house the high voltage monitoring and control instrumentation and equipment. The sub-station will also be equipped with KPLC’s own internal microwave telecommunications facilities.

Substation Design and Layout

The layout of the substation is very important since there should be a Security of electrical power supply. In an ideal substation all circuits and equipment would be duplicated such that following a fault, or during maintenance, a connection remains available. Practically this is not feasible since the cost of implementing such a design is very high. Methods have been adopted to achieve a compromise between complete security of supply and capital investment.

The proposed substation layout consists essentially the arrangement of a number of switchgear components in an ordered pattern governed by their function and rules of spatial separation. The spatial separation will include; Earth clearance this is the clearance between live parts and earthed structures, walls, screens and ground, Phase clearance this is the clearance between live parts of different phases and Isolating distance this is the clearance between the terminals of an isolator and the connections thereto.

2.3 Site Ownership
The proposed site original was classified agricultural land which has been changed to electrical use. The land parcel, title number DAGORETTI/MUTUINI/557 approximate area 0.43 HA (refer to Annex II for copy of sale agreement).

2.4 Project Justification
Transmission and distribution of electricity within the Nairobi Region has not been addressed adequately. This has created a gap in planned power system development which now needs to be addressed. National load forecast projects rapid load growth over the 2009-2029 planning period with power demand
expected to rise to 3600 MW by 2020 and to 8000 MW by 2029. To ensure system adequacy it is therefore anticipated that power transformation in Nairobi Region will have to be increased so as to meet the demand of the electrical consumers in the Nairobi Region. For optimal power transmission and Distribution around Nairobi region, additional 66/11kV substations will be required at suitable locations in the region along with the associated 66 kV sub-transmission networks. Also, KPLC has a target of connecting at least 250,000 new customers per year. Therefore, there is need to boost the capacity of available electrical energy.

The Dagoretti substation was requested for establishment to take care of the growing load in the general area of Dagoretti due to increase of various residential homes, industries, hotels, businesses in the area. This was to relieve the existing overloaded and long feeders and hence reduce technical losses in the system. To enhance the level of supply reliability in Dagoretti area and its environments, the substation will be interconnected in a 66 kV circuit, with optimal interconnection of the existing circuit. Therefore KPLC proposes to construct 66/11 kV substation in Dagoretti area.

2.5 Project Activities
It is expected that the proposed site will undergo alteration during the construction process to install the 66/11 kV of the substation and associated structures. Safety protocol and established International Environmental Protection Regulations/ Standards shall guide the Contractor and substation operator. Modest construction procedures will be followed to reduce noise levels and the production of dust that may affect the neighbouring community.

The first construction activity will be to clear the site of vegetation and to level off and terrace the ground surface for those areas where the heavy electrical transformer and other switchgear will stand. After this will follow the concrete and building construction for foundations for the supporting steelwork, transformers and other switchgear, storm water drainage pipes, slabs, bund walls, the control room, small buildings and storage areas that are needed.

All open areas between the transformer plinths and other switchgear foundations will be covered with about a 150 mm layer of 25 mm crushed stone. Before laying the crushed stone, the ground surface is intensively treated to strict specification
with insecticide and herbicide to prevent insect activity and the growth of weeds and other plants in the high voltage yard.

KPLC has decades of experience in the construction and operational use of both low and high voltage equipment such as the proposed Dagoretti Sub-station. All equipment, commissioning and operational procedures and protocols are subject to strict specifications, which KPLC has had in place for many years. During construction, which is when the civil works are being carried out (foundations, storm water drainage, buildings, etc), there should not be more than 20 people present on the site at any one time.

No people will be housed on site on a permanent basis during the operational life of the substation. However, there will be ongoing monitoring and control of operations as well as planned and other maintenance work done on an *ad hoc* basis.

### 2.6 Construction Procedures

All construction activities including ground preparation, earth moving, materials delivery, building, walling, roofing and the installation of amenities (power, water, communication equipment, etc.), fittings (doors, windows, safety provisions, etc.) will be carried out by competent personnel obtained through respectable contractors to ensure consistent high standard of finish and providing superb value for money.

### 2.6.1 Construction activities Outline

Construction activities will involve the following:

- Construction of the substation access road to the substation
- Removal of vegetation within substation footprint
- Terracing and levelling of the site
- Installation of foundations for infrastructure such as transformers, control room and radio tower
- Construction of bunds and oil holding dams (for emergency holding of transformer oil in the event of a spill) and wall safety walls
- Compaction and filling with gravel of the areas between the foundations
- Creation of formal drainage and storm water control measures
• Delivery and installation of transformers, towers, busbar and associated infrastructure
• Construction of control room and administrative infrastructure
• Redirecting of existing 66 kV lines to enter the substation
• Connection of the new infrastructure to the proposed 66/11 kV network
• Construction of perimeter fencing and lighting.

2.6.2 Input Materials

The 66/11 kV of the distribution substation will be constructed using common construction materials and construction procedures that are not expected to compromise the safety of the neighbouring communities as well as the general environment. The following inputs will be required for construction:

(i) Raw construction materials e.g. sand, cement, natural building stone blocks, hard core, gravel, concrete among others.
(ii) Timber (e.g. doors and frames, fixed furniture, etc.),
(iii) Paints, solvents, white wash, etc.,
(iv) A construction labour force (of both skilled and unskilled workers).

2.7 Temporary storage of hazardous substances

The hazardous substances referred to comprise fuels, oils and lubricants that will be stored and dispensed at the proposed substation construction site. Specifications for the storage and dispensing of fuels, oils and lubricants include the following:

• Specifically designated areas.
• All storage of fuels, oils and lubricants shall be stored above ground and under cover.
• All designated areas will be bunded.
• Each designated area will be equipped with adequate fire protection equipment appropriate for the nature of the fuels, oils and lubricants that are stored and dispensed.
• All areas shall be properly signed in all applicable languages.
• All employees must be properly trained in the storage and dispensing of specific fuels, oils and lubricants.
2.8 Use of services and resources during construction

Water
Water will be required for potable use and in the construction of the foundations for the sub-station. The water that could be used for construction phase will be sourced from Nairobi Water and Sewerage Company and nearby rivers.

Sewerage
A negligible sewerage flow is anticipated for the duration of the construction period. On site, use will be made of toilets that will be serviced periodically. For operations, a similarly negligible amount of sewerage will be generated. Septic tanks and soak pits always will be provided.

Roads
Existing roads will be utilized as far as possible during the construction and operational periods. The Dagoretti Sub-station will be served by the tarmacked road from kikuyu town heading to Karen and there will be a gravel access road to access the proposed substation. The flow of traffic to the site during the construction and operation phases will be relatively light.

Solid waste disposal
All solid waste will be collected at a central location at the construction site and will be stored temporarily until removal to an appropriately permitted NEMA registered landfill or dumping site. Waste streams should be kept separate to facilitate recycling.

Electricity
Either KPLC will provide electricity for construction and operations.

2.9 Project Budget
The estimated cost of the project is approximately Two hundred and fifteen (215) Million Kenya Shillings.
2.10 Target Group for the ESIA Report

The ESIA Report has been prepared for use by different stakeholders to be involved in the construction and operation of the proposed 66/11 kV of the distribution substation. The report contains useful information on policies and procedures to be adhered to, implementation modalities, analysis of potential environmental and social impacts and suggested mitigation measures at various stages of project activities. The information will be useful in planning, implementation, management and maintenance of the substation.

In this regard, the report is useful to the following stakeholders:

- Funding agencies and donors;
- Relevant government ministries and agencies for policy implementation;
- Affected and Interested persons;
- Planners and Engineers to be involved in preparation of designs and plans for the 66/11 kV substation;
- Contractors to be engaged in the construction works for the 66/11 kV substation;
- People to be involved in the management and operation of the 66/11 kV substation.
- Government regulatory agencies like National Environment and Management Authority (NEMA) and Energy Regulatory Commission (ERC).
CHAPTER THREE: BASELINE INFORMATION OF THE STUDY AREA

This chapter gives the physical description of the project site in terms of position and size, topography, climate and soils.

3.1 Location

Nairobi is the Capital City of Kenya. The city borders Eastern Province to the east and Central Province to the west and south and Rift Valley Province to the Northwest. Nairobi owes its birth and growth to the construction of Kenya-Uganda Railway. Following its establishment in 1899 as a railway depot, Nairobi soon became a communications centre and the headquarters of the provincial administration. Recently the Government of Kenya declared Nairobi a Metropolitan City so as to comprise of the nearby towns such as Thika, Machakos, Kitengela, Athi River, Kikuyu, Limuru, Ongata-Rongai and Ngong.

Nairobi is located at approximately 1° 9’S, 1° 28’S and 36° 4’E, 37° 10’E at the south-eastern end of Kenya’s agricultural heartland. It occupies an area of about 696km² and the altitude varies between 1,600 and 1,850 metres above sea level. The proposed project location is on Title Numbers. Dagoretti/Mutuini/557 along Dagoretti - Karen road, Dagoretti area, Mutuini Location, Nairobi West District in the county of Nairobi Latitude 1°17’37.95”S Longitude 36°41’2.93”E.

3.2 Topography

The surrounding area is developed with both residential and commercial enterprises. The area is sloppy with shallow red soils and prominent subsurface hard rock which may offer the best foundation support for the proposed Substation. Key significant physical feature is the natural forest with natural trees along Dagoretti - Karen road on the upper side of the road.

3.3 Climate

3.3.1 Average Daily Temperatures

The average daily temperature throughout the year (See table below) varies slightly from month to month with average temperatures of around 17 degrees Celsius during the months of July and August to about 20 degrees Celsius in March. But, the daily range is much higher, with the differences between maximum and minimum temperatures each day around 10 degrees in May and up to 15 degrees in February. Between the months of June to September, southeast winds prevail in the coastal parts of Kenya and last up to several days without a break. The clouds cause day temperatures to remain low and most times the maximum temperature
stay below 18 degrees Celsius. The minimum temperatures also remain low during cloudy nights, usually hovering around 8 degrees Celsius and sometimes even reaching 6 degrees Celsius. Clear skies in January and February also bring colder nights. The highest temperature ever reached in Nairobi was 32.8 degrees Celsius and the lowest was 3.9 degrees Celsius.

### Table 1 Average Daily Temperature in Nairobi City

<table>
<thead>
<tr>
<th>Months</th>
<th>Mean Maximum °C</th>
<th>Mean Minimum °C</th>
<th>Mean Range °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>26.8</td>
<td>13.1</td>
<td>13.7</td>
</tr>
<tr>
<td>February</td>
<td>28.0</td>
<td>13.4</td>
<td>14.6</td>
</tr>
<tr>
<td>March</td>
<td>27.4</td>
<td>14.4</td>
<td>13.0</td>
</tr>
<tr>
<td>April</td>
<td>24.6</td>
<td>14.3</td>
<td>10.3</td>
</tr>
<tr>
<td>May</td>
<td>24.1</td>
<td>14.2</td>
<td>9.9</td>
</tr>
<tr>
<td>June</td>
<td>23.1</td>
<td>12.6</td>
<td>10.5</td>
</tr>
<tr>
<td>July</td>
<td>22.3</td>
<td>11.5</td>
<td>10.8</td>
</tr>
<tr>
<td>August</td>
<td>22.7</td>
<td>11.8</td>
<td>10.9</td>
</tr>
<tr>
<td>September</td>
<td>25.3</td>
<td>12.2</td>
<td>13.1</td>
</tr>
<tr>
<td>October</td>
<td>26.2</td>
<td>13.7</td>
<td>12.5</td>
</tr>
<tr>
<td>November</td>
<td>23.6</td>
<td>14.4</td>
<td>9.2</td>
</tr>
<tr>
<td>December</td>
<td>25.1</td>
<td>13.8</td>
<td>11.6</td>
</tr>
<tr>
<td>Year</td>
<td>24.9</td>
<td>13.3</td>
<td>11.6</td>
</tr>
</tbody>
</table>

#### 3.3.2 Average Humidity Values

Because of Nairobi’s location just south of the equator in combination with humid air pumped in from the Indian Ocean, the humidity values for each day are generally on the higher end (See table below)

### Table 2 Mean Relative Humidity Values (%)

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>9.00 A.M</strong></td>
<td>79</td>
<td>74</td>
<td>82</td>
<td>86</td>
<td>85</td>
<td>85</td>
<td>83</td>
<td>85</td>
<td>82</td>
<td>80</td>
<td>36</td>
<td>83</td>
</tr>
<tr>
<td><strong>3.00 P.M</strong></td>
<td>45</td>
<td>37</td>
<td>43</td>
<td>53</td>
<td>55</td>
<td>59</td>
<td>53</td>
<td>53</td>
<td>50</td>
<td>47</td>
<td>57</td>
<td>54</td>
</tr>
</tbody>
</table>

This is not to say that values are always high, since the easterly winds coming off the Indian Ocean tend to keep the temperatures standard throughout the country; therefore the “warm sticky” feeling is usually not associated with Nairobi as much as one would think. In the summer to autumn months of January to April, relative humidity values have been known to plummet to anywhere from 10% to 20%. The typical day, humidity-wise, starts off with nearly saturated in the morning hours, and steadily decreases throughout the remainder of the day.
3.3.3 Average Rain Amounts
With these routinely high relative humidity figures, it is not surprising that the Nairobi climate is one that produces much rain annually. In fact, from the past 50 years, the expected amount of rain could be anywhere in the range of 500 to 1500 mm, with the average ringing in at 900 mm. The majority of these rainfall figures crash down in Nairobi in one major and one minor monsoon seasons respectively. The major monsoon season occurs within the months of March to May, and is called the “Long Rains” by the locals. The minor monsoon seasons emerges within the October to December Months, and is called the “Short Rains” by the Nairobi citizens. That is what the meteorologists as a whole know about the monsoon seasons. What they do not know is exactly when these seasons will start. There is usually not an indication of when these rainy seasons will start, since it is difficult to determine when one starts and when the other finishes. Consequently, a person may think there is only one rainy season when looking at the annual rainfall amounts (See following table).

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>48</td>
<td>115</td>
<td>195</td>
<td>137</td>
<td>42</td>
<td>15</td>
<td>21</td>
<td>24</td>
<td>52</td>
<td>114</td>
<td>77</td>
</tr>
</tbody>
</table>

3.3.4 Average Winds
Winds along the surface are predominantly easterly throughout the entire year. They are shifted to northeast between October and April, and they are shifted southeast between May and September. Right before the “Long Rains” season, the strongest winds occur, reaching speeds of 20 to 25 miles per hour. During the rest of the year, winds are usually at speeds of 10 to 15 miles per hour. During the night, the winds are calm.

3.3.5 Average Sunshine
Early mornings in Nairobi are often cloudy, but the sun peeks through by mid-morning. Throughout the year, there is an average of seven hours of sunshine per day. Thirty percent more sunlight reaches the ground during the afternoon than in the morning. Of course, there is more sunshine during the summer months, when the sun is more overhead in the southern hemisphere. Infrequently during the rainy season the sun never show through the clouds. Even in August, the cloudiest month, there is an average of four hours of sunshine.
3.4 Geological Setting
The geological history of Nairobi has been dominated by volcanic activity whereby a thick succession of alkaline lavas and associated tuffs began accumulating in mid-miocenene time and continued into the upper Pleistocene. Practically the entire Nairobi area is covered by these volcanic rocks derived from the Rift Valley region and estimated to accumulate in volume to more than 250 cubic miles (1,042 cubic km) and covering an area of nearly 1,200 square miles (3,000 km²). In the present area, the extent of the lava flows beneath the cover of Limuru Trachytes has been estimated to form a major part of geology of western areas of Nairobi. Volcanism began with the extrusion of Kapiti phonolite which has been dated 13Ma. The eruptive products of the volcanoes provide the most topographic expression of Nairobi. The main geologic formations in Nairobi area are, undifferentiated Ngong volcanic materials (Tv3), Tva1 (Basanites), Tva2 (Tephrites), Tvp2 (Kandizi phenolites), Tvt2 (Nairobi Trachytes), which covers most of the Karen area; Tvtf2 (middle and upper Kerichwa valley tuffs) which covers Wilson Airport area; Tvp3 (Nairobi phonolites - of lower Trachyte Division) which covers most of eastern parts of Nairobi, including Jomo Kenyatta International Airport (JKIA). The Central Business District (CBD) and the rest of the city is covered by various forms of Trachytes.

3.5 Potential Disaster Sites for City of Nairobi
Nairobi sits close to the eastern flanks of the Great Rift Valley and there are recent revelations that the valley may be expanding at a rate of (2-3) mm per year due to tensional forces in the crust. The high heat flow beneath the crust is represented by the geothermal activities at Olkaria, Bogoria and Kapedo in Turkana District and the high seismicity around Lake Magadi is evidence of the continental plate break-up. Recent geodynamic studies based on the International GPS Service (IGS) indicate that the African plate has moved northwards by 7 cm into European plate between 1993 and 2000. This proximity to the active rifting system and general behaviour of African plate calls for continuous assessment of the tectonic state of the City. Preliminary results on the potential disaster sites for the city of Nairobi indicate that there are numerous faultlines towards the western edge of the city passing through some prime plots in Bellevue estate and Lang’ata area. The Ngong/Ongata/Kiserian area shows a lot of seismicity and numerous faultlines. Lack of seismicity on the faultlines within Karen/Lang’ata area however implies that the faultlines are not active. No faultlines are available within the Central Business District (CBD) of the city and towards the eastern end. Seismicity in the city is also minimal and all the points are below magnitude.
3.6 Soils and Geology
The rocks in the Nairobi area mainly comprise a succession of lavas and pyroclastics of the Cainozoic age and overlying the foundation of folded Precambrian schist’s and gneisses of the Mozambique belt. The crystalline rocks are rarely exposed but occasionally fragments are found as agglomerates derived from former Ngong volcano. The soils of the Nairobi area are products of weathering of mainly volcanic rocks. Weathering has produced red soils that reach more than 50 feet (15m) in thickness. A number of subdivisions are recognized in the Nairobi area according to drainage, climatic regions and slopes, and other categories have been introduced for lithosols and regosols.

3.7 Infrastructure
Due to such rapid urban growth, provision of basic infrastructure for all has become an important concern of development planners in Nairobi. Basic infrastructural services that have deteriorated due to such rapid increase in population include: Solid Waste Management (SWM) system; water and sewage systems; drainage and flood protection; roads; mass transportation; electric installations; and telecommunications. Greater environmental pollution, congestion and other problems have been the result of under-provision of such basic services. The city is well served, with good communication and transport network such as air, road, and railway. It is centrally located to serve the Eastern African countries. Bus and train stations are within an easy walk of the City Centre. The main railway line runs from Mombasa to Malaba through Nairobi City. This network facilitates transportation of agricultural products from western Kenya to the coast. The city is a hub of road transport connecting other major towns in the country. On air transport Jomo Kenyatta International airport and Wilson airport make it easy to transport people and goods from all over the world into the country and vice versa.

The Haile sellasie Avenue connecting the city and Ngong road is in a good state of repair, but characterized most of the time with slow moving traffic. Traffic congestion is common along the road and the proponent should do a small diversion to access the Substation site.

3.8 Population
The city’s population in 2009 was about 3,138,395 million, and is projected to reach 3.8 million by 2015 which represents 51% of the country’s urban population. This increase will put even more pressure on the available resources. Although it covers only 0.1 per cent of Kenya’s total surface area, Nairobi already has about 8 per cent of the country’s total population and 25 percent of Kenya’s urban population. Nairobi City has one of the highest urban population densities in the
country of up to 3,079 persons per square kilometre, bringing with it the associated needs for supply of household goods groceries among other basic items. Such needs can be catered for by establishment of adequate facilities such as shopping complexes which stock an assortment of products. Nairobi City has experienced rapid growth both in terms of population and physical expansion. The physical area of Nairobi has been expanding tremendously from 3.84 Km\(^2\) in 1900 to 684 Km\(^2\) in 1963 which is the current official size of the City, but with the introduction of the Nairobi Metropolis, the area is much larger now.

**3.10 Economic Activities**
Nairobi city is the centre of commercial, manufacturing and industrial development in East Africa. The major economic activities in Nairobi City include trade. Like most modern cities, Nairobi has crowded markets and trading areas, middle class suburbs, and spacious mansions for the rich and powerful. It also has vast overcrowded tenements and slums, exploitation, and high unemployment. Between these two worlds, the city offers big screen film, theatres, restaurants, bookshops, cafes and bars for the local population and tourists from all over the world. The Upper-hill area is an upcoming and most lucrative hub of the city with many prestigious offices, international consulates and hotels springing up and due to the elevated heights it’s possible to watch greater spans of the city’s environs from there.

**3.11 Waste Management**
Out of 1600 metric tons of solid wastes generated daily in the City by 2002, only 40 per cent was being collected (Kibwage, 2002). Out of this total the Nairobi City Council and Private Companies combined, only manage to dispose only 47.1 per cent of the total garbage turnover. The accumulated mess of waste collection over the years has continued to be a bottle neck to Nairobi City administrators. By 1986, some of the City residents, who were able and willing to pay for the refuse-collection service, opted for Private Companies (PCs). There are over 70 companies that have emerged in the city targeting domestic and large waste producers like industries and supermarkets.

**3.12 Drainage**
Nairobi City lies in the Athi River Drainage Basin. The major rivers that cross the City include Nairobi, Ruaraka, Ngong, Athi and Mathare River. All these drain from the West and flow towards the Eastern direction as dictated by the topographical features. As the rivers pass through the City, industrial effluents, municipal waste and siltation heavily pollute them.
Nairobi’s main drainage follows the regional slope of the volcanic rocks towards the east, while subsidiary internal drainage into the Rift region is confined to the western part. The lava plains east of the line Ruiru-Nairobi-Ngong are underlain by a succession of lava flows alternating with lakebeds, streams deposits, tuffs and volcanic ash. These plains, comprising mainly the Athi plains and the northern section of the Kapiti plain, extend westwards, rising from 4900 feet (1493 m) at the Athi River to 6000 feet (1829 m) in the faulted region near Ngong. The lava plains are crisscrossed with steep-walled gullies and canyon-like gorges, such as those along the Mbagathi valley. Further east this valley widens slightly where soft material is being actively eroded. Water draining eastward from the hill area accumulates on the low-lying ground between Parklands in the north and Nairobi South estate, forming a perched water table above the Nairobi phonolite. The Kerichwa Valley Tuffs lying to the east of the highway function like a sponge and the contact between them and the underlying impermeable phonolite thus forms a perfect aquifer, so much so that a number of channels containing water occur beneath Nairobi.

3.13 Human Settlement
In 1948, about 51.95 km² (58.43 percent) of the city’s area was covered with residential areas ranging from very low to very high density. In 1979 residential land use had increased to 217.6 km², constituting about 31.81 percent of the city’s 684 km², but by 1994 the planned residential land area decreased to about 175.6 km² out of 696.27 km², covering approximately 25.22 percent of the city. This was due to the re-zoning of various residential neighbourhoods to commercial and other institutional uses, particularly around Capital Hill and Kilimani, Ngara, Pangani, Westlands and Parklands areas. The existing environmental problems in human settlements are the result of current urban policies. These problems are exacerbated by locating settlements on fragile land; inadequate infrastructure and provision of services such as solid waste management, water supply and sanitation and inadequate development control. Housing constitutes a major dilemma for Nairobi. The housing deficit has resulted in the proliferation of informal settlements, construction of unauthorized extensions in existing estates, poor standards of construction of housing units and increasing conflicts between tenants and landlords, especially in low income housing estates and informal settlements.

3.14 Transport
Nairobi acts as the central point where journeys begin to destinations all-round the country and is itself the country’s primary destination. Transport in Nairobi can be divided into five categories: private vehicles, buses, matatus (minibuses),
motorcycles commuter trains and taxis. Sometimes ignored, but equally important are the non-motorized forms of transport, such as walking and cycling. Dealing with urban mobility issues is an economic, social and environmental priority. The city’s traffic jams, pollution and inadequate pedestrian facilities and cycle lanes represent a major setback to the productive capacity of the economy, affecting all segments of society. The development of housing should be evenly distributed around the Nairobi Metropolitan Area so as to reduce the traffic jams experienced in the city and other modes of transportation to be explored.

3.15 Industry
Nairobi is the most industrialized urban centre in Kenya and in East Africa in general. Most of these industries are located in the main industrial area and along Mombasa road, some in the Ruaraka Industrial area, some in the CBD and the rest dispersed in other parts of the city. Gaseous emissions from industries contribute to smog and haze over the city. The industrial area is located to the east of the city and the prevailing winds come from the east. Gaseous emissions from industries and vehicles are thus trapped against the western hills and sometimes form a cloud of smog over the city. Apart from contributing to respiratory ailments in people, this affects visibility and can cause traffic accidents or create an unpleasant living environment for inhabitants. In 1992, measurements of the concentration of suspended particulate matter in Nairobi revealed the highest concentrations in the industrial area (252.µg/m³), decreasing with distance from the industrial area. Other areas of the city had levels less than a third of this 80 and 83µg/m³ in Buru Buru area and Woodley areas respectively. Due to high number of city residents who are working in these industries there is need for adequate housing so as their need are taken into consideration to enhance environmental sustainability. The area around the proposed project site was previously low and middle class housing scheme but is currently transforming to high class commercial area with the establishment of prestigious offices, diplomatic missions, and three and five star hotels.
CHAPTER 4: RELEVANT LEGISLATIVE AND REGULATORY FRAMEWORKS

4.1 Introduction
There are many environmental problems and challenges in Kenya today. Among the cardinal environmental problems include: loss of biodiversity and habitat, land degradation, land use conflicts, human animal conflicts, water management and environmental pollution. This has been aggravated by lack of awareness and inadequate information amongst the public on the consequences of their interaction with the environment.

There is a growing concern in Kenya and at global level that many forms of development activities do cause damage to the environment. Development activities have the potential to damage the natural resources upon which the economies are based. Environmental Impact Assessment is a useful tool for protection of the environment from the negative effects of developmental activities. It is now accepted that development projects must be economically viable, socially acceptable and environmentally sound.

Kenya has over 77 statutes which relate to environmental concerns. Most of the statutes are sector specific, covering issues such as land use, occupational health and safety, water quality, wildlife, public health, soil erosion, air quality among others.

4.2 Environmental Policy Framework
Environmental Impact Assessment (EIA) critically examines the effects of a project on the environment. An EIA identifies both negative and positive impacts of any development activity or project, how it affects people, their property and the environment. EIA also identifies measures to mitigate the negative impacts, while maximizing on the positive ones. EIA is basically a preventive process. It seeks to minimize adverse impacts on the environment and reduces risks. If a proper EIA is carried out, then the safety of the environment can be properly managed at all stages of a project-planning, design, construction, operation, monitoring and evaluation as well as decommissioning. The assessment is required at all stages of project development with a view to ensuring environmentally sustainable development for both existing and proposed public and private sector development ventures. The National EIA regulations were issued in accordance with the provisions of Environmental Management and Coordination Act (EMCA) of 1999. The EIA Regulations must be administered, taking into cognizance provisions of EMCA 1999 and other relevant national laws.
4.3 Institutional Framework

At present there are over twenty (20) institutions and departments which deal with environmental issues in Kenya. Some of the key institutions include the National Environmental Council (NEC), National Environment Management Authority (NEMA), Kenya Forestry Services (KFS), Kenya Wildlife Services (KWS) and others.

4.3.1 National Environment Management Authority (NEMA)
The objective and purpose for which NEMA is established is to exercise general supervision and co-ordinate over all matters relating to the environment and to be the principal instrument of the government in the implementation of all policies relating to the environment. However, NEMA’s mandate is designated to the following committees:

4.3.1.1 Provincial and District Environment Committees
According to EMCA, 1999 No. 8, the Minister by notice in the gazette appoints Provincial and District Environment Committees of the Authority in respect of every province and district respectively. The Provincial and District Environment Committees are responsible for the proper management of the environment within the Province and District in respect of which they are appointed. They are also to perform such additional functions as are prescribed by the Act or as may, from time to time be assigned by the Minister by notice in the gazette. The decisions of these committees are legal and it is an offence not to implement them.

4.3.1.2 Public Complaints Committee
The Committee performs the following functions:

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

4.3.1.3 National Environment Action Plan Committee
This Committee is responsible for the development of a 5-year Environment Action Plan among other things. The National Environment Action Plan shall:
Proposed 66/11 kV Dagoretti Substation

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

4.3.1.4 Standards and Enforcement Review Committee
This is a technical Committee responsible for environmental standards formulation methods of analysis, inspection, monitoring and technical advice on necessary mitigation measures.

4.3.1.5 National Environment Tribunal
This tribunal guides the handling of cases related to environmental offences in the Republic of Kenya.
4.3.2 National Environment Council (NEC)
EMCA 1999 No. 8 part III section 4 outlines the establishment of the National Environment Council (NEC). NEC is responsible for policy formulation and directions for purposes of EMCA; set national goals and objectives and determines policies and priorities for the protection of the environment and promote cooperation among public departments, local authorities, private sector, non-governmental organisations and such other organisations engaged in environmental protection programmes.

4.4 Kenyan Environmental Legal Framework
Previously, environmental management activities were implemented through a variety of instruments such as policy statements, permits and licences and sectoral laws. There was however need for a stronger enforcement machinery to achieve better standards in environment management. The enactment of the Environmental Management and Coordination Act in 1999 provided for the establishment of an appropriate legal and institutional framework for the management and protection of the environment.

4.4.1 The Environment Management and Co-ordination Act, 1999
The Environmental Management and Coordination Act (EMCA) 1999 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 therewith and incidental thereto. The main objective of the Act is to:

- Provide guidelines for the establishment of an appropriate legal and institutional framework for the management of the environment in Kenya;
- Provide a framework legislation for over 77 statutes in Kenya that contain environmental provisions;
- Provide guidelines for environmental impact assessment, environmental audit and monitoring, environmental quality standards and environmental protection orders.

The Act empowers the National Environment Management Authority (NEMA) to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of government in the implementation of all policies related to the environment.
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Part II of the Environment Management & Coordination Act, 1999 states that every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment. In order to partly ensure this is achieved, Part VI of the Act directs that any new programme, activity or operation should undergo environmental impact assessment and a report prepared for submission to the National Environmental Management Authority (NEMA), who in turn may issue a license as appropriate.

Part VIII section 72 of the Act prohibits discharging or applying poisonous, toxic, noxious or obstructing matter, radioactive or any other pollutants into aquatic environment. Section 73 require that operators of projects which discharges effluent or other pollutants to submit to NEMA accurate information about the quantity and quality of the effluent. Section 74 demands that all effluent generated from point sources be discharged only into the existing sewerage system upon issuance of prescribed permit from the local authorities or from the licensee. Finally, section 75 requires that parties operating a sewerage system obtain a discharge license from NEMA to discharge any effluent or pollutant into the environment.

Section 87 Sub-section 1 states that no person shall discharge or dispose of any wastes, whether generated within or outside Kenya, in such a manner as to cause pollution to the environment or ill health to any person, while section 88 provides for acquiring of a license for generation, transporting or operating waste disposal facility. According to section 89, any person who, at the commencement of this Act, owns or operates a waste disposal site or plant or generate hazardous waste, shall apply to the NEMA for a licence. Sections 90 through 100 outline more regulations on management of hazardous and toxic substances including oils, chemicals and pesticides.

Finally the Environmental Impact Assessment Guidelines require that a study be conducted in accordance with the issues and general guidelines spelt out in the Second and Third schedules of the Environmental Regulations (2003). These include coverage of the issues on Schedule 2 (ecological, social, landscape, land use and water considerations) and general guidelines on Schedule 3 (impacts and their sources, project details, national legislation, mitigation measures, a management plan and environmental auditing schedules and procedures.)
Under EMCA 1999 NEMA has developed regulations to establish guidelines for better management of the environment and promote sustainable development. To date, the regulations presented in the following sections have been gazetted.

a) Environmental Impact Assessment and Audit Regulations (2003) Legal Notice No. 101
The Environmental Impact Assessment and Audit Regulations state in Part III Rule No. 6 that an environmental impact assessment study shall be conducted in accordance with the terms of reference developed.

Part III Rule 16, takes into account environmental, social, cultural, economic, and legal considerations, and shall:

- Identify the anticipated environmental impacts of the project and the scale of the impacts;
- Identify and analyse alternatives to the proposed project;
- Proposed mitigation measures to be taken during and after the implementation of the project; and
- Develop an environmental management plan with mechanisms for monitoring and evaluating the compliance and environmental performance which shall include the cost of mitigation measures and the time frame of implementing the measures

The Proponent has commissioned the environmental impact assessment study in compliance with the Act. The environmental management and monitoring plan laid out in this report shall be adhered to by the Proponent.

b) Environmental Management and Coordination (Water Quality) Regulation 2006
These regulations are described in Legal Notice No. 120 of the Kenya Gazette Supplement No. 74, September 2006. The regulation applies to drinking water, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife and water used for any other purposes. This includes the following:

- Protection of sources of water for domestic use;
- Water for industrial use and effluent discharge;
- Water for agricultural use.
The regulations outline:

- Quality standards for various sources of domestic water;
- Quality monitoring for sources of domestic water;
- Standards for effluent discharge into the environment;
- Monitoring guide for discharge into the environment;
- Standards for effluent discharge into public sewers;
- Monitoring for discharge of treated effluent into the environment.

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 4, gives Waste Water Discharge Guidelines from NEMA
### Table 5.1: NEMA Waste Water Discharge Guidelines

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Discharge into public sewers</th>
<th>Discharge into open water bodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH</td>
<td>-</td>
<td>6.0 - 9.0</td>
<td>6.0 - 9.0</td>
</tr>
<tr>
<td>BOD (5 days at 20° C) not to exceed</td>
<td>Mg/l</td>
<td>500</td>
<td>20</td>
</tr>
<tr>
<td>COD not to exceed</td>
<td>Mg/l</td>
<td>1000</td>
<td>50</td>
</tr>
<tr>
<td>Total suspended solids not to exceed</td>
<td>Mg/l</td>
<td>500</td>
<td>30</td>
</tr>
<tr>
<td>n-hexane extract not to exceed</td>
<td>Mg/l</td>
<td>Nil</td>
<td>30</td>
</tr>
<tr>
<td>Oils(mineral, animal &amp; vegetable)</td>
<td>Mg/l</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Total phenol not to exceed</td>
<td>Mg/l</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Copper (Cu) not to exceed</td>
<td>Mg/l</td>
<td>1.0</td>
<td>0.05</td>
</tr>
<tr>
<td>Zinc (Zn) not to exceed</td>
<td>Mg/l</td>
<td>5.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Lead (Pb) not to exceed</td>
<td>Mg/l</td>
<td>1.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Arsenic (As) not to exceed</td>
<td>Mg/l</td>
<td>0.2</td>
<td>0.002</td>
</tr>
<tr>
<td>Total Mercury (Hg) not to exceed</td>
<td>Mg/l</td>
<td>0.05</td>
<td>0.005</td>
</tr>
<tr>
<td>Alkyl mercury not to exceed</td>
<td>Mg/l</td>
<td>0.01</td>
<td>0.001</td>
</tr>
<tr>
<td>PCB (Polychlorinated biphenyl) not to exceed</td>
<td>Mg/l</td>
<td>Nil</td>
<td>0.003</td>
</tr>
<tr>
<td>Pesticides residues not to exceed</td>
<td>Mg/l</td>
<td>Nil</td>
<td>0.05</td>
</tr>
<tr>
<td>Sulphates not to exceed</td>
<td>Mg/l</td>
<td>1000</td>
<td>500</td>
</tr>
<tr>
<td>Dissolved manganese (Mn)</td>
<td>Mg/l</td>
<td>-</td>
<td>1.0</td>
</tr>
<tr>
<td>Chromium (total)</td>
<td>Mg/l</td>
<td>1.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Chloride not to exceed</td>
<td>Mg/l</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Fluoride not to exceed</td>
<td>Mg/l</td>
<td>-</td>
<td>2.0</td>
</tr>
<tr>
<td>Coliform bacteria</td>
<td></td>
<td>-</td>
<td>1000/100ml</td>
</tr>
<tr>
<td>Free ammonia not to exceed</td>
<td>Mg/l</td>
<td>2.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Sulphides (S) not to exceed</td>
<td>Mg/l</td>
<td>2.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Cadmium (Cd) not to exceed</td>
<td>Mg/l</td>
<td>0.5</td>
<td>0.05</td>
</tr>
<tr>
<td>Cyanide (CN) total not to exceed</td>
<td>Mg/l</td>
<td>0.5</td>
<td>0.1</td>
</tr>
<tr>
<td>Organic phosphorous not to exceed</td>
<td>Mg/l</td>
<td>30</td>
<td>1.0</td>
</tr>
<tr>
<td>Chromium six (Cr 6) not to exceed</td>
<td>Mg/l</td>
<td>0.5</td>
<td>0.005</td>
</tr>
<tr>
<td>Total dissolved solids not to exceed</td>
<td>Mg/l</td>
<td>3000</td>
<td>1200</td>
</tr>
<tr>
<td>Selenium (Se) not to exceed</td>
<td>Mg/l</td>
<td>1.0</td>
<td>0.05</td>
</tr>
<tr>
<td>Nickel (Ni) not to exceed</td>
<td>Mg/l</td>
<td>3.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Barium (Ba) not to exceed</td>
<td>Mg/l</td>
<td>10</td>
<td>2.0</td>
</tr>
<tr>
<td>Temperature not to exceed</td>
<td>-</td>
<td>+/- 2° of the ambient temperature of the sewer</td>
<td>+/- 2° C of ambient temperature of the water body</td>
</tr>
<tr>
<td>Oil/ grease</td>
<td>Mg/l</td>
<td>No trace</td>
<td>Nil/ no trace</td>
</tr>
<tr>
<td>Toxic substances</td>
<td>Mg/l</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>Odour</td>
<td>-</td>
<td>-</td>
<td>Not objectionable to the nose</td>
</tr>
<tr>
<td>Colour</td>
<td>-</td>
<td>-</td>
<td>Not objectionable to the eye or not to exceed 5 mg Pt/l</td>
</tr>
</tbody>
</table>
C) Environmental Management and Coordination (Waste Management) Regulation 2006

These regulations are described in Legal Notice No. 121 of the Kenya Gazette Supplement No. 69, September 2006. These Regulations apply to all categories of waste as provided in the regulations. These include:

- Industrial wastes;
- Hazardous and toxic wastes;
- Pesticides and toxic substances;
- Biomedical wastes
- Radio-active substances.

These Regulations outline requirements for handling, storing, transporting, and treatment/disposal of all waste categories as provided therein. For this project, anticipated waste includes domestic, industrial, hazardous and toxic waste. Wastes contaminated with petroleum product are considered to be hazardous. Treatment of toxic or hazardous waste should be done using the classes of incinerators presented in the third schedule of these regulations.

The regulation provides that a waste generator shall use cleaner production methods, segregate waste generated and the waste transporter should be licensed. The notice further states no person shall engage in any activity likely to generate any hazardous waste without a valid Environmental Impact Assessment license issued by the National Environment Management Authority. Hazardous waste will not be generated from this development. The project proponent will ensure that waste is segregated and a licensed waste and to disposed solid waste.

d) Environmental Management and Coordination, (Conservation of Biological Diversity) (BD) Regulations 2006

These regulations are described in Legal Notice No. 160 of the Kenya Gazette Supplement No. 84, December 2006. These regulations apply to conservation of biodiversity which includes conservation of threatened species, inventory and monitoring of BD and protection of environmentally significant areas, access to genetic resources, benefit sharing and offences and penalties. Additionally, these links provide for the local enforcement of the International Convention on Biological Diversity (CBD).
The proposed site has no rich biodiversity and there is no known rare or endangered species in the site.

e) Environmental Management and Coordination, (Fossil Fuel Emission Control) Regulations 2006

These regulations are described in Legal Notice No. 131 of the Kenya Gazette Supplement No. 74, October 2006. These regulations include internal combustion engine emission standards, emission inspections, the power of emission inspectors, fuel catalysts, licensing to treat fuel, cost of clearing pollution and partnership to control fossil fuel emissions. The fossil fuels considered are petrol, transformer oil, diesel, fuel oils and kerosene.

f) Environmental Management and Coordination, (Wetlands, Riverbanks, Lake Shores and Sea Shore Management) Regulations 2009

These regulations are described in Legal Notice No. 19 of the Kenya Gazette Supplement No. 9, February 2009. These regulations include management of wetlands, wetland resources, river banks, lake shores and sea shores. Specific sections have requirements that apply to wetlands in Kenya either in private or public land. These regulations empower the District Environment Committee to coordinate, monitor and advise on all aspects of wetland resource management within the district.

g) Environmental Management and Coordination, (Noise and Excessive Vibration Pollution) Regulations 2009

These regulations are described in Legal Notice No. 31 of the Kenya Gazette Supplement No. 21, May 2009. These regulation prohibit any person from making or causing 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. It also prohibits excessive vibration which annoys, disturb, injure or endanger the comfort, repose, health or safety of others and the environment or excessive vibrations which exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source. Part 11 section 6(1) provides that no person is shall cause noise from any source which exceeds any sound level as set out in the First Schedule of the regulations.

4.4.2 Public Health Act (Cap. 242)

This is an Act of Parliament to make provisions for securing and maintaining health. Sections include those dealing with notification of infectious diseases;
inspection of infected premises and examination of persons suspected to be suffering from infectious diseases; rules for prevention of diseases; venereal diseases and infection by employees, among others. The proposed project will encourage the movement of people in search of jobs and opportunities, and with this, the risk associated with spread of diseases.

Part IX, section 115, of the Act states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires that Local Authorities take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to be injurious or dangerous to human health. Such nuisance or conditions are defined under section 118 and include nuisances caused by accumulation of materials or refuse which in the opinion of the medical officer of health is likely to harbour rats or other vermin.

*The environmental management plan (EMP) advices the Proponent on safety and health aspects, potential impacts, personnel responsible for implementation and monitoring, frequency of monitoring, and estimated cost.*

4.4.3 Local Government Act (Rev. 1998)
This Act provides for the establishment of authorities for local government, to define their functions and to provide for matters connected therewith and incidental thereto. In all areas where the project shall be undertaken, the local authorities will require to be informed.

Section 160 helps local authorities ensure effective utilization of the sewages systems.
Section 170, allows the right to access to private property at all times by local authorities, its officers and servants for purposes of inspection, maintenance and alteration or repairs of sewers.

The Act under section 176 gives powers to local authority to regulate sewage and drainage, fix charges for use of sewers and drains and require connecting premises to meet the related costs. According to section 174, any charges so collected shall be deemed to be charges for sanitary services and will be recoverable from the premise owner connected to the facility. Section 264 also requires that all charges due for sewage sanitary and refuse removal shall be recovered jointly and severally from the owner and occupier of the premises in respect of which the
services were rendered. This in part allows for application of the “polluter-pays-principle”

Section 163 allows the County Council to prohibit all business, which may be or become a source of danger, discomfort, or annoyance due to their noxious nature through smoke, fumes, dust, noise, or vibrations. Section 165 allows the local authority to refuse to grant or renew any license which is empowered in this act or any other written law on the grounds that the activity does not conform to the requirements of any by-laws in force in the area of such local authority the granting of the license would be contrary to the public interest.

Part XI section 168 provides that every municipal council, town council or urban council may establish and maintain sewerage and drainage works within or without its area of jurisdiction. For purposes of the land required for such development, section 144 states in part “A local authority may, subject to the approval of the Minister, apply to the government or any other authority having power to acquire land required for purposes of any of its functions, to be acquired compulsorily for and on behalf of, and at the expense of the local authority”. The Act, however, does not indicate the repercussions of impacts on landowners.

Section 160 helps local authorities ensure effective utilization of the sewerage systems. It states in part that municipal authorities have powers to establish and maintain sanitary services for the removal and destruction of, or otherwise deal with all kinds of refuse and effluent and where such service is established, compel its use by persons to whom the service is available. However, to protect against illegal connections, section 173 states that any person who, without prior consent in writing from the council, erects a building on: excavate or opens-up: or injures or destroys an sewers, drains or pipes shall be guilty of an offence. Any demolitions and repairs thereof shall be carried out at the expense of the offender.

For maintenance of such sewerage systems, the following relevant clauses have been drawn from section 169 of the Act that reads in part “A municipal council may for purposes of carrying out any drainage or sewerage works------”:

“------cause such sewers, drains and pipes to be made, altered, deepened, covered, laid and maintained either within or without as may be necessary for effectively disposing of the sewage and draining of its area ------“
“------carry such sewers, drains and pipes through, across, or under any public road, street, square or open place laid out for public road, street, square or open space without paying compensation and after giving 30 days notices in writing to the owner or occupier of the intention to do so ------“

“------from time to time alter, enlarge, divert, discontinue, close-up or destroy any sewers, drains, or pipes under its control ------“

Section 170, allows the right of access to private property at all times by local authorities, its officers and servants for purposes of inspection, maintenance and alteration or repairs. In addition, the municipal Council may establish and maintain sewage farms or disposal works, and dispose of the effluent therefrom, but shall not be liable for any nuisance or damage as a consequence of proper and ordinary conduct of the sewage farms or disposal works (section 171). To ensure sustainability in this regard, the local authority is empowered to make by-laws in respect of all such matters as are necessary or desirable for the maintenance of health, safety and wellbeing of the inhabitants of its area as provided for under section 201 of the Act.

To ensure sustainability in this regard, the local authority is empowered to make by-laws in respect of all such matters as are necessary or desirable for the maintenance of health, safety and wellbeing of the inhabitants of its area as provided for under section 201 of the Act.

The Proponent shall observe the guidelines as set out in the environmental management and monitoring plan laid out in this report as well as the recommendation provided for mitigation/minimisation/avoidance of adverse impacts arising from the project activities.

4.4.4 Physical Planning Act, 1996
The Local Authorities are empowered under section 29 of the Act to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section, therefore allows for the prohibition or control of the use and development of land and buildings in the interest of proper and orderly development of an area.

Section 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,
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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 power 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 it's original conditions.

The Proponent site is zoned as agricultural land which will be changed to electrical use.
4.5.5 **Land Planning Act (Cap. 303)**
Section 9 of the subsidiary legislation (The Development and Use of Land Regulations, 1961) under this Act requires that before the local authorities submit any plans to the Minister for approval, steps should be taken as may be necessary to acquire the owners of any land affected by such plans.

4.4.6 **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 permit system.

Part II, section 18, of the Water Act 2002 provides for national monitoring and information system on water resources. Following on this, sub-section 3 allows the Water Resources Management Authority (WRMA) to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specific records may require to be kept by a facility operator and the information thereof furnished to the authority.

The Water Act Cap 372 vests the rights of all water to the state, and the power for the control of all body of water with the Minister, the powers is exercised through the Minister and the Director of water resources in consultation with the water catchments boards, it aims at provision of conservation of water and appointment and use of water resources.

Part II Section 18 provides for national monitoring and information systems on water resources. Following on this, Sub-section 3 allows the Water Resources Management Authority to demand from any person, specified information, documents, samples or materials on water resources. Under these rules, specific records may be required to be kept and the information thereof furnished to the authority on demand.

Section 25 of the Act requires a permit to be obtained for among others any use of water from a water resources, discharge of a pollutant into any water resource. According to section 29 of the same Act, application for such a permit shall be subject to public consultation as well as an environmental impact assessment as per the Environmental Management and Coordination Act, 1999. The conditions of the permit may also be varied if the authority feels that the water so used is
causing deterioration of water quality or causing shortage of water for other purposes that the authority may consider has priority. This is provided for under section 35 of the Act.

Section 73 of the Act allows a person with a license to supply water (licensee) to make regulations for purposes of protecting against degradation of sources of water which he is authorised to take. Under the Act, the licensee could be a local authority, a private Trust or an individual and the law will apply accordingly under the supervision of the Regulatory Board.

Section 76 states that no person shall discharge any trade effluent from any trade premises into sewers of a licensee without the consent of the licensee upon application indicating the nature and composition of the effluent, maximum quantity anticipated, flow rate of the effluent and any other information deemed necessary. The consent shall be issued on conditions including the payment rates for the discharge as may be provided under section 77 of the same Act.

The proposed site shall include the construction of drainage channels for the Management of waste water. Bund walls and paved surface will be constructed so as to contain oil spills.

4.4.7 Energy Act of 2006

This is an Act of Parliament passed to ament and consolidates the law relating to energy, to provide for the establishment, powers and functions of the Energy Regulatory Commission and the Rural Electrification Authority and for connected purposes.

The Energy Act 2006 replaced the Electric Power Act of 1997 and The Petroleum Act, Cap 116. The Energy Act, amongst other issues, deals with all matters relating to all forms of energy including the generation, transmission, distribution, supply and use of electrical energy as well as the legal basis for establishing the systems associated with these purposes.

The Energy Act, 2006, also established the Energy Regulatory Commission (ERC) whose mandate is to regulate all functions and players in the Energy sector. One of the duties of the ERC is to ensure compliance with Environmental, Health and Safety Standards in the Energy Sector, as empowered by Section 98 of the Energy Act, 2006.
In this respect, the following environmental issues will be considered before approval is granted:

1. The need to protect and manage the environment, and conserve natural resources;
2. The ability to operate in a manner designated to protect the health and safety of the project employees; the local and other potentially affected communities.

Licensing and authorisation to generate and transmit electrical power must be supported by an Environmental Impact Assessment Report (EIA) approved by NEMA.

Part IV Section 80(1) provides that a person shall not conduct a business of importation, refining, exportation, wholesale, retail, storage or transportation of petroleum, except under and in accordance with the terms and conditions of a valid licence.

Part IV Section 90 (1) stipulates that a person intending to construct a pipeline, refinery, bulk storage facility or retail dispensing site shall before commencing such construction, apply in writing to the Energy Regulatory commission for a permit to do so. The application shall: specify the name and address of the proposed owner; be accompanied by three (3) copies of plans and specifications and be accompanied by an Environmental Impact Assessment (EIA) Report.

Part IV section 91(1) stipulates that the Energy Regulatory Commission shall, before issuing a permit under section 90, take into account all relevant factors including the relevant government policies and compliance with Environment Management and Coordination Act, 1999 and in particular EIA report as per Impact Assessment and Audit Regulations 2003, the Physical Planning Act, 1996 and the Local Government Act.

Part iv section 100 (1) provides that it is an offence if a person being the owner or operator of a refinery, pipeline, bulk liquefied Petroleum gas or natural gas facility, service station, filling station or storage depot, fails to institute appropriate environmental, health or safety control measures. The offence if convicted, he/she shall be liable to a fine not exceeding two million shillings or to a maximum term of imprisonment of two years, or to both.
The proposed project will be required to follow the guidelines set out in this Act.

4.4.8 The Standards Act Cap 496
The Act is meant to promote the standardization of the specification of commodities, and code of practice; to establish a Kenya Bureau of Standards, to define its functions and provide for its management and control. The proponent will ensure that commodities and codes of practice utilized in the project adhere to the provisions of this Act.

4.4.9 Building Code 1968
Section 194 requires that where sewer exists, the occupants of the nearby premises shall apply to the local authority for a permit to connect to the sewer line and all the wastewater must be discharged into sewers.

4.4.10 Penal Code Act (Cap.63)
Section 191 of the penal code states that if any person or institution that voluntarily corrupts or foils water for public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence. Section 192 of the same Act says a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons /institution, dwelling or business premises in the neighborhood or those passing along public way, commits an offence.

The Proponent shall observe the guidelines as set out in the environmental management and monitoring plan laid out in this report as well as the recommendation provided for mitigation/minimisation/avoidance of adverse impacts arising from the project activities.

4.4.11 The Wildlife Conservation and Management Act, Cap 376

This Act provides for the protection, conservation and management of wildlife in Kenya. The provisions of this Act should be applied in the management of the project.

Part III Section 13 subsection (I) stipulates that any person who not being an officer of Kenya Wildlife Service hunts any animal in a National Park shall be guilty of a forfeiture offence and liable to a fine or imprisonment. Subsection 2 of the Act
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likewise provides that any person who, without authorisation conveys into a National Park, or being within the area thereof, in possession of, any weapon, ammunition, explosive, trap or poison, shall be guilty of a forfeiture offence. The Act further provides that no person is allowed to use any aircraft, motor vehicle or mechanically propelled vessel in such a manner as to drive, stampede or unduly disturb any protected animal or game animal. Therefore it will be prudent that the construction workforce is conversant with the provisions of this Act.

*The proposed project is not located within a conservation/protected area.*

4.4.12 The Lakes and Rivers Act Chapter 409 Laws of Kenya:
This Act provides for protection of rivers, lakes and associated flora and fauna. The provisions of this Act may be applied in the management of the project.

4.4.13 The Forest Act
The forest Act, Cap 385 of 1962(revised 1982, 1992 and 2005) addresses the reservation, protection, management, enforcement and utilization of forests and forest resources on government land. The forest Act is applicable to gazetted forest areas (Forest Reserves) and specifically covers:
- Gazettement, alteration of boundaries and De-Gazettement of Forest Reserves
- Prohibition of activities in Forest Reserves (removal of forest produce, grazing, cultivation, hunting etc) and on unalienated Government land (removal of trees, collection of honey, lighting of fires) except under license from the Director of Forest Services (Section 8);
- Enforcement of the provisions of the Act, penalties and powers afforded to enforcing officers, among others.

*The proposed project is not on a forest reserve or near one.*

4.4.14 The Forestry Services Act, 2005
The Act led to the establishment of Kenya Forest Service which is charged with management of forests in consultation with the forest owners. The body enforces the conditions and regulations pertaining to logging, charcoal making and other forest utilisation activities.

To ensure community participation in forest management, the service collaborates with other organizations and communities in the management and conservation of forests and for the utilisation of the biodiversity.
Section 43 (1) provides that if mining, quarrying or any other activity carried out in the forest, where the activity concerned is likely to result in forest cover depletion, the person responsible shall undertake compulsory re-vegetation immediately upon the completion of the activity.

*The proposed project is not on a forest reserve or near one.*

**4.4.15 Occupational Safety and Health Act, 2007**

This is an Act of parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. It applies to all workplaces where any person is at work, whether temporarily or permanently.

The purpose of the Act is to:

- Secure the safety, health and welfare of persons at work;
- Protect persons other than persons at work against safety and health arising out of, or in connection with the activities of persons at work.

The Act provides that before any premises are occupied, or used as a workplace, a certificate of registration must be obtained from the Director of Occupational Safety and Health Services. The Act provides for the health, safety and welfare for employees at workplaces. This shall be considered at the construction, implementation and decommissioning phases of the project. The following are other provisions of the Act.

**4.4.14.1 Health**

The premise must be kept clean and not overcrowded. The circulation of fresh air must secure adequate ventilation of workrooms. There must be sufficient and suitable lighting in every part of the premise in which persons are working or passing. There should also be sufficient and suitable sanitary conveniences separate for each sex, must be provided subject to conformity with any standards prescribed by rules. Food and drinks should not be partaken in dangerous places or workrooms. Provision of suitable protective clothing and appliances including where necessary, suitable gloves, footwear, goggles, gas masks, and head covering, and maintained for the use of workers in any process involving expose to wet or to any injurious or offensive substances.
4.4.14.2 Safety
Fencing of premises and dangerous parts of other machinery is mandatory. Training and supervision of inexperienced workers, protection of eyes with goggles or effective screens must be provided in certain specified processes. Floors, passages, gangways, stairs, and ladders must be soundly constructed and properly maintained and handrails must be provided for stairs. Special precaution against gassing is laid down for work in confined spaces where persons are liable to overcome by dangerous fumes. Air receivers and fittings must be of sound construction and properly maintained. Adequate and suitable means for extinguishing fire must be provided in addition to adequate means of escape in case of fire must be provided.

4.4.14.3 Welfare
An adequate supply of both quantity and quality of wholesome drinking water must be provided. Maintenance of suitable washing facilities, accommodation for clothing not worn during working hours must be provided. Sitting facilities for all female workers whose work is done while standing should be provided to enable them take advantage of any opportunity for resting. Every premise shall be provided with maintenance, readily accessible means for extinguishing fire and person trained in the correct use of such means shall be present during all working periods.

Regular individual examination or surveys of health conditions of industrial medicine and hygiene must be performed and the cost will be met by the employer. This will ensure that the examination can take place without any loss of earning for the employees and if possible within normal working hours. The (OSH) Act provides for development and maintenance of an effective programme of collection, compilation and analysis of occupational safety. This will ensure that health statistics, which shall cover injuries and illness including disabling during working hours, are adhered.

The Environmental Management Plan (EMP) advises the Proponent on safety and health aspects, potential impacts, personnel responsible for implementation and monitoring, frequency of monitoring, and estimated cost.

4.4.15 Work Injury and Benefits Act, 2007
This Act provides for compensation to employees for work related injuries and disease contracted in the course of their employment and for connected purposes.
Key sections of the Act include the obligations of employers; right to compensation; reporting of accidents; compensation; occupational diseases; medical aid etc. In case of any accidents or incidents during the project cycle, this Act will guide the course of action to be taken.

4.4.16 Occupiers Liability Act (Cap. 34)

This Act provides that it’s the duty of occupier of the premises owes to his visitors in respect of danger and risk due to the state of the premises or to things omitted or attributes an affliction on his/her health to a toxic materials in the premises.

4.4.17 The Radiation Protection Act (Cap 243 Laws of Kenya)

This is an Act of Parliament to provide for the protection of the public and radiation workers from the dangers arising from the use of devices or material capable of producing ionizing radiation and for connected purposes. Since 1982, Kenya decided to join in the global movement for the use of nuclear energy for peaceful purposes, a movement lead by the International Atomic Energy Agency (IAEA). Most of such uses are in the fields of medicine, agriculture, energy and environmental monitoring. The dangers of injury to the public prompted the adoption of the Radiation Protection Act (Cap 243) in November 1984 to provide according to its citation, protection of the public and radiation workers from the dangers arising from the use of devices or materials capable of producing ionizing radiation and for connected purpose.

The Act prohibits the unauthorized manufacture, production, possession or use, sale, disposal, lease, loan or dealership, import, export of any irradiating device or radioactive material. All authorized buyers, sellers, users, of such device must be properly licensed. The Act is administered by the Chief Radiation Protection Officer assisted by a Radiation Protection Board.

The proposed project won’t emit/produce ionizing radiations.

4.4.18 The Traffic Act Chapter 295 Laws of Kenya

This Act consolidates the law relating to traffic on all public roads. Key sections include registration and licensing of vehicles; driving licenses; driving and other offences relating to the use of vehicles on roads; regulation of traffic; accidents;
offences by drivers other than motor vehicles and other road users. Many types of equipment and fuel shall be transported through the roads to the proposed site. Their registration and licensing will be required to follow the stipulated road regulations. The Act also prohibits encroachment on and damage to roads including land reserved for roads. The project is under the provision of the Act.

4.4.19 The Public Roads and Roads of Access Act (Cap 22 Laws of Kenya)

Section 8 and 9 of the Act provides for the dedication, conversion or alignment of public travel lines including construction of access roads adjacent lands from the nearest part of a public road. Section 10 and 11 allows for notices to be served on the adjacent landowners seeking permission to construct the respective roads.

The project design concept has left the required road reserves and relevant road widening surrenders. This Act consolidates the law relating to traffic on all public roads. The Act also prohibits encroachment on and damage to roads including land reserved for roads.

The proposed facility location complies with the provision of the Act. It is not on road reserves.

4.4.20 The Way leaves Act Cap 292

According to the Way leaves Act cap 292 Section 2, Private land does not include any land sold or leased under any Act dealing with Government lands. Section 3 of the Act states that the Government may carry any sewer, drain or pipeline into, through, over or under any lands whatsoever, but may not in so doing interfere with any existing building. Section 8 further states that any person who, without the consent of the Permanent Secretary to the Ministry responsible for works (which consent shall not be unreasonably withheld), causes any building to be newly erected over any sewer, drain or pipeline the property of the Government shall be guilty of an offence and liable to a fine of one hundred and fifty shillings, and a further fine of sixty shillings for every day during which the offence is continued after written notice in that behalf from the Permanent Secretary; and the Permanent Secretary may cause any building erected in contravention of this section to be altered, demolished or otherwise dealt with as he may think fit, and may recover any expense incurred by the Government in so doing from the offender.
The proposed site is not inhabited hence there will be no compensation.

4.4.21 The Agriculture Act, Cap 318 of 1980 (revised 1986)

This Act has stated objectives to promote and sustain agricultural production, provide for conservation of the soil and its fertility, and stimulate the development of agricultural land in accordance with accepted practices of good land management and good husbandry.

The proposed site is zoned industrial purposes and no agricultural activities will be done on site.

4.4.22 Antiquities and Monuments Act, 1983 (Cap 215)

This Act aims to preserve Kenya’s national heritage. Kenya is rich in its antiquities, monuments and cultural and natural sites which are spread all over the country. The National Museums is the custodian of the country’s cultural heritage. Through the National Museums many of these sites are protected by law by having them gazette under the Act.

The proposed site has no sites of cultural heritage.

4.4.23 The Registration of Titles Act Cap 281

This Act provides for the transfer of the land by registration of titles. Parts within the Act elaborate on mechanisms of bringing lands under the Act, and for related purposes. The Act also elaborates on the incorporation of group representatives and the administration of groups.

Section 34 of this Act states that when land is intended to be transferred or any right of way or other easement is intended to be created or transferred, the registered proprietor or, if the proprietor is of unsound mind, the guardian or other person appointed by the court to act on his/her behalf in the matter, shall execute, in original only, a transfer in form F in the First Schedule, which transfer shall, for description of the land intended be dealt with, refer to the grant or certificate of title of the land, or shall give such description as may be sufficient to identify it, and shall contain an accurate statement of the land and easement, or the easement, intended to be transferred or created, and a memorandum of all leases, charges and other encumbrances to which the land may be subject, and of all rights-of-way, easements and privileges intended to be conveyed.
4.4.24 The Land Titles Act Cap 282

The Land Titles Act Cap 282 section 10 (1) states that there shall be appointed and attached to the Land Registration Court a qualified surveyor who, with such assistants as may be necessary, shall survey land, make a plan or plans thereof and define and mark the boundaries of any areas therein as, when and where directed by the Recorder of Titles, either before, during or after the termination of any question concerning land or any interest connected therewith, and every area so defined and marked shall be further marked with a number of other distinctive symbol to be shown upon the plan or plans for the purposes of complete identification and registration thereof as is herein after prescribed.

4.4.25 The Land Acquisition Act Chapter 295 Laws of Kenya

The Act provides for the compulsory or otherwise acquisition of land from private ownership for the benefit of the general public. Section 3 states that when the Minister is satisfied on the need for acquisition, notice will be issued through the Kenya Gazette and copies delivered to all the persons affected. Full compensation for any damage resulting from the entry onto land to do things such as survey upon necessary authorisation will be undertaken in accordance with section 5 of the Act. Likewise where land is acquired compulsorily, full compensation shall be paid promptly to all persons affected in accordance to sections 8 and 10 along the following parameters:

(i) Area of land acquired
(ii) The value of the property in the opinion of the Commissioner of land ( after valuation),
(iii) Amount of the compensation payable,
(iv) Market value of the property,
(v) Damages sustained from the severance of the land parcel from the land,
(vi) Damages to other property in the process of acquiring the said land parcel,
(vii) Consequences of changing residence or place of business by the land owners,
(viii) Damages from diminution of profits of the land acquired.

Part II of the Act allows for the temporary acquisition of the land for utilisation in promotion of the public good for periods not exceeding 5 years. At the expiry of the period, the Commissioner of Land shall vacate the land and undertake to
restore the land to the conditions it was before. Any damages or reduction of value shall be compensated to the landowners.

4.5 International Environmental Guidelines

Kenya is a signatory to a number of conventions on sustainable development and is a member of various bilateral and multilateral organizations. Some of the relevant international treaties and conventions include:

- Vienna Convention for the Protection of the Ozone Layer. Inter-govern mental negotiations for an International agreement to phase out ozone depleting substances concluded in March 1985 with The adoption of this convention to encourage Inter-governmental co-operation on research, systematic observation of the ozone layer, monitoring of CFC production and the exchange of information;

- Montreal Protocol on Substances that Deplete the Ozone layer: Adopted in September 1987 and intended to allow the revision of phase out schedules on the basis of periodic scientific and technological assessment, the Protocol was adjusted to accelerate the phase out schedules and has since been amended to introduce other kinds of control measures and to add new controlled substances to the list;

- The Basel Convention: Sets an ultimate objective of stabilizing greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system;

- Kyoto Protocol: Drawn up in 1997, pursuant to the objectives of the United Nations Framework Convention on Climate Change, in which the developed nations agreed to limit their greenhouse gas emissions, relative to the levels emitted in 1990;

- Convention on Biological Diversity (CBD, 1992): This Convention entered into force on 29 December 1993, and its objectives are to: conserve biological diversity; use biological diversity in a sustainable fashion and share the benefits of biological diversity fairly and equitably. This Convention governs Kenya’s international obligations regarding biological diversity;

- UNESCO Convention for the protection of the World Cultural and Natural Heritage (World Heritage Convention, 1972): This Convention aims to
encourage the identification, protection, and preservation of Earth’s cultural and natural heritage. It recognizes that nature and culture are complementary and that cultural identity is strongly related to the natural environment in which it develops;

- Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar Convention): The Convention was signed in Iran in 1971 and came into force in 1975. It represents the first attempt to establish a legal instrument providing comprehensive protection for a particular type of ecosystem. The Ramsar parties agree to implement their planning so as to promote conservation of the wetlands included in the list. There is no Ramsar site near the proposed site.

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES): This convention seeks to control the trade in species of wild animals and plants that are, or may be, threatened with extinction as a result of International trade. CITES is an important line of defense against the threat posed to diversity by invasive species.

- The Africa-Eurasia Migratory Water Bird Agreement (AEWA, 1995): The goal of the agreement is to protect migratory waterfowl by ensuring that they are protected for the entire length of their migratory routes. The list of birds protected under the AEWA Convention covers 235 species of birds.

- African Convention on Conservation of Nature and Natural Resources (1968): This Convention of the African Union is ratified by 40 African countries, including Kenya. The fundamental principle requires contracting states to adopt the measures necessary to ensure conservation, utilization and development of soil, water, flora and faunal resources in accordance with scientific principles and with due regard to the best interests of the people.

Kenya has a duty under these multilateral agreements. The project should adhere to strict guidelines and procedures to ensure the agreements are not violated.

### 4.6 World Bank’s Safeguard Policies

The objective of the World Bank’s environmental and social safeguard policies is to prevent and mitigate undue harm to people and their environment in the
development process. These policies provide guidelines for bank and borrower
staffs in the identification, preparation, and implementation of programs and
projects. Safeguard policies have often provided a platform for the participation of
stakeholders in project design, and have been an important instrument for building
ownership among local populations. (World Bank, 1999-2006)

4.6.1 World Bank Safeguard Policy 4.01-Environmental Assessment

The environmental assessment process provides insights to ascertain the
applicability of other WB safeguard policies to specific projects. This is especially
the case for the policies on natural habitats, pest management, and physical
cultural resources that are typically considered within the EA process. The policy
describes an environmental assessment (EA) process for the proposed project. The
breadth, depth, and type of analysis of the EA process depend on the nature,
scale, and potential environmental impact of the proposed project. The policy
favours preventive measures over mitigatory or compensatory measures, whenever
feasible.

The operational principles of the policy require the environmental assessment
process to undertake the following:

- Evaluate adequacy of existing legal and institution framework including
  applicable international environmental agreements. This policy aims to
  ensure that projects contravening the agreements are not financed.
- Stakeholder consultation before and during project implementation
- Engage service of independent experts to undertake the environmental
  assessment
- Provide measures to link the environmental process and findings with
  studies of economics, financial, institutional, social and technical analysis of
  the proposed project.
- Develop programmes for strengthening of institutional capacity in
  environmental management
- The requirements of the policy are similar to those of EMCA which aims to
  ensure sustainable project implementation. Most of the requirements of
  this safeguard policy have been responded to in this report by evaluating the
  impact of the project, its alternatives, existing legislative framework and
  public consultation.

4.6.2 Bank Safeguard Policy 4.04-Natural Habitats

This safeguard policy requires that the study use precautionary approach to natural
resources management to ensure environmental sustainability. The policy requires
conservation of critical habitat during project development. To ensure
conservation and project sustainability the policy requires that:

Project alternative be sought when working in fragile environment areas;
Key stakeholders be engaged in project design, implementation, monitoring and
evaluation including mitigation planning. The requirements of this policy were
observed as much as possible during the EIA. The consulting team engaged several
stakeholders in the study impact evaluation this included the KWS, WRMA, KFS,
Nature Kenya among others.
This policy is not triggered by the proposed project as the project area doesn’t have wildlife conservation areas.

4.6.3 Bank Safeguard Policy 4.36 - Forests
This safeguard policy provides measures for protection of forests through impact evaluation and conservation of forest during project development. This policy is not triggered because the proposed project area does not have natural forest. The area is fully settled with various land uses but a few community members hence this policy will not be triggered.

4.6.4 Bank Safeguard Policy 4.11 - Physical Cultural Resources
This policy assists in preserving physical cultural resources and helps reduce chances of their destruction or damage. The policy considers Physical Cultural Resources (PCR) to be resources of archeological, paleontological, historical, architectural, and religious (including graveyards and burial sites), aesthetic or other cultural significance. The project shall traverse several homes in rural Kenya thus it shall stumble onto several burial sites within the affected homesteads; since the tradition of burying the deceased within the homesteads is practiced in the project area. 
There are no communities members likely to be affected by the project hence this policy is not triggered.

4.6.5 Bank Safeguard Policy 4.12 - Involuntary Resettlement
Resettlement due to infrastructure development is not a new phenomenon in Kenya but the government has no Policy Document or Act that aims at ensuring that persons who suffer displacement and resettlement arising from such development activities can be compensated adequately for their losses at replacement costs. The proponent plans to implement the World Bank’s Operational Policy 4.12 which has been designed to mitigate against impoverishment risks associated with Involuntary Resettlement and the restoration or improvement of income-earning capacity of the Project Affected People (PAP). The policy requires full public participation in resettlement planning and implementation and describes the conditions that borrowers are obliged to meet in operations involving involuntary resettlement.

The proposed project does not trigger the resettlement and relocation in the project area since there are no community members whose parcels of land reach the proposed project site. The scope of study didn’t include the development of a Resettlement Action Plan (RAP) as an integral part of the EIA study in order to facilitate evaluates the project impacts holistically.

4.6.7 Bank Safeguard Policy 4.12 - Indigenous People
This policy requires project to be designed and implemented in a way that fosters full respect for Indigenous Peoples’ dignity, human rights and cultural uniqueness
and so that they receive culturally compatible social and economic benefits and do not suffer adverse effects during the development process.

This policy is not triggered as the proposed project area is not occupied by Indigenous People who identifies with the areas.

4.6.8 World Bank Safeguard Policy BP 17.50- Public Disclosure
This BP encourages Public Disclosure (PD) or Involvement as a means of improving the planning and implementation process of projects. This procedure gives governmental agencies responsibility of monitoring and managing the environmental and social impacts of development projects particularly those impacting on natural resources and local communities. The policy provides information that ensures that effective PD is carried out by project proponents and their representatives. The BP requires that Public Involvement should be integrated with resettlement, compensation and indigenous peoples’ studies. Monitoring and grievances address mechanism should also be incorporated in the project plan.

The proposed project incorporated public participation and stakeholders’ consultation as part of the E&SIA studies in order to collect the views of the local communities and their leaders for incorporation in the project mitigation plan. The consultation was successful and the community members gave a number of views that have been considered in the mitigation plan.
CHAPTER 5: PUBLIC PARTICIPATION

5.1 Sources of Information
Public participation was a key component of the EIA of the proposed 66/11 kV substation, in Dagoretti. Positive and negative views of the immediate neighbours were sought as from 12th to 16th of August 2013. The exercise was conducted using pre-designed questionnaires and interviews in the premises neighbouring the proposed project area. Their responses are found in Annex VII.

The table below shows the names of the neighbours who were interviewed and given the questionnaires to fill in relation to the proposed 66/11 kV substation, in Dagoretti area. The lists of the public consultation and stakeholder’s meetings are attached in the appendixes.

5.2 Issues Raised by the would be affected community
The following issues were raised by the project neighbours during public participation of the proposed 66/11 kV substation, in Dagoretti.

5.2.1 Positive Issues

5.2.1.1 Employment opportunities
Most neighbours close to the proposed project site expected that the project will create casual and permanent employment opportunities during the proposed project construction work, operation and decommissioning phases. The employment opportunities could be either directly in the project or indirectly through associated businesses. One of the main positive impacts during projects construction phase will be the availability of job opportunities especially to casual workers and several other specialised workers.

5.2.1.2 Improvement of local and national economy
Through the use of locally available materials during the construction phase of the proposed 66/11 kV substation will contribute towards growth of the economy by contributing to the gross domestic product. The distribution of reliable electricity will lead to industrialization and general urbanization. It will improve electricity availability in the country resulting in low competitive costs of electricity in long term.
5.2.1.3 Boosting of the informal sector
During the construction, operational and decommissioning phase of the proposed 66/11 kV substation, it is expected that the other businesses in the informal sector will flourish. These include activities such as food vending who will be benefiting directly from the construction, operational and decommissioning staff members who will be buying food and other commodities from them. This will promote the informal sector in securing some temporary revenue and hence livelihood.

5.2.1.4 Improved Electricity Supply
The proposed project aims to increase the quality and security of the power supply to the surrounding industries, businesses, homes and social institutions among others. The neighbours, who are mostly from the neighbouring industries, were optimistic that power outages will be minimized and that they will not be subjected to power rationing. With this additional reliable electricity in the national grid, the country and the local area are expected to attract more investments.

5.2.1.5 Drainage
The proposed site is next to the source of river Athi. The community members informed the experts that during the rainy season water does flood the area and adviced the project proponent to put in place adequate drainage mechanisms into the proposed substation so as to avoid the flooding of the substation.

5.2.2 Negative Issues

5.2.2.1 Increased Emissions (Air Pollution)
During construction and decommissioning phase of the proposed 66/11 kV substation, there will be undesirable emissions that will be emitted like Sulphur Oxide and Nitrogen Oxide. Dust will also be emitted during the construction and decommissioning phases. Neighbours asked for air pollution control measures to be put in place.

5.2.2.2 Increased Noise Level and Vibration
There were concern over the possibility of high noise and vibration levels in the proposed project site as a result of construction works. However, the project proponent will have to take appropriate steps to minimize noise production by using silent machines, construction works should be done during the daytime working hours and ensuring that all equipments are well maintained.

5.2.2.3 Social concerns
Some neighbours thought that the location of the project will attract people to the area. This may lead to social vices like drug abuse, spread of diseases including HIV and insecurity.
5.2.2.4 Oil Spillage and Fire Incidents
Some neighbours expressed their concerns on the possibilities of transformer oil spills and fire outbreaks during project implementation. Neighbours want the project proponent to put in place oil spill prevention measures and to have the facility well fenced to prevent unauthorized access.
CHAPTER 6: IDENTIFICATION OF ENVIRONMENTAL IMPACTS OF THE PROPOSED 66/11 kV substation PROJECT

6.1 Introduction

This Section identifies and discusses both negative and positive impacts associated with the proposed 66/11 kV substation, in Dagoretti. The impacts are identified according to Phases namely: Construction Phase, Operational Phase and Decommissioning Phase. However poor planning of the project could also affect the environment that supports millions of Kenyans through the potential hazards that the project could pose to the public like water, soil contamination and poor waste disposal.

The summary of the main potential impacts of the proposed project are listed in Table below and have been analyzed into different categories based on stakeholder’s views and perceptions as well as the consultant’s previous experience in undertaking ESIA of similar nature. The project impacts are classified as positive or negative. However the study goes further to categorize the impacts in terms of direct or indirect, temporary or permanent, major or minor.

Table 6.1: Summary of Project Potential Impacts

<table>
<thead>
<tr>
<th>Environmental &amp; Social Impact</th>
<th>Positive/ Negative</th>
<th>Direct/ Indirect</th>
<th>Temporary/ Permanent</th>
<th>Major/ Minor</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Construction</td>
<td>Operation</td>
</tr>
<tr>
<td>Employment Opportunities</td>
<td>Positive</td>
<td>Direct</td>
<td>Permanent/T temporary</td>
<td>Major</td>
<td>/</td>
</tr>
<tr>
<td>Gains in the Local and National Economy</td>
<td>Positive</td>
<td>Direct</td>
<td>Permanent</td>
<td>Major</td>
<td>/</td>
</tr>
<tr>
<td>Provision of Market for Supply of Building Materials</td>
<td>Positive</td>
<td>Direct</td>
<td>Temporary</td>
<td>Major</td>
<td>/</td>
</tr>
<tr>
<td>Informal Sectors Benefits</td>
<td>Positive</td>
<td>Direct</td>
<td>Temporary</td>
<td>Minor</td>
<td>/</td>
</tr>
<tr>
<td>Environmental Benefits</td>
<td>Positive</td>
<td>Indirect</td>
<td>Permanent</td>
<td>Minor</td>
<td>/</td>
</tr>
<tr>
<td>Noise pollution &amp; increased vibration</td>
<td>Negative</td>
<td>Direct</td>
<td>Permanent</td>
<td>Major</td>
<td>/</td>
</tr>
<tr>
<td>Generation of Exhaust Emissions</td>
<td>Negative</td>
<td>Direct</td>
<td>Permanent</td>
<td>Minor</td>
<td>/</td>
</tr>
<tr>
<td>Dust Emissions</td>
<td>Negative</td>
<td>Direct</td>
<td>Temporary</td>
<td>Minor</td>
<td>/</td>
</tr>
<tr>
<td>Disposal of Excavated Soil</td>
<td>Negative</td>
<td>Direct</td>
<td>Temporary</td>
<td>Minor</td>
<td>/</td>
</tr>
<tr>
<td>Increased water demand</td>
<td>Negative</td>
<td>Direct</td>
<td>Permanent</td>
<td>Major</td>
<td>/</td>
</tr>
</tbody>
</table>
### Proposed 66/11 kV Dagoretti Substation

| Workers accidents and hazards | Negative | Direct | Permanent | Minor | / | / | / |
| Energy (Transformer oil) Consumption | Negative | Direct | Permanent | Major | x | / | x |
| Extraction and Use of Building Materials | Negative | Direct | Temporary | Minor | / | x | x |
| Solid Waste Generation | Negative | Direct | Permanent | Major | / | / | / |
| Liquid Waste Generation | Negative | Direct | Permanent | Major | / | / | / |
| Possible Exposure of Workers to Diseases | Negative | Direct | Permanent | Major | / | / | x |
| Increased Storm Water Runoff from New Impervious Areas | Negative | Direct | Permanent | Major | / | / | x |
| Soil Erosion | Negative | Direct | Temporary | Minor | / | x | / |
| Oil Spills Hazards | Negative | Direct | Permanent | Major | / | / | / |
| Destruction of existing vegetation | Negative | Direct | Permanent | Minor | / | x | x |
| Fire Outbreaks | Negative | Direct | Temporary | Major | / | / | / |
| Quality electricity supply | Positive | Direct | Permanent | Major | x | / | x |
| Increased Population around the project area | Negative | Direct | Permanent/Temporary | Minor | / | / | x |
| Visual Impacts | Negative | Direct | Permanent | Minor | / | / | / |

#### 6.2 Positive Impacts during Construction Phase

The positive impacts associated with the proposed 66/11 kV substation, in Dagoretti, during construction phase are as discussed below;

**6.2.1 Employment Opportunities**

With the construction of 66/11 kV in Dagoretti substation, there will be employment opportunities especially for casual workers from the local community. Creation of employment opportunities has both economic and social benefit. In the economic benefit, abundant unskilled labour will be used in economic production while socially these young and energetic otherwise poor people will be engaged in productive employment other than remaining idle. Employees with diverse skills are expected to work on the site during the construction period.

**6.2.2 Gains in the Local and National Economy**

There will be gains in the local and national economy as a result of the construction of the proposed 66/11 kV in Dagoretti substation, through consumption of locally available materials including: timber, glasses, metals,
cement among other construction materials. The consumption of these materials in addition to fuel oil and others will attract taxes including Value Added Tax (VAT) which will be payable to the government. The cost of the materials will be payable directly to the producers.

6.2.3 Provision of Market for Supply of Building Materials
The project will require supply of large quantities of building materials most of which will be sourced locally from the surrounding areas especially Nairobi town and neighbouring small towns. This provides ready market for building material suppliers such as quarrying companies which are credited by NEMA, hardware shops and individuals with such materials.

6.2.4 Informal Sectors Benefits
During construction phase of proposed 66/11 kV in Dagoretti substation, the informal sectors are temporarily likely to benefit from the operations. This will involve kiosk operators who will be selling food to the construction workers on site. This will finally promote Jua Kali entrepreneurs in Dagoretti, Kikuyu, Nairobi towns and small neighbouring town during the construction period.

6.2.5 Environmental Benefits
The proposed 66/11 kV in Dagoretti substation has a potential for contributing to the good of the environment of the area. The project will enhance electricity to the surrounding customers of Dagoretti area and its environments. This will lead to a substantial reduction in reliance on other sources of energy that have impacts on the forest cover and greenhouse.

6.3 Negative Impacts during Construction Phase
The following negative impacts are also associated with the construction of the proposed 66/11 kV in Dagoretti substation.

6.3.1 Noise pollution
The construction works of the proposed 66/11 kV in Dagoretti substation is most likely to be noiser operation due to the moving machines (mixers, tippers, communicating workers) and incoming vehicles to deliver construction materials to site. The construction workers who will be working in the site will generate some noise as they are communicating to one another. This will be a potential source of disturbance at the site and surrounding neighbourhoods of the proposed 66/11 kV in Dagoretti substation. The impact however will not be major.
6.3.2 Generation of Exhaust Emissions
Exhaust emissions are likely to be generated by the construction equipment during the construction phase of proposed 66/11 kV in Dagoretti substation. Motor vehicles that will be used to ferry construction materials would cause air quality impact by emitting pollutants through exhaust emissions. The impacts will be direct, permanent but not significant.

6.3.3 Dust Emissions
Particulate matter pollution is likely to occur during the site clearance, excavation and spreading of the topsoil during construction of proposed 66/11 kV in Dagoretti substation. There is a very small possibility of PM$_{10}$ suspended and settleable particles affecting the site workers and even neighbours’ health, it is minimal given the construction method of minimum excavation and nil cart away of soil. The impacts will be direct, temporary and minor.

6.3.4 Disposal of Excavated Soil
Though little excavation is likely to take place at the proposed 66/11 kV in Dagoretti substation, the excavation works to level the site will result in the generation of small amounts of excavated material. But there will be no cart away of excavated material. The impact will be direct, temporary and minor.

6.3.5 Increased water demand
During the construction phase of the proposed 66/11 kV in Dagoretti substation, both the construction workers and works will be using water that will cause additional demand for water in addition to the existing demands. Water will be mostly used in the creation of concrete for construction works and for wetting surfaces or cleaning completed structures. It will also be used by the construction workers to wash themselves and even drink. The impact will be direct, permanent and major.

6.3.6 Workers accidents and hazards during construction
During construction of the proposed 66/11 kV in Dagoretti substation, it is expected that construction workers especially non-skilled casuals are likely to have accidental injuries and hazards. Because of these 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. Such injuries can result from accidental falls from high elevations, injuries from hand
tools and construction equipment cuts from sharp objects. The impacts will be direct, permanent and minor.

6.3.7 Energy Consumption
During the construction phase of the proposed 66/11 kV in Dagoretti substation will consume fossil fuels (mainly diesel) to run transport vehicles and construction machinery. Fossil energy is non-renewable and its excessive use may have serious environmental implications on its availability, price and sustainability. The impact will be direct, permanent and major.

6.3.8 Extraction and Use of Building Materials
Building materials such as hard core, ballast, cement, rough stone and sand required for the construction of the proposed 66/11 kV in Dagoretti substation will be obtained from quarries, hardware shops and sand harvesters who extract such materials from natural resource banks such as rivers and land. Small quantities of these materials will be required for construction of the buildings transformer sites and pavements, the availability and sustainability of such resources at the extraction sites will be negatively affected as they are not renewable in the short term. In addition, the sites from which the materials will be extracted may be significantly affected in several ways including landscape changes, displacement of animals and vegetation, poor visual quality and opening of depressions on the surface leading to several human and animal health impacts. The impact will be direct, temporary and minor.

6.3.9 Solid Waste Generation
During construction of the proposed 66/11 kV in Dagoretti substation, will generate a lot of solid waste. These wastes include papers used for packing cement, plastics, metal scraps, food remains and timber remains among others. Dumping of these wastes around the proposed project site will interfere with the aesthetic status of the proposed area. This will have a direct effect to the surrounding community. Disposal of these solid wastes off-site could also be a social inconvenience if done in the wrong places. The off-site effects could affect aesthetic, pest breeding, pollution of physical environment, invasion of scavengers and informal recycling communities.

6.3.10 Possible Exposure of Workers to Diseases
Workers are likely to be exposed to diseases from building materials during the construction phase of the proposed 66/11 kV in Dagoretti substation. It is therefore recommended that before the construction phase of the proposed 66/11 kV in Dagoretti substation commences, there is need for the construction materials to be
well inspected according to the occupational health and safety standards and worker encouraged to use personal protective equipments.

6.3.11 Increased Storm Water Runoff from New Impervious Areas
Construction of the proposed 66/11 kV in Dagoretti substation buildings, pavements and its associated structures within the proposed project site will lead to additional runoff through creation of impervious areas and compaction of soils. Impervious areas and compacted soils generally have higher runoff coefficients than natural area, and increased flood peaks are a common occurrence in developed areas. The impact will be direct, permanent and minor.

6.3.12 Soil Erosion
There are possibilities of soil erosion occurring during the construction of the proposed 66/11 kV in Dagoretti substation especially during rainy and windy seasons. The impact will however be minimal as there area to be disturbed for the proposed development is small. The impacts will be direct, temporary and minor.

6.3.13 Oil Spills Hazards
The construction machines on the proposed site for the 66/11 kV in Dagoretti substation may be containing moving parts which will require continuous oiling to minimise the usual corrosion or wear and tear. This will contaminate the soil. Likewise, moving vehicles on site may require oil change. The impact will be direct, permanent and major.

6.3.14 Destruction of existing vegetation
The construction process of the proposed 66/11 kV in Dagoretti substation buildings and other associated facilities and structures will involve clearing of the existing vegetation cover (mainly grass) and some small trees on site. The impact will be direct, permanent and minor.

6.3.15 Surface and ground water Hydrology and Water Quality Degradation
Changes in surface hydrology alter the flow of water through the landscape. Construction of impervious surfaces such as transformers sites, cabling trenches, parking lots, walking pavements, roads and buildings might increase the volume and rate of runoff, resulting in habitat destruction, increased pollutant loads, and flooding. Contaminated soil or ground water in the path of the project could be disturbed by excavation resulting in a potential transfer of the contamination to surface waters. Oil spills during construction could introduce contaminants into subsurface which may end-up into ground water. Development activities such as
the proposed 66/11 kV in Dagoretti substation development as well as the spill-over effects of development such as increased demand for water use and increased auto use can impact water quality by contributing sediment, nutrients, and other pollutants to limit water supplies, increasing the temperature of the water, and increasing the rate and volume of runoff. The impact will be direct, permanent and major.

6.3.16 Fire Outbreaks
Due to various construction activities at the proposed 66/11 kV in Dagoretti substation project, fire outbreaks can occur. Handling of inflammable products increases fire risks like the transformer oil. The impact will be direct, temporary and major.

6.4 Positive Impacts during Operation Phase
Like construction phase, there are positive impacts associated with the proposed 66/11 kV in Dagoretti substation during operation phase. These positive impacts are discussed below.

6.4.1 Quality electricity supply
The existing distribution system capacity in Dagoretti and its environment has been constrained during the peak hours when system voltage do drop below acceptable levels, occasioning load shedding despite availability of generation capacity. The problem has been partly due to inadequate reactive power supply in major load centres and also distribution bottleneck. This could be sorted by establishing and constructing new 66/11 kV substation area so as to enhance quality electricity supply in Dagoretti and its environments. The impact will be direct, permanent and major. The impact will be direct, permanent and major.

6.4.2 Employment Opportunities
Employment opportunities are one of the long-term major positive impacts of the proposed 66/11 kV substation. This will occur during the operation and maintenance of the proposed 66/11 kV substation. These will involve security personnel that will be employed to look after the proposed 66/11 kV substation. Other sources of employment will involve direct technical service provision to the proposed 66/11 kV substation e.g. electrical engineers, civil engineers, mechanical engineers, drivers among others. The impact will be direct, permanent and major.
6.4.3 Increase in Revenue
There will be positive gain for the revenue system arising from the step down and distribution of the electricity power from the proposed 66/11 kV in Dagoretti substation to Government, the suppliers and KPLC. This will in turn be supplied to various customers who will be paying taxes to the Government. The impact will be direct, permanent and major.

6.4.4 Improved Security
With the establishment of the proposed 66/11 kV in Dagoretti substation, the level of security will be improved around the project area. This is as a result of more security lights and security personnel being employed to guard the proposed 66/11 kV substation. The project site will also be well fenced. Hence if the level of security is increased, the residents will feel more secure than before. The impact will be direct, permanent and minor.

6.5 Negative Impacts during Operation Phase
The following are the negative impacts that are associated with the proposed 66/11 kV in Dagoretti substation during the operation phase.

6.5.1 Solid Waste Generation
The proposed 66/11 kV in Dagoretti substation is expected to generate some amounts of solid waste during its operation phase. The bulk of the solid waste generated during the operation of the project will consist of drums, paper, plastic, cables, metal, transformers and capacitors. Such wastes can be injurious to the environment. Some of these waste materials especially the plastic, cables, metals, polythene among others are not biodegradable hence may cause long-term injurious effects to the environment. The impact will be direct, permanent and minor.

6.5.2 Liquid Waste Generation
Since the substation’ transformers will be using oil for cooling purposes of the transformers for the purpose of stepping down and distributing electric, transformer oil and other effluents will be generated. Likewise waste oil will be generated through transformer leakages. The liquid waste to be generated will be hazardous hence may cause long-term injurious effects to the environment. The impact will be direct, permanent and minor.

6.5.3 Increased oil Consumption
The proposed 66/11 kV substation shall consume large amount of transformer oil in the process of stepping down electric power. Since transformer oil fuel is produced
mainly through non-renewable resources, this will have adverse impacts on these non-renewable resources base and their sustainability. The impact will be direct, permanent and major.

6.5.4 Increased Population around the project area
With the construction and operation of the proposed 66/11 kV in Dagoretti substation it will lead to the establishment of food kiosks within the proposed project area whereby the workers of the proposed 66/11 kV substation will be eating from. Since the proposed project site doesn’t have adequate infrastructural facilities, for the speculated population will have some negative environmental impacts. The impact will be direct, permanent and minor.

6.5.5 Increased water demand
The operation activities during the operation phase of the proposed 66/11 kV in Dagoretti substation will involve the use of water for substation cleaning, drinking, washing and toilet flushing. These will increase strain water resources in the area. The impact will be direct, permanent and major.

6.5.6 Increased Pressure on Infrastructure
The proposed 66/11 kV in Dagoretti substation will have a potential of increasing pressure on existing infrastructure such as roads and water among others. This would be due to increased use of volumes on water, human and vehicle traffic in the project area. The impact will be direct, permanent and minor.

6.5.7 Increased Storm Water Flow
The building roofs and pavements of the proposed 66/11 kV in Dagoretti substation will lead to increased volume and velocity of storm water or run-off flowing across the area covered by the proposed 66/11 kV substation during operation phase. This will lead to increased amounts of storm water entering the drainage systems. The impact will be direct, permanent and minor.

6.5.8 Water Pollution
During the operation phase of the proposed 66/11 kV in Dagoretti substation, If the sites for dumping solid wastes are not well taken care of, they may cause contamination of ground water sources. There is need therefore for the project proponent to put in place an efficient waste management plan that will prevent the accumulation of uncontrolled waste, as well as an efficient collection system and off-site disposal. The impact will be direct, permanent and minor.
6.5.9 Oil Spills Hazards
Potential oil spills and accidents during oil transportation, storage and operations of the transformers and batteries of the proposed 66/11 kV in Dagoretti substation may occur. In the case of oil spill the relatively lighter, more volatile, mobile, and water soluble compounds in transformer oil will tend to evaporate fairly quickly into the atmosphere or migrate to groundwater. When exposed to oxygen and sunlight, most of these compounds will tend to break down relatively quickly. Accidental oil spills can occur due to leakage from the transformers. Poor maintenance of transformers can also lead to oil spills. The impact will be direct, permanent and minor.

6.5.10 Fire Outbreaks
Due to handling of flammable substances at the proposed 66/11 kV substation project, fire outbreaks can occur. Handling of inflammable products increases fire risks. The impact will be direct, temporary and major.

6.5.11 Visual Impacts
The substation might present unwanted visual impacts, both by its physical presence and profile against the surrounding area, and by visual impacts its associated structures that may also have adversely impact the visual quality of the area. The impact will be direct, permanent and minor.

6.6 Positive Impacts during Decommissioning Phase
The following positive impacts are associated with the proposed 66/11 kV substation during the decommissioning phase:

6.6.1 Site Rehabilitation
Upon decommissioning of the proposed 66/11 kV in Dagoretti substation rehabilitation of the project site will be carried out to restore the site to its original status or to a better state than it was originally. This will include replacement of topsoil and re-vegetation which will lead to restoration of the visual quality of the area.

6.6.2 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 66/11 kV in Dagoretti substation. The impact will be direct, temporary and minor.
6.7 Negative Impacts during Decommissioning Phase

The following three negative impacts discussed below are associated with the proposed 66/11 kV in Dagoretti substation during its decommissioning phase.

6.7.1 Noise and Vibration
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 66/11 kV in Dagoretti substation. The impact will be direct, temporary and minor.

6.7.2 Solid Waste Generation
Demolition of the proposed 66/11 kV substation and other related infrastructure will result in generation of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. The impact will be direct, permanent and major.

6.7.3 Generation of Dust
Some dust will be generated during demolition works of the proposed 66/11 kV substation. This will affect demolition staff as well as the neighbours. The impact will be direct, temporary and minor.
CHAPTER 7: MITIGATION MEASURES AND MONITORING PROGRAMMES

This section highlights the mitigation measures for the expected negative impacts of the proposed 66/11 kV in Dagoretti substation. The potential impacts and the possible mitigation measures have herein been analyzed under three categories: Construction, Operational and Decommissioning.

7.1 Mitigation of Construction Related Negative Impacts
The following measures can be considered as mitigation measures of the negative impacts associated with the proposed 66/11 kV in Dagoretti substation during construction phase.

7.1.1 Minimization of Noise and Vibration
The project proponent of the proposed 66/11 kV in Dagoretti substation should put in place several measures that will mitigate noise pollution arising during the construction phase. The following noise-suppression techniques will be employed to minimise the impact of temporary construction noise at the project site.

- Install portable barriers to shield compressors and other small stationary equipment where necessary.
- Use quiet equipment (i.e. equipment designed with noise control elements).
- Co-ordinate with relevant agencies regarding all construction.
- Limit vehicles to a minimum idling time and observe a common-sense approach to vehicle use, and encourage drivers to switch off vehicle engines whenever possible.

Compliance with the recently issued Noise and Vibration Regulations of 2009 is expected at all the phases of the project.

7.1.2 Control of generation of Exhaust Emissions
In order to control exhaust emissions that are likely to occur during the construction of the proposed 66/11 kV in Dagoretti substation, the following measures shall be implemented during construction.

- Vehicle idling time shall be minimized
- Alternatively fuelled construction equipment shall be used where feasible
- Equipment shall be properly tuned and maintained
This will also be achieved through proper planning of transportation of materials to be used during construction of the project to ensure that vehicle fills are increased in order to reduce the number of trips done or the number of vehicles on the road.

7.1.3 Dust Emissions and Air quality
Controlling dust emissions that are likely to take place during construction phase of the proposed 66/11 kV in Dagoretti substation is useful in minimizing nuisance conditions. It is recommended that a standard set of feasible dust control measures be implemented for all construction activities. Emissions of other contaminants (NO$_x$, CO$_2$, SO$_x$, transformer oil and diesel related PM$_{10}$) that would occur in the exhaust from heavy equipment are also included. The project proponent is committed to implementing measures that shall reduce air quality impacts associated with construction.

- During construction, any stockpiles of earth should be enclosed / covered / watered during dry or windy conditions to reduce dust emissions;
- Construction trucks removing soil from the site, delivering sand and cement to the site should be covered to prevent material dust into the surrounding areas;
- All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction. This means that construction workers will be trained regarding the minimization of emissions during construction.
- Specific training will be focused on minimizing dust and exhaust gas emissions from heavy construction vehicles. Drivers of vehicles used during construction will be under strict instructions to minimize unnecessary trips and minimize idling of engines.
- During construction, where water is available, sprinkle the construction area with water to keep dust levels down.
- Masks should be provided to all personnel in areas prone to dust emissions throughout the period of construction.
- Drivers of construction vehicles must be supervised so that they do not leave vehicles idling, and they limit their speeds so that dust levels are lowered.
- Maintain all machinery and equipment in good working order to ensure minimum emissions including carbon monoxide, NO$_x$, SO$_x$ and suspended particulate matter;
7.1.4 Excavated Soil during Construction
The Excavated soil during the construction of the proposed 66/11 kV substation will not be disposed. It is recommended that part of the topsoil excavated from the proposed construction site be re-spread in areas to be landscaped to enhance plant health.

7.1.5 Minimization of increased Water Demand
The proponent of the proposed 66/11 kV in Dagoretti substation shall ensure that water is used efficiently at the site by sensitizing construction staff to avoid irresponsible water use.

7.1.6 Minimization of Worker accidents and hazards during Construction phase
To reduce the workers accidents and hazards during the construction phase of the proposed 66/11 kV in Dagoretti substation, the contractor and proponent are expected to adhere to the provisions of the Occupational Safety and Health Act, 2007 and its subsidiary legislation. It is the responsibility of the project proponent and contractor to provide a safe and healthy environment for construction workers as outlined in the EMP. The proposed 66/11 kV substation Response and Evacuation Plan must be in place in addition to safety education and training shall be provided to the employees.

7.1.7 Reduction of Energy Consumption
The project proponent and contractor shall ensure responsible electricity use at the construction site through sensitization of staff to conserve electricity by switching off electrical equipment or appliances when they are not being used. In addition, proper planning of transportation of materials will ensure that fossil fuels (transformer oil, diesel, petrol) are not consumed in excessive amounts. Complementary to these measures, the proponent shall monitor energy use during construction and set targets for reduction of energy use.

7.1.8 Reduction of Impacts at Extraction Sites and Efficient Use of Raw Materials
The proponent of the proposed 66/11 kV in Dagoretti substation will source building materials such as sand, ballast and hard core from registered quarry and sand mining firms whose projects have undergone satisfactory Environmental Impact Assessment/Audit and received NEMA approval. Since such firms are expected to apply acceptable environmental performance standards, the negative impacts of their activities at the extraction sites are considerably well mitigated.
To reduce the negative impacts on availability and sustainability of the materials, the proponent will only order for what will be required through accurate budgeting and estimation of actual construction requirements. This will ensure that materials are not extracted or purchased in excessive quantities. Moreover, the proponent will ensure that wastage, damage or loss (through run-off, wind, etc) of materials at the construction site is kept minimal, as these would lead to additional demand for and extraction or purchase materials.

In addition to the above measures, the proponent shall consider reuse of building materials and use of recycled building materials. This will lead to reduction in the amount of raw materials extracted from natural resources as well as reducing impacts at the extraction sites.

7.1.9 Minimization of Solid Waste during Construction Phase

It is recommended that demolition and construction waste be recycled or reused to ensure that materials that would otherwise be disposed of as waste are diverted for productive uses. In this regard, the proponent is committed to ensuring that construction materials left over at the end of construction will be used in other projects rather than being disposed off. In addition, damaged or wasted construction materials including cabinets, doors, plumbing and lighting fixtures, marbles and glass will be recovered for refurbishing and use in other projects. Such measures will involve the sale or donation of such recyclable/reusable materials to construction companies, local community groups, institutions and individual residents or home owners.

The proponent shall put in place measures to ensure that construction materials requirements are carefully budgeted for and to ensure that the amount of construction materials left on site after construction is kept minimal. It is further recommended that the proponent should consider the use of recycled or refurbished construction materials. Purchasing and using once-used or recovered construction materials will lead to financial savings and reduction of the amount of construction debris disposed of as waste. Additional recommendations for minimization of solid waste during construction of the proposed 66/11 kV in Dagoretti substation include:

i. Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time
Proposed 66/11 kV Dagoretti Substation

ii. Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements

iii. Purchase of perishable construction materials such as paints incrementally to ensure reduced spoilage of unused materials

iv. Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste

v. Use of construction materials containing recycled content when possible and in accordance with accepted standards.

vi. Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated areas shall be provided.

7.1.10 Possible exposure of workers to diseases and injuries

Possible exposure of workers to diseases from building materials at construction site shall be mitigated by compliance with occupational health and safety standards.

7.1.11 Minimization of Storm Water Run-off and Soil Erosion

The proponent of the proposed 66/11 kV in Dagoretti substation will put in place some measures aimed at minimizing soil erosion and associated sediment release from the project site during construction. These measures will include terracing and levelling the project site to reduce run-off velocity and increase infiltration of rain water into the soil. In addition, construction vehicles will be restricted to designated areas to avoid soil compaction within the project site, while any compacted areas will be ripped to reduce run-off. Increased runoff from paved grounds and expansive roofs causing extreme flooding and overflows of drainage systems shall be mitigated. Surface runoff and roof water shall be harvested and stored in underground reservoir for reuse. A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structures will be designed.

Excavations at the site will be restricted to the sections of the substation. Excavated earth will be held away from trenches and on locations of the site not susceptible to surface runoff of storm water. The earth removed for external disposal will require to be deposited on sites without the risk of being washed down during rains and where it will not compromise other land use activities in those areas. Caution will be required during construction at times of heavy rains.
Re-vegetate exposed areas around the site so as to mitigate erosion of soil by storm water runoff. The final site grade should facilitate drainage and avoid flooding and pooling. A site drainage plan should be developed to protect against erosion. Protecting stockpiles through the use of silt fencing and reduced slope angles should be used to minimize soil erosion during construction. Installation of drainage ditches, construction of runoff and retention ponds is necessary. Minimization of disturbances and scarification of the surface should be observed to reduce erosion impacts. All slopes and working surfaces should be returned to a stable condition and topsoil on the final site would be graded and planted as appropriate.

7.1.12 Controlling Oil Spills during Construction Phase
The proponent of the proposed 66/11 kV in Dagoretti substation will control the dangers of oil spills during construction by maintaining the machinery in specific areas designed for this purpose hence might not be a serious impact as a result of the construction of the proposed 66/11 kV in Dagoretti substation.

7.1.13 Minimization of Vegetation Disturbance
Clearance of part of the vegetation (mainly grass and shrubs) at the proposed 66/11 kV in Dagoretti substation site to pave way for construction will be inevitable. However, the project proponent will ensure proper demarcation of the project area to be affected by the construction works. This will be aimed at ensuring that any disturbance to flora is restricted to the actual project area and avoid spillover effects to the neighbouring areas. In the same vein, there will be strict control of construction vehicles to ensure that they operate only within the area to be disturbed by access routes and other works. Another important measure aimed at reducing disturbance of vegetation in the proposed project area will be preservation of individual trees within the site. In addition, the proponent will be involved in re-vegetation of some of the disturbed areas through implementation of a well-designed landscaping programme.

7.1.14 Hydrology and Water Quality Degradation
Several measures shall be put in place to mitigate the impacts that are likely to lead to Hydrology and water quality degradation at the proposed 66/11 kV in Dagoretti substation. The project proponent will prepare a hazardous substance control and 66/11 kV substation response plan that will include preparations for quick and safe clean-up of accidental spills. It will prescribe hazardous-materials handling procedures to reduce the potential for a spill during construction, and will include a 66/11 kV substation response programme to ensure quick and safe
clean-up of accidental spills. The plan will identify areas where refuelling and vehicle maintenance activities and storage of hazardous materials, if any, will be permitted. Trial holes digging will be conducted before construction begins and soil information will be provided to construction crews to inform them about soil conditions and potential hazards. Oil absorbent material, tarps and storage drums will be used to contain and control any minor releases of transformer and other equipment oil.

7.2 Mitigation of Operation Phase Negative Impacts

The negative impacts of the proposed 66/11 kV in Dagoretti substation will be mitigated as discussed below.

7.2.1 Ensuring Efficient Solid Waste Management

The project proponent of the proposed 66/11 kV in Dagoretti substation will be responsible for efficient management of solid waste generated by the project during its operation. In this regard, the proponent will provide waste handling facilities such as labelled waste bins and skips for temporarily holding solid waste generated at the site.

In addition, the project proponent will ensure that such are disposed of regularly and appropriately. It is recommended that the proponent puts in place measures to ensure that the proposed 66/11 kV substation operating personnel manage the waste efficiently through recycling, reuse and proper disposal procedures.

The proponent will put in place an integrated solid waste management system and give priority to reduction at source of the materials. This option will demand a solid waste management awareness programme in the management and the operator employees. Solid wastes shall be disposed off in a manner that is acceptable to NEMA and Environmental Regulations.

7.2.2 Ensuring efficient liquid Waste Management

The transformer oil should be re-used in the substation or other related sites and the unusable one should be disposed by a NEMA approved contractor. The substation should be well paved to prevent spilled oil from reaching the sub-surface. It is proposed that a bund wall and oil holding dam be constructed to contain transformer oil in case of accidental leakage.
7.2.3 Ensure Efficient Energy Consumption
To ensure efficient energy consumption during the operation phase of the proposed 66/11 kV in Dagoretti substation, the proponent plans to install an energy-efficient lighting system at the project site. This will contribute immensely to energy saving during the operational phase of the project. In addition, the substation operators will be sensitised to ensure energy efficiency in their daily operations. To complement these measures, it will be important to monitor energy use during the operation of the proposed 66/11 kV in Dagoretti substation and set targets for efficient energy use.

7.2.4 Ensure Efficient Water Use
The proponent of the proposed 66/11 kV in Dagoretti substation will install water-conserving automatic taps and toilets. Moreover, any water leaks through damaged pipes and faulty taps will be fixed promptly by qualified staff. In addition, the substation operators of the proposed 66/11 kV substation will be sensitized to use water efficiently.

7.2.5 Oil Spills
To prevent oil spills and environmental contamination, the substation and transformers should be designed with spill prevention and detection systems to protect the environment. With spill prevention and protection measures there should no adverse effects to the ground and surface water and soil. Need to design appropriate protection devices against accidental discharge of toxic substances (bases/airtight tanks for machines, reservoirs etc.).

All the transformers should have secondary containment with sufficient volume to contain any spill from them in the containment structure. The containment area should have a means of removing accumulated water. The containment area should have a means of removing accumulated water. A retention area should be designed that surrounds the fuel storage tanks.

The substation operators should provide containers for the storage of chemical and lubricating products. Drains should be routed through a site/water separator. A spill and substation response plan would be developed and put in place prior to commencement of construction.

A written substation response plan should be prepared and retained on the site and the workers should be trained to follow specific procedures in the event of oil spills.
leakages and spills. The project proponent will orientate the workers on site on their specific EHS policies to prevent incidents and accidents of oil spill.

A floating boom should be used to contain spillage during refilling and unrefilling oil to transformers procedures. Frequent inspection and maintenance of transformer can minimize leakages.

The waste oil or used oil from maintenance of the transformers for proper disposal. In the Environmental Management Plan (EMP), disposal of used oil will be the responsibility of the project operator. The proponent will identify a reputable company to handle disposal of oil and oil filters.

7.2.7 Visual Impacts
The visual negative impacts can be mitigated through landscaping the area with trees to screen the project stacks, poles, cables and transformers by the project proponent of the proposed 66/11 kV in Dagoretti substation. Since the area is zoned as industrial, the visual impact will not be out of conformity with the surrounding areas.

7.2.8 Minimization of Sewage Release
The project proponent of the proposed 66/11 kV in Dagoretti substation will ensure that there are adequate means for handling the sewage generated at the proposed 66/11 substation. It will also be important to ensure that toilets are kept clean and properly maintained.

7.2.9 Fire Suppression
The site must contain firefighting equipments of recommended standards and in key strategic points all over the proposed project site of the proposed 66/11 kV in Dagoretti substation. Fire pumps, Hydrants, Sprinkler/water spray systems, Hose houses, Dry chemical systems, Carbon dioxide systems, Detection/alarm systems, Portable fire extinguishers among others. A fire evacuation plan must be posted in various points of the construction site including procedures to take when a fire is reported. All workers must be trained on fire management and fire drills undertaken regularly.

7.2.10 Workers Health and Safety
All workers entering the proposed 66/11 kV substation must be equipped with appropriate and adequate PPE including ear muffs, safety footwear, overalls,
Proposed 66/11 kV Dagoretti Substation

gloves, dust masks, among others. The PPE should be those meeting the international standards of PPE. Personal protection gear must be provided and its use made compulsory to all. The entire workforce of the substation should be trained in the use of protective gear, handling of chemical products and acid storage cells, electric safety equipment, procedures for entering enclosed areas, fire protection and prevention, substation response and care procedures. Training given to the employees should be backed by regular on-site training in safety measures. ‘Restricted ENTRY’ signs such as “HATARI” should be installed to keep away unauthorized persons from access to restricted areas. Machines and Equipments must be operated only by qualified staff and a site supervisor should be on site at all times to ensure adherence. The project operator must develop a Workplace Health and Safety Policy Manual for which all the workers should be conversant and comply with. The project operator should appoint a responsible person from the management team to be in charge of workplace Safety, Health and Environmental issues. The operator should develop a substation Response Plan for handling any emergencies arising thereof during the project implementation phase.

7.2.11 Hazardous waste

The amount of hazardous waste created will be very low and possibly originate from maintenance sources. The waste would consist primarily transformer oil and their containers, used rags and spent clean-up solvents. The used oil should be stored in a place with a drip collection mechanism before they are collected by the disposal agent for proper disposal. The substation operator should ensure that the used oil and its containers are properly disposed off in an environmental sound way. The mitigation measure is to provide training to site operation and maintenance staff to proper handle and dispose of the hazardous wastes using acceptable methods. Hazardous wastes on the site shall be clearly marked out and the entire workforce trained to recognize the danger signs and familiarize themselves with procedures to be followed before entering hazardous areas.

7.2.12 Noise and Vibration

Noise and vibration are expected during the operation phase of the project. Mitigation is through installation of generator muffling materials and with inbuilt sound and vibration absorption materials. The project operator will be expected to comply with the recent EMCA (Noise and Vibration) Regulations of 2009 during the operation phase of the project. All equipments and machinery installed must be tested to verify if they are compliant with Kenya and the World Bank acceptable
standards of noise. Tested noise levels should be recorded as baseline and used for future monitoring.

Noise emitting equipment should comply with the applicable Kenya and World Bank noise standards and should be properly maintained. All workers in the project site must be equipped with the necessary and required Personal Protective Equipment (PPE) prescribed by the Directorate of Occupational Safety and Health of the Ministry of Labour like PPE.

7.3 Mitigation of Decommissioning Phase Impacts
Just as in the case during the construction and operation phase, the negative impacts of the decommissioning phase of the proposed 66/11 kV in Dagoretti substation can be mitigated as follows.

7.3.1 Minimization of Noise and Vibration
Significant impacts on the acoustic environment will be mitigated by the project proponent of the proposed 66/11 kV in Dagoretti substation shall put in place several measures that will mitigate noise pollution arising during the decommissioning phase. The following noise-suppression techniques will be employed to minimise the impact of temporary destruction noise at the project site.

- Install portable barriers to shield compressors and other small stationary equipment where necessary.
- Use quiet equipment (i.e. equipment designed with noise control elements).
- Co-ordinate with relevant agencies regarding all substation construction activities in the residential areas.
- Install sound barriers for pile driving activity.
- Limit pickup trucks and other small equipment to a minimum idling time and observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible.
- Demolish mainly during the day. The time that most of the neighbours are out working.

7.3.2 Efficient Solid Waste Management
Solid waste resulting from demolition or dismantling works associated with the proposed 66/11 kV in Dagoretti substation during decommissioning phase will be managed as follows:
- Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of demolition waste generated during decommissioning phase
- Provision of facilities for proper handling and storage of demolition materials to reduce the amount of waste caused by damage or exposure to the elements
- Use of materials that have minimal packaging to avoid the generation of excessive packaging waste
- Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area shall be provided.

7.3.3 Reduction of Dust Concentration
High levels of dust concentration resulting from demolition or dismantling works will be minimized as follows:

- Watering all active demolition areas as and when necessary to lay dust.
- Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard.
- Pave, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at demolition sites.

7.3.4 Site Rehabilitation after Decommissioning
The project operator shall, on decommissioning of the project, restore the site to its original status as far as practicable and plant trees at the site.
CHAPTER 8: ANALYSIS OF PROJECT ALTERNATIVES

8.1 Introduction
One of the functions of the Environmental and Social Impact assessment process is to describe and evaluate the alternatives to the proposed project to be undertaken therefore this chapter will describe and examine the various alternatives available for the proposed 66/11 kV in Dagoretti substation project. Alternatives examined during the study are discussed hereby;

8.2 Alternative Designs
The cost of a proposed substation project such as this is substantial, resulting in detailed research and development being put into the design of the components of the substation construction. The current design for the 66/11 kV substation and its components at Dagoretti is regarded as the most cost effective whilst operationally sound for such a project.

8.3 Strategic Alternatives
Strategic alternatives to the construction of the Dagoretti Substation include the “do nothing” option, demand-side management, the construction of the proposed 66/11 kV in Dagoretti substation capacity. An overview of the strategic alternatives is outlined below.

8.3.1 The “Do Nothing” Option
The environmental experts states that the “do nothing” or “no-go” option should be considered in cases where the proposed development could have negative impacts. For this project, the no-development option would mean the proposed 66/11 kV in Dagoretti substation will not be constructed. The implications of this would be no additional security of quality electricity supply to the Dagoretti area and its environments. The low perceived level of impacts associated with the construction and high probability of mitigation of these lead to the conclusion that the “no-go” option would not be the most viable option in this instance, given the shortfalls in electricity supply and security of supply that need to be addressed.

8.3.2 Demand-side Management
Demand Side Management (DSM) is a function carried out by the electricity supply utility aimed at encouraging a reduction in the amount of electricity used at peak times. This is achieved by influencing customer usage to improve efficiency and reduce overall demand. These efforts are intended to produce a flat load duration
curve to ensure the most efficient use of installed network capacity. By reducing peak demand and shifting load from high load to low load periods, reductions in capital expenditure (for network capacity expansion) and operating costs can be achieved. One of the basic tools is the price differentiation (such as time-of-use tariffs) between peak demand time and low demand time. This option is practiced to a certain extent, but is currently not considered feasible for managing the level of growth forecast for Dagoretti area and its environments.

8.4 Alternative Site
Relocation option to a different site is an option available for the project implementation. The project proponent can look for alternative land. Looking for the land to accommodate the scale and size of the project and completing official transaction on it may take a long time although there is no guarantee that the land would be available. The developer will spend another one year on design and approvals since design and planning has to be according to site conditions. Project design and planning before the stage of implementation will cost the developer a large sum of money.

Assessment of the proposed site with an alternative site was considered in this study. In the assessment, land use, impacts and technical feasibility of the two were used to arrive to a viable alternative. The proposed site is industrial zone and is not located close to residential area. Using the criteria of zoning industrial land use, the consultants went further to examine the environmental impact of the project on the area.

8.5 Alternative Processes and Materials
The process materials that are consumed by the proposed project area, transformer oil for cooling the transformer and water for substation cleaning purposes. There is no alternative for transformer oil for transformer cooling and for substation cleaning water. So the task was to assess alternative water and transformer oil sources for the project. The study had four alternatives sources for substation cleaning water they include; piped Municipal water, groundwater and rainwater. Groundwater quality and recharge in the area is very poor, making it less viable for any firm to venture into groundwater extraction.

Surface water from streams and rivers is not a viable option for the substation as the area has no nearby river. But this would be costly and unfeasible for the proposed 66/11 kV substation. Tapping rainwater would also be an option but it would require the project proponent to have a large roof catchment surface which
is not the case. Nairobi City water supply thus is the only viable option for the project based on the steady supply and quantities that would not impact other water users. Another material input for the project that was assessed for sustainable alternative was fuel for running the generators.

The transformer oil helps cool the transformer, because it provides part of the electrical insulation between internal live parts, transformer oil must remain stable at high temperatures for an extended period. To improve cooling of large power transformers, the oil-filled tank may have external radiators through which the oil circulates by natural convection. Very large or high-power transformers (with capacities of thousands of KVA) may also have cooling fans, oil pumps, and even oil-to-water heat exchangers. Large, high voltage transformers undergo prolonged drying processes, using electrical self-heating, the application of a vacuum, or both to ensure that the transformer is completely free of water vapour before the cooling oil is introduced. This helps prevent corona formation and subsequent electrical breakdown under load. Oil filled transformers with a conservator (an oil tank above the transformer) tend to be equipped with Buchholz relays. These are safety devices that detect the build-up of gases (such as acetylene) inside the transformer (a side effect of corona or an electric arc in the windings) and switch off the transformer. Transformers without conservators are usually equipped with sudden pressure relays, which perform a similar function as the Buchholz relay.

8.6 Analysis of Alternative Construction Materials and Technology
The proposed 66/11 kV in Dagoretti substation will be constructed using modern, locally and internationally accepted materials to achieve public health, safety, security and environmental aesthetic requirements. Equipment that saves energy and water will be given first priority without compromising on cost or availability factors. The concrete pillars and walls will be made using locally sourced stones, cement, sand (washed and clean), metal bars and fittings that meet the Kenya Bureau of Standards requirements.

Beautiful and durable re-enforced concrete roofs with tile profile will be used because they are good in heat insulation as compared to the iron sheet roofs, and afford more security. This will ensure that the rainwater harvested will be used in the proposed 66/11 kV substation operations and landscaping. Heavy use of timber during construction is discouraged because of destruction of forests. The exotic
species would be preferred to indigenous species in the construction where need will arise.

**8.7 Solid waste management alternatives**
The proposed 66/11 kV in Dagoretti substation will generate some of solid wastes. The proponent will give priority to reduction at Source of the materials. This option will demand a solid waste management awareness programme in the management and the residents. Solid wastes shall be disposed off in a manner that is acceptable to NEMA and Environmental Regulations.
CHAPTER 9: ENVIRONMENTAL MANAGEMENT PLAN (EMP)

9.1 Significance of an EMP

Environmental Management Plan (EMP) for development projects provides a logical framework within which identified negative environmental impacts can be mitigated and monitored. In addition, the EMP assigns responsibilities of actions to various actors and provides a timeframe within which mitigation measures and monitoring can be done. EMP is a vital output of an Environmental Impact Assessment as it provides a checklist for project monitoring and evaluation. The EMP outlined below have addressed the identified potential negative impacts and mitigation measures of the proposed 66/11 kV in Dagoretti Substation during construction, operational, and decommissioning phases, based on the Chapters of Environmental Impacts and Mitigation Measures of the expected Negative Impacts.

9.2 Construction phase EMP

Environmental Management Plan for the construction phase is as shown on the Table 9.1.
Table 9.1: Environmental Management Plan during CONSTRUCTION PHASE of the proposed 66/11 kV in Dagoretti substation

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Minimize extraction site impacts and ensure efficient use of raw materials in construction</td>
<td>1. Source building materials from local suppliers who use environmentally friendly processes in their operations.</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>0</td>
</tr>
<tr>
<td>Demand of Raw material</td>
<td>2. Ensure accurate budgeting and estimation of actual construction material requirements to ensure that the least amount of material necessary is ordered.</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>5,000</td>
</tr>
<tr>
<td></td>
<td>3. Ensure that damage or loss of materials at the construction site is kept minimal through proper storage.</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>4. Use at least 5%-10% recycled, refurbished or salvaged materials to reduce the use of raw materials and divert material from landfills.</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>0</td>
</tr>
<tr>
<td>2. Minimize vegetation disturbance at and or around construction site</td>
<td>1. Ensure proper demarcation and delineation of the project area to be affected by construction works.</td>
<td>Contractor, Resident Project Manager</td>
<td>1 month</td>
<td>3,000</td>
</tr>
</tbody>
</table>
### Expected Negative Impacts

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. Specify locations for trailers and equipment, and areas of the site which should be kept free of traffic, equipment, and storage.</td>
<td>Civil Engineer and Resident Project Manager</td>
<td>1 month</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td>3. Designate access routes and parking within the site.</td>
<td>Civil Engineer and Resident Project Manager</td>
<td>1 month</td>
<td>5,000</td>
</tr>
<tr>
<td></td>
<td>4. Introduction of vegetation (trees, shrubs and grass) on open spaces and around the project site and their maintenance.</td>
<td>Architect &amp; Landscape specialist</td>
<td>Monthly to Annually</td>
<td>10,000</td>
</tr>
<tr>
<td></td>
<td>5. Design and implement an appropriate landscaping programme to help in re-vegetation of part of the project area after construction.</td>
<td>Architect &amp; Landscape specialist</td>
<td>2 months</td>
<td>10,000</td>
</tr>
</tbody>
</table>

### 3. Reduce storm-water, runoff and soil erosion

| Increased storm water, runoff and soil erosion | 1. Surface runoff and roof water shall be harvested and stored in tanks so that it can be used for cleaning purposes. | The Civil Engineer, Mechanical Engineer and Resident Project Manager | 2 months | 10,000 |
|                                               | 2. A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structure will be designed. | The Civil Engineer, Mechanical Engineer and Resident Project Manager | 1 month | 10,000 |
### Expected Negative Impacts

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3. Apply soil erosion control</td>
<td>The Civil Engineer,</td>
<td>1 months</td>
<td></td>
</tr>
<tr>
<td></td>
<td>measures such as levelling of</td>
<td>Mechanical Engineer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>the project site to reduce run-</td>
<td>Resident Project</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>off velocity and increase</td>
<td>Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>infiltration of storm water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>into the soil.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>4. Ensure that construction</td>
<td>Contractor</td>
<td>Throughout construction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>vehicles are restricted to use</td>
<td></td>
<td>period</td>
<td></td>
</tr>
<tr>
<td></td>
<td>existing graded roads.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Ensure that any compacted</td>
<td>Contractor</td>
<td>2 months</td>
<td></td>
</tr>
<tr>
<td></td>
<td>areas are ripped to reduce</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>run-off.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Site excavation works to be</td>
<td>Resident Project</td>
<td>Throughout construction</td>
<td>5,000 per unit</td>
</tr>
<tr>
<td></td>
<td>planned such that a section is</td>
<td>Manager</td>
<td>period</td>
<td></td>
</tr>
<tr>
<td></td>
<td>completed and rehabilitated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>before another section begins.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. Interconnected open drains</td>
<td>Civil Engineer</td>
<td>Throughout construction</td>
<td>5,000 per unit</td>
</tr>
<tr>
<td></td>
<td>will be provided on site.</td>
<td></td>
<td>period</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8. Roof catchments will be used</td>
<td>Civil Engineer</td>
<td>Throughout construction</td>
<td>5,000 per unit</td>
</tr>
<tr>
<td></td>
<td>to collect the storm water for</td>
<td></td>
<td>period</td>
<td></td>
</tr>
<tr>
<td></td>
<td>some substation uses.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9. Construction of water</td>
<td>Civil Engineer</td>
<td>Throughout construction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>storage tanks to collect storm</td>
<td></td>
<td>period</td>
<td></td>
</tr>
<tr>
<td></td>
<td>water for substation uses.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Minimize solid waste generation and ensure efficient solid waste management during construction
### Expected Negative Impacts

| Increased solid waste generation |

<table>
<thead>
<tr>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Use of an integrated solid waste management system i.e. through a hierarchy of options: Reduction at source 2. Recycling 3. Reusing 4. Incineration 5. Sanitary land filling.</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>10,000</td>
</tr>
<tr>
<td>2. Through accurate estimation of the dimensions and quantities of materials required.</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>One-off</td>
<td>0</td>
</tr>
<tr>
<td>3. Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>0</td>
</tr>
<tr>
<td>4. Provide facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>One-off</td>
<td>12,000</td>
</tr>
<tr>
<td>5. Use building materials that have minimal or no packaging to avoid the generation of excessive packaging waste</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>0</td>
</tr>
<tr>
<td>6. Reuse packaging materials such as cartons, cement bags, empty metal and plastic containers to reduce waste at site</td>
<td>Resident Project Manager, Mechanical Engineer &amp; Contractor</td>
<td>Throughout construction period</td>
<td>0</td>
</tr>
</tbody>
</table>
### Expected Negative Impacts

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7. Dispose waste more responsibly by contracting a registered waste handler who will dispose the wastes at designated sites or landfills only.</td>
<td>Resident Project Manager, Mechanical Engineer Contractor</td>
<td>Throughout construction period</td>
<td>10,000/month</td>
</tr>
<tr>
<td></td>
<td>8. Waste collection bins to be provided at designated points on site</td>
<td>Resident Project Manager, Mechanical Engineer Contractor</td>
<td>Throughout construction period</td>
<td>40,000</td>
</tr>
<tr>
<td>5. Air Pollution</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dust emission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Ensure strict enforcement of on-site speed limit regulations</td>
<td>Resident Manager Contractor</td>
<td>Throughout construction period</td>
<td>5,000</td>
</tr>
<tr>
<td></td>
<td>2. Avoid excavation works in extremely dry weathers</td>
<td>Resident Manager Contractor</td>
<td>Throughout construction period</td>
<td>30,000/month</td>
</tr>
<tr>
<td></td>
<td>3. Sprinkle water on graded access routes when necessary to reduce dust generation by construction vehicles</td>
<td>Resident Manager Contractor</td>
<td>Throughout construction period</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Personal Protective equipment to be provided to employees and worn</td>
<td>Resident Manager</td>
<td>Throughout construction period</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exhaust emission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Vehicle idling time shall be minimised</td>
<td>Resident Manager Contractor</td>
<td>Throughout construction period</td>
<td>0</td>
</tr>
</tbody>
</table>
### Proposed 66/11 kV Dagoretti Substation

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. Alternatively fuelled construction equipment shall be used where feasible equipment shall be properly maintained</td>
<td>Resident Manager Contractor</td>
<td>Project &amp; construction period</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>3. Sensitise truck drivers to avoid unnecessary running engines of stationary vehicles and to switch off engines whenever possible</td>
<td>Resident Manager Contractor</td>
<td>Project &amp; construction period</td>
<td>0</td>
</tr>
</tbody>
</table>

#### 7. Minimization of Noise and Vibration

<table>
<thead>
<tr>
<th>Noise and vibration</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Sensitise construction vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used.</td>
<td>Resident Manager Contractor</td>
<td>Project &amp; construction period</td>
<td>Routine site operation</td>
</tr>
<tr>
<td></td>
<td>2. Sensitise construction drivers to avoid running of vehicle engines or hooting</td>
<td>Resident Manager Contractor</td>
<td>Project &amp; construction period</td>
<td>Routine site operation</td>
</tr>
<tr>
<td></td>
<td>3. Ensure that construction machinery are kept in good condition to reduce noise generation</td>
<td>Resident Manager Contractor</td>
<td>Project &amp; construction period</td>
<td>10,000</td>
</tr>
<tr>
<td></td>
<td>4. Ensure that all generators and heavy duty equipment are insulated or placed in enclosures (containers) to minimize ambient noise levels.</td>
<td>Resident Manager Contractor</td>
<td>Project &amp; construction period</td>
<td></td>
</tr>
</tbody>
</table>
### Expected Negative Impacts

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5. Trees to be planted around the site to provide some buffer against noise propagation</td>
<td>Resident Manager &amp; foreman</td>
<td>Throughout construction period</td>
<td>4,000</td>
</tr>
<tr>
<td></td>
<td>6. The noisy construction works will entirely be planned to be during daytime when most of the neighbours will be at work.</td>
<td>Resident Manager &amp; foreman</td>
<td>Throughout construction period</td>
<td>0</td>
</tr>
</tbody>
</table>

### Minimization of Energy Consumption

<table>
<thead>
<tr>
<th>8 Minimization of Energy Consumption</th>
<th>Increased energy consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ensure electrical equipment, appliances and lights are switched off when not being used</td>
<td>Resident Manager &amp; Contractor</td>
</tr>
<tr>
<td>2. Install energy saving bulbs/tubes at all lighting points instead of incandescent bulbs which consume higher electric energy</td>
<td>Resident Manager &amp; Contractor</td>
</tr>
<tr>
<td>3. Plan well for transportation of materials to ensure that fossil fuels (diesel, transformer oil, petrol) are not consumed in excessive amounts</td>
<td>Resident Manager &amp; Contractor</td>
</tr>
<tr>
<td>4. Monitor energy use during construction and set targets for reduction of energy use.</td>
<td>Resident Manager &amp; Contractor</td>
</tr>
</tbody>
</table>

### Minimize water consumption and ensure more efficient and safe water use
### Expected Negative Impacts

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased Water Demand</td>
<td>1. Water to be brought in from the City Water and Sewerage Company</td>
<td>Mechanical Engineer and Resident Project Manager</td>
<td>Throughout construction period</td>
<td>5,000 per unit</td>
</tr>
<tr>
<td></td>
<td>2. Harness rainwater for office &amp; gardening</td>
<td>Mechanical Engineer and Resident Project Manager</td>
<td>Throughout construction period</td>
<td>5,000 per unit</td>
</tr>
<tr>
<td></td>
<td>3. Install water conserving taps that turn-off automatically when water is not being used</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>One-off</td>
<td>40% more than price of ordinary taps</td>
</tr>
<tr>
<td></td>
<td>5. Promote recycling and reuse of water as much as possible</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>2,000</td>
</tr>
<tr>
<td></td>
<td>6. Install a discharge meter at water outlets to determine and monitor total water usage</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>One-off</td>
<td>2,000</td>
</tr>
<tr>
<td></td>
<td>7. Promptly detect and repair of water pipe and tank leaks</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>1,000 per month</td>
</tr>
<tr>
<td></td>
<td>8. Sensitise construction workers to conserve water by avoiding unnecessary toilet flushing etc.</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td>9. Ensure taps are not running when not in use</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td>10. Minimize release of liquid effluent</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Responsible Party**
  - Mechanical Engineer and Resident Project Manager
  - Resident Project Manager & Contractor

- **Time Frame**
  - Throughout construction period
  - One-off

- **Cost (Ksh)**
  - 5,000 per unit
  - 40% more than price of ordinary taps
  - 2,000
  - 1,000 per month
  - 1,000
### Proposed 66/11 kV Dagoretti Substation

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
</table>
| Generation of wastewater               | 1. Provide means for handling sewage generated at the construction site  
2. Conduct regular checks for sewage pipe blockages or damages since such vices can lead to release of the effluent into the land and water bodies  
3. Monitor effluent quality regularly to ensure that the stipulated discharge rules and standards are not violated | Mechanical Engineer & Resident Project Manager         | One-off                          | 30,000     |
<p>| | | | | |
|                                        |                                                                                                                                                                                                                                      |                                                        |                                 |            |
|                                        | 11. Minimize occupational health and safety risks                                                                                                                                                                                  | Contractor                                             | During the construction period |            |
|                                        | Statutory Requirements                                                                                                                                                                                                              |                                                        |                                 |            |
|                                        | Ensure compliance with The OSHA (Building Operations and Works of Engineering Construction Rules), L.N. 40 of 1984                                                                                                                                                  | Developer                                              | One-off                          | 5,000      |
|                                        | 12. Minimize Oil Spills                                                                                                                                                                                                              |                                                        |                                 |            |</p>
<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil spills Hazards</td>
<td>Install oil trapping equipments in areas when there a likelihood of oil spillage such during the maintenance of construction facility. Soil in such an area will be well protected from contamination</td>
<td>Resident Project Manager</td>
<td>Continuous</td>
<td>50,000</td>
</tr>
</tbody>
</table>
9.3 Operational Phase EMP

The necessary objectives, activities, mitigation measures, and allocation of costs and responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts and maximization of positive impacts associated with the operational phase of proposed 66/11 kV in Dagoretti substation, are outlined in this section.

Table 9.2 below indicates the operational phase EMP.
### Table 9.3: Environmental management/monitoring Plan for the OPERATIONAL PHASE of the proposed 66/11 kV in Dagoretti substation

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid waste generation</td>
<td>2. Provide solid waste handling facilities such as rubbish bags and skips</td>
<td>Resident Project Manager</td>
<td>One-off</td>
<td>20,000</td>
</tr>
<tr>
<td></td>
<td>3. Ensure that solid wastes generated at the substation are regularly disposed of appropriately at authorised disposal sites</td>
<td>Resident Project Manager</td>
<td>Continuous</td>
<td>15,000/month</td>
</tr>
<tr>
<td></td>
<td>4. Ensure that wastes generated at the substation are efficiently managed through recycling, reuse and proper disposal procedures.</td>
<td>Resident Project Manager</td>
<td>Continuous</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5. A private company to be contracted to collect and dispose solid waste on regular intervals</td>
<td>Resident Project Manager</td>
<td>Continuous</td>
<td>30,000 per month</td>
</tr>
</tbody>
</table>
Proposed 66/11 kV Dagoretti Substation

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6. Install site smokeless incinerator</td>
<td>Resident Manager and contractor</td>
<td>During design and construction</td>
<td>To be determined</td>
</tr>
<tr>
<td></td>
<td><strong>2. Ensuring Efficient Liquid waste management</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Paving of substation surface to reduce spilled liquid waste from reaching sub-surface</td>
<td>Resident Manager Contractor</td>
<td>During construction</td>
<td>Part of construction cost</td>
</tr>
<tr>
<td></td>
<td>2. Install sludge treatment unit on site</td>
<td>Resident Manager Contractor</td>
<td>During construction</td>
<td>Part of construction cost</td>
</tr>
<tr>
<td></td>
<td>3. Install oil interceptor on site to separate oil and water</td>
<td>Resident Manager Contractor</td>
<td>During construction</td>
<td>Part of construction cost</td>
</tr>
<tr>
<td></td>
<td><strong>3. Minimise risks of sewage release into environment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Provide adequate and safe means of handling sewage generated at the substation</td>
<td>Resident Manager and Mechanical Engineer</td>
<td>One-off</td>
<td>40,000</td>
</tr>
<tr>
<td></td>
<td>2. Conduct regular inspections for sewage pipe blockages or damages and fix appropriately</td>
<td>Resident Manager and Mechanical Engineer</td>
<td>Continuous</td>
<td>500 per inspection</td>
</tr>
<tr>
<td></td>
<td>3. Ensure regular monitoring of the sewage discharged from the project to ensure that the stipulated sewage/effluent discharge rules and standards are not violated</td>
<td>Resident Manager and Mechanical Engineer</td>
<td>Continuous</td>
<td>500/parameter</td>
</tr>
</tbody>
</table>
### Proposed 66/11 kV Dagoretti Substation

#### Expected Negative Impacts

<table>
<thead>
<tr>
<th>High demand for energy</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Switch off electrical equipment, appliances and lights when not being used</td>
<td>Resident Manager</td>
<td>Project</td>
<td>Continuous</td>
</tr>
<tr>
<td></td>
<td>2. Install occupation sensing lighting at various locations such as storage areas which are not in use all the time</td>
<td>Resident Manager</td>
<td>Project &amp; Contractor</td>
<td>One-off</td>
</tr>
<tr>
<td></td>
<td>3. Install energy saving fluorescent tubes at all lighting points within the substation instead of bulbs which consume higher electric energy</td>
<td>Resident Manager</td>
<td>Project &amp; Occupants</td>
<td>One-off</td>
</tr>
<tr>
<td></td>
<td>4. Monitor energy use during the operation of the project and set targets for efficient energy use</td>
<td>Resident Manager</td>
<td>Project</td>
<td>Continuous</td>
</tr>
<tr>
<td></td>
<td>5. Sensitise the substation workers to use energy efficiently</td>
<td>Resident Manager</td>
<td>Project</td>
<td>Continuous</td>
</tr>
</tbody>
</table>

#### 5. Minimize water consumption and ensure more efficient and safe water use

<table>
<thead>
<tr>
<th>High water demand</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Promptly detect and repair of water pipe and tank leaks</td>
<td>Resident Manager</td>
<td>Project &amp; Mechanical Engineer</td>
<td>Continuous</td>
</tr>
</tbody>
</table>
### Proposed 66/11 kV Dagoretti Substation

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Substation workers to be sensitized on water conservation techniques.</td>
<td>Substation workers to be sensitized on water conservation techniques.</td>
<td>Resident Project Manager &amp; Mechanical Engineer</td>
<td>Continuous</td>
<td>500/month</td>
</tr>
<tr>
<td>3. Ensure taps are not running when not in use</td>
<td>Ensure taps are not running when not in use</td>
<td>Resident Project Manager &amp; Mechanical Engineer</td>
<td>Continuous</td>
<td>500/month</td>
</tr>
<tr>
<td>4. Install water conserving taps that turn-off when water is not being used</td>
<td>Install water conserving taps that turn-off when water is not being used</td>
<td>Resident Project Manager &amp; Mechanical Engineer</td>
<td>One-off</td>
<td>40% more than ordinary taps</td>
</tr>
<tr>
<td>5. Install a discharge meter at water outlets to determine and monitor total water usage</td>
<td>Install a discharge meter at water outlets to determine and monitor total water usage</td>
<td>Resident Project Manager &amp; Mechanical Engineer</td>
<td>One-off</td>
<td>2,000</td>
</tr>
<tr>
<td>6. Create water conservation awareness</td>
<td>Create water conservation awareness</td>
<td>Resident Project Manager &amp; Mechanical Engineer</td>
<td>Continuous</td>
<td>2,000</td>
</tr>
</tbody>
</table>

#### 6. Minimization of health and safety impacts

<table>
<thead>
<tr>
<th>Increased health and safety impacts</th>
<th>Minimization of health and safety impacts</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh) per month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implement all necessary measures to ensure health and safety of the substation workers and the general public during operation of the proposed 90MVA 220/60 kV substation as stipulated in the Occupational Safety and Health Act, 2007</td>
<td>Minimization of health and safety impacts</td>
<td>Resident Project Manager, Mechanical Engineer, &amp; Developer</td>
<td>Continuous</td>
<td>5,000</td>
</tr>
</tbody>
</table>

7. Ensure the general safety and security of the proposed 66/11kV substation and surrounding areas
### Increased general safety and security impacts

Ensure the general safety and security at all times by providing day and night security guards and adequate lighting within and around the premises.

- **Security Officer, Resident Project Manager & Police**
- **Security Officer**
- **Continuous**
- **10,000/month**

### Increased Pressure on Infrastructure

1. Coordinate with other planning goals and objectives for region
   - **Architect, Project Manager, and the Developer**
   - **Continuous**
   - **40,000**

2. Upgrade existing infrastructure and services, if and where feasible.
   - **Architect, Project Manager and the Developer**
   - **Continuous**

### Air Pollution

1. Suitable wet suppression techniques need to be utilized in all exposed areas
   - **Site Safety Officer**
   - **Continuous**

2. Enforce low speed limits for vehicles moving within the site
   - **Site Safety Officer**
   - **Continuous**
   - **20,000**

3. Ensure that the site is located away from such pollution sources
   - **Site Safety Officer**
   - **Continuous**

4. Use of transformer oil should have be sulphur free for the purpose of cooling the transformers
   - **Residents project manager**
   - **Continuous**
   - **5,000 per month**

### Minimization of fire risks

1. Installation of firefighting equipments
   - **Substation manager and contractors**
   - **Continuous**

2. Development of fire evaluation plan

3. Training of all staff in fire management

- **Substation manager and contractors**
- **Continuous**
- **100,000PA**
| 12. Worksite Safety and Health Hazards to employees | Ensure compliance with the Occupational Safety and Health Act (OSHA) 2007 provisions e.g. employees to be provided with appropriate PPE | Developer | One-off | 5,000 |
9.4 Decommissioning Phase EMP
In addition to the mitigation measures provided in the above two tables, it is necessary to outline some basic mitigation measures that will be required to be undertaken once all operational activities of the proposed 66/11 kV in Dagoretti substation have. The necessary objectives, mitigation measures, allocation of responsibilities, time frames and costs pertaining to prevention, minimization and monitoring of all potential impacts associated with the decommissioning and closure phase of the proposed 66/11 kV substation project are outlined in the Table 9.4.
Table 9.4: Environmental management/monitoring Plan for the DECOMMISSIONING PHASE of the proposed 66/11 kV in Dagoretti substation

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. All machinery, equipment, structures and partitions that will not be used for other purposes must be removed and recycled/reused as far as possible or they be taken to a licensed waste disposal site</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>One-off</td>
<td>0</td>
</tr>
<tr>
<td>Vegetation disturbance</td>
<td>1. Implement an appropriate re-vegetation programme to restore the site to its original status.</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>One-off</td>
<td>10,000</td>
</tr>
<tr>
<td></td>
<td>2. Consider use of indigenous plant species in re-vegetation</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>One-off</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>3. Trees should be planted at suitable locations so as to interrupt slight lines (screen planting), between the adjacent residential area and the development.</td>
<td>Resident Project Manager &amp; Contractor</td>
<td>Once-off</td>
<td>0</td>
</tr>
</tbody>
</table>
### 3. Minimization of Generation of Dust

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
</table>
| Generation of dust                        | 1. Watering all active demolition areas as and when necessary to lay dust.  
|                                           | 2. Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard.  
|                                           | 3. Pave, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at demolition sites. | Resident Project Manager & Contractor  | During Decommissioning    | To be determined |

### 4. Reduction of Noise and Vibrations

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
</table>
| Increase noise and vibration              | 1. Install portable barriers to shield compressors and other small stationary equipment where necessary.  
|                                           | 2. Demolish mainly during the day. The time that most of the neighbours are out working.                                                                                                                                         | Resident Project Manager & Contractor  | During Decommissioning    | To be determined |
### Expected Negative Impacts

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3. Co-ordinate with relevant agencies regarding all substation construction activities in the residential areas.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 10. CONCLUSIONS AND RECOMMENDATIONS

10.1 Introduction

As a result of the ESIA findings, potentially environmental and social impacts have been identified. It is our recommendation that this project to go ahead and implemented since various environmental concerns that will result up due to this development will be mitigated as required.

10.2 General Mitigation and Intervention Measures

10.2.1 General Conclusions

- Mitigation of potential impacts (environmental and social) as described and implementation of the ESMP of this report will help to prevent or avert negative impacts, and enhance the positive outcomes of the project. This will help to achieve project sustainability.
- The responsibility for the incorporation of mitigation measures for the project implementation lies with the project engineer, who must ensure that the Contractor implements all specified mitigation measures.
- Community participation will be encouraged;

10.3 General Recommendations

Avoidance of negative environmental impacts should be the Proponent’s priority. Impacts can be avoided completely by a “no-project” alternative, but it should be recognized that even substations have impacts on their surrounding environment; these impacts can increase over time with economic growth and development, however their effect on the environment may be reduced by maintenance, rehabilitation, design and construction actions.

10.3.1 Mitigation

Mitigation is the lessening of negative environmental impacts through:

- Changes in the design, construction practices, maintenance, and operation of a project; and
- Additional actions taken to protect the biophysical and social environment, as well as individuals who have been impacted adversely by a project.

The extent and timing of mitigative actions should be based on the significance of the predicted impacts. Some aspects of impact mitigation can be incorporated into
Proposed 66/11 kV Dagoretti Substation

project design and can largely resolve the threat of impacts before construction commences.

However, many measures require an on-going implementation plan to ensure that proposed actions are carried out at the correct times, that environmental measures such as planting and slope protection are maintained, and that prompt remedial actions are taken when the initial measures are not fully successful.

Some measures may not be the exclusive domain of the Proponent; Government departments, local authorities, neighbouring communities, businesses, non-governmental organizations, and the legal system may all be involved in their design and implementation of these mitigation measures. Clear definition of responsibilities, funding, and reporting requirements can help to ensure the success of such measures.

10.3.2 Compliance Monitoring
During construction, all mitigative measures designed to reduce the impact of the construction activities should be monitored and enforced by the environmental monitoring authorities. This requires:

- Defining the proposed mitigative measures;
- Specifying who is responsible for the monitoring activity;
- Including implementation of mitigative measures in contract specifications;
- Making environmental competence one of the selection criteria for contractors; and briefing, educating, and training contractors in environmental protection methods.

Compliance monitoring should cover all sites affected by the project, including disposal sites, materials treatment areas, access roads, and site house among others.

10.3.3 Effects Monitoring (Evaluation)
After mitigative measures are implemented, effects monitoring or evaluation can test whether the objectives of environmental impact study were achieved by determing if the mitigative measures have achieved their expected results. Evaluation is necessary not only for individual projects, but also to advance methodology, assist in designing future studies, and through lessons learned -contribute to the relevance and cost-effectiveness of environmental protection measures. Responsibility for corrective action to be taken in the event of mitigation failure should be defined clearly within the Proponent’s organization.
10.3.3.1 Monitoring Guidelines
Continuous observations and assessment is essential for identification of impacts unforeseen during the EIA of the proposed substation project. To ensure success of the project adequate consultation should be undertaken in the project area with the community members.

Monitoring parameters/indicators should be identified and programmes developed for their observation and action. When developing a monitoring programme the following should be considered:

- Frequency of monitoring
- Required personnel - Monitoring should be conducted by trained personnel
- Methods of record keeping
- Availability of calibrated and maintained equipments
- Existence of baseline information
- Data analysis and review

The environmental indicators to be monitored during the project phases namely the construction; operation and decommissioning. The monitoring parameters can be revised as the project development proceeds to enable incorporate and foreseen indicators.
REFERENCES

1. Environmental Management and Co-ordination Act, 1999,
2. Environmental (Impact Assessment and Audit) Regulations, Kenya Gazette Notice No. 56 of 13th June 2003,
4. Building Code, 2000,
5. Local Government Regulations (1963),
6. The Way Leaves Act, Cap. 292,
7. The Physical Planning Act, Cap 286,
8. The Survey Act, Cap. 299,
9. The Water Act, 2002,
10. The Public Health Act, Cap. 242,
12. Environmental Assessment Source Book, 1999 (World Bank),
13. Environmental Assessment Requirements, A guide for UN-HABITAT Activities,
ANNEXES

Annex I: Minutes for the Stakeholder Consultative Meeting

Minutes of Public Consultative Meeting Held at deliverance church in Mutuini Location, Dagoretti Division, Nairobi west district.

Date: 16th August 2013
Venue: Dagoretti Church Compound Mutuini Location
Agenda: Public Consultation for Environmental Impact Assessment for proposed 66/11 kV Dagoretti substation and Associated Lines.

The meeting began by a word of prayer from one of the community members at 11 a.m. The Assistant chief (Mr. George Mukuria) of the area welcomed all in attendance and expressed the need for all the people to participate in the meeting. He then called upon the area chief to address the gathering and to welcome the KPLC EIA report to take over the programme and educate the public on the project. The area chief thanks the members of the public for their continuous participation in development agendas in the locations and for always attending consultative meetings. He told the gathering that the importance of embracing development from the GoK as it strive to meet the vision 2030 agenda. He inform the members of the public to take advantage of the youth and women fund to spur their economic growth by investing in profitable ventures including Jua kali off the power to be supplied will come in handy. He further challenged them to come up with fundable project proposals since the government is so much committed to development in the sub-county and county at large. He informed them that the meeting was called by Kenya power so that we can discuss and deliberate on the electricity reinforcement and supply in the area due to upcoming substation. The Chief then called on the EIA team to explain the agenda of the meeting in details.

Samuel Abaya explained the importance of EIA process and the role of consultations before construction decisions are made. He further explained the need for the project. Additionally, the environmentalist explained the positive impacts of the project including; increased supply of electricity, direct and indirect skilled and non-skilled employment opportunities, Improved security, enhance access to education, food hawking gains in the local and national economy, increase in government revenue, provision of market for supply of construction materials, informal sectors benefits among others. He further explained the negative impacts of the project such as dust, solid waste, noise, visual intrusion and aesthetic impacts, occupational health and safety impacts, social vices, public safety and stress on local infrastructure.
Roselyn Njeru and Pius Nyaga sensitized the community on issues of safety and health and he mainly touch base on the social impacts associated with project. He further stressed that the safety issues in regards to electricity along KPLC lines, upcoming substation and also in their houses. The socio-economist noted there have been several electrocution amongst the public due to vandalisms, poor wiring done by unqualified electricians, overloading in our homes, ignorance and carelessness in handling electrical equipment. He further noted that most of the negative impacts will occur during construction and are temporary. However, the proponent (KPLC) would provide mitigation measures for the negative impacts through and Environmental and social management plan.

Question and answer/suggestions session

**Question:** in case the line passes over my house what happens  
**Answer:** the house is valued and compensation done  
**Question:** Are we going to be supplied directly from the new incoming lines to be constructed with the substation?  
**Answer:** No. Power will be fed to the substation to be stepped down and then be distributed through the existing low voltage lines.  
**Question:** How sure are we that we shall get employment during construction?  
**Answer:** the contractors are under instruction to give unskilled and semi-skilled labour to the local people and if that doesn’t happen the matter should be raised through the provincial administration.  
**Question:** when is the project likely to start?  
**Answer:** Once NEMA approves and Licence is granted the project will kick of  
**Questions:** how will the locals benefit with the construction of the proposed substation?  
**Answer:** They will get casual employment during the construction phase of the project and the power of the area and its surrounding environment will stabalise.  
**Question:** if your property is destroyed because of electric power fault is going to be compensated  
**Answer:** investigation will be carried out first to ascertain the real cause of fire and if the power wiring was done by a qualify electrician certified by Kenya Power and if it is a genuine case it is going to be compensated  
**Question:** why do Kenya power does power bills estimates?  
**Answer:** Estimate is a times done when the meter readers cannot access your house meter but is always good to go with the meter readings to get the actual bills to avoid huge bills or overpayment.  
**Question:** what is the current power connection fees, is it still the same or it has increased
Answer: The connection fee has been reduced to Kshs.35,000 for the period of three months hence community members were encouraged to utilize the reduction of connection fee to connect their homes.

Question: a substation is a high risk area and people or children may be electrocuted

Answer: Kenya power is aware that a Substation is a high risk facility in terms of safety and that is why the company has proposed to construct a wall around it with razor wires on the top of the boundary wall to deter any access and a 24-hour security will be installed

The locals were in support of the project and assured maximum cooperation. They all welcome the project and said it should have started like yesterday

Having no other business the meeting ended at 1:45 pm with a word of prayer

The list of attendance is attached.
Annex 2: List of attendance

The Kenya Power and Lighting Company Limited intend to construct a Proposed Dagoretti 66/11kV Substation. The objective of the project is to reinforce and improve quality and reliability of power supply within Nairobi county and its environs.

DATE: \[\text{16th February 2013}\]  
VENUE: Deliverance Church 
Dagoretti market

**LIST OF ATTENDANCE:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Area/Location</th>
<th>ID No./Phone number</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Jeff Kimathi</td>
<td>Mutuini</td>
<td>0722748866/42517574</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Edwin Nyamu</td>
<td>Mitulaki</td>
<td>0776039720</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>George Onyango</td>
<td>Manyatta</td>
<td>0724406688</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>David Njoroge</td>
<td>Manyatta</td>
<td>0728600238</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Nengi Kamau</td>
<td>Manyatta</td>
<td>0726193298</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Grace Mochia</td>
<td>Ass. Chief</td>
<td>0722932371</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Simon Kang’ethe</td>
<td>Ass. Chief</td>
<td>0721386197</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Joseph Kanyigwa</td>
<td>Manyatta</td>
<td>0719614279</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Joseph Ndwiga</td>
<td>Manyatta</td>
<td>07833585</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Simon Ngila</td>
<td>Manyatta</td>
<td>0718459235</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Mwanda C mult.</td>
<td>Gichungo</td>
<td>0719467109</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Geoffrey Nyangika</td>
<td>Manyatta</td>
<td>0728235387</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Peter Mbugi</td>
<td>Manyatta</td>
<td>0720399189</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Jackson G Kariuki</td>
<td>Manyatta</td>
<td>0720146629</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>George Karwa</td>
<td>Manyatta</td>
<td>0723973268</td>
<td></td>
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<td>Kenya Power</td>
<td>0723581424</td>
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<td>17.</td>
<td>Josephine Njeri</td>
<td>Kenya Power</td>
<td>0720571017</td>
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<td>18.</td>
<td>Maua P. Mwangi</td>
<td>Mutuini</td>
<td>0720303377</td>
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<td>Edward Mwangi</td>
<td>Chief</td>
<td>0723209105</td>
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<tr>
<td>20.</td>
<td>Samuel Abata</td>
<td>UPLC</td>
<td>0723492692</td>
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Proposed 66/11 kV Dagoretti Substation

Annex 3: Meeting and project site photos.

Proposed site for the 66/11 kV substation

Environmental specialist addressing the public

The tarmacked road from Dagoretti to Karen which access the proposed substation.

The fence of the proposed substation site

The access road leading to the proposed substation site from the tarmack road

The children playing on the proposed site of the substation
The flyover for northern bypass which is next to the proposed substation site

The houses that are next to the proposed substation

Kikuyu forest which is opposite the substation

The road leading to the proposed project site
Annex 4: Copy of Land Title Deed

Title Deed

Title Number: DAGORETTI/MUTUINI/557
Approximate Area: 0.43 HA.
Registry Map Sheet No.: 3 & 4

This is to certify that

THE KENYA POWER AND LIGHTING COMPANY LIMITED, P.O. BOX 30099, NAIROBI

is (are) now registered as the absolute proprietor(s) of the land comprised in the above-mentioned title, subject to the entries in the register relating to the land and to such of the overriding interests set out in section 30 of the Registered Land Act as may for the time being subsist and affect the land.

GIVEN under my hand and the seal of the

NAIROBI District Land Registry

this 28TH day of SEPTEMBER 2012

P. Kibue
Land Registrar
## PART A—PROPERTY SECTION

<table>
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<tr>
<th>EDITION:</th>
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### REGISTRATION SECTION

**DAGORETTI/MUTUINI**

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<th>REGISTRY MAP SHEET NO.</th>
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## PART B—PROPRIETORSHIP SECTION

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<th>CONSIDERATION AND REMARKS</th>
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<td>28/09/2012</td>
<td>TITLE DEED</td>
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(To be completed only when the applicant has paid the fee of Sh. 125)

At the date stated on the front hereof, the following entries appeared in the register relating to the land:

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<th>EDITION:</th>
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</tbody>
</table>

[Signature]

Land Registrar
Title Deed

REPUBLIC OF KENYA

THE REGISTERED LAND ACT
(Chapter 300)

MLS/TD/02/A2/02  A NO 721253

OPK 2956-308a-11/2011
Proposed 66/11 kV Dagoretti Substation

Annex 5: Public and Stakeholders Questionnaires

ENVIRONMENTAL IMPACT ASSESSMENT

Public Consultation Questionnaire for Proposed Dagoreti 66/11KV substation.

The Kenya Power and Lighting Company Limited intend to construct a Dagoreti 66/11KV substation in Nairobi County. The objective of the project is to reinforce and improve quality and reliability of power supply within Nairobi and its environs.

Please respond to the following questions in relation to the proposed project.

1. What benefits do you expect from the construction and operation of Proposed Dagoreti 66/11KV substation (FAIDA)

2. What Negative Environmental impacts do you expect from the proposed project? (MADHARA)

3. What actions should be taken to minimize /reduce the above negative impacts? (JINSI YA KUZUJA AU KUPUNGUZA MADHARA)

4. Do you support the proposed project? Yes ........../No....... (Tick as appropriate)

If NO give reasons

Name of Respondent ........................................ Signature ........................................
ID. Number: .................................................... Telephone No. 0724440668
Location: ........................................................ Date 16th Aug 2013
Proposed 66/11 kV Dagoretti Substation

ENVIRONMENTAL IMPACT ASSESSMENT

Public Consultation Questionnaire for Proposed Dagoreti 66/11KV substation.

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2. What Negative Environmental Impacts do you expect from the proposed project? (MADHARA)
   
3. What actions should be taken to minimize/reduce the above negative impacts? (JINSI YA KUZUIA AU KUPUNGUZA MADHARA)
   
4. Do you support the proposed project? Yes./No. (Tick as appropriate)
   
   If NO give reasons

Name of Respondent: DAVID AIDUUGU

ID. Number: 8539740

Location: MUUU-11H

Signature: 

Telephone No.: 0770806025

Date: 16/05/2013
ENVIROMENTAL IMPACT ASSESSMENT

Public Consultation Questionnaire for Proposed Dagoreti 66/11KV substation.

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3. What actions should be taken to minimize /reduce the above negative impacts? (JINSI YA KIZUJA AU KUPUNGUZA MADHARA)

4. Do you support the proposed project? Yes !/No....... (Tick as appropriate)

   If NO give reasons

Name of Respondent... ___________________________ Signature ______________

ID. Number... ___________________________ Telephone No. ______________

Location... ___________________________ Date... 16/8/2013
ENVIRONMENTAL IMPACT ASSESSMENT

Public Consultation Questionnaire for Proposed Dagoreti 66/11KV substation.

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4. Do you support the proposed project? Yes ......../No...... (Tick as appropriate)

If NO give reasons

Name of Respondent: ........................................ Signature: ........................................

ID. Number: ............................................... Telephone No. ........................................

Location: .................................................. Date: ...............................................
ENVIRONMENTAL IMPACT ASSESSMENT

Public Consultation Questionnaire for Proposed Dagoreti 66/11KV substation.

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Please respond to the following questions in relation to the proposed project.

1. What benefits do you expect from the construction and operation of Proposed Dagoreti 66/11KV substation (FAIDA)
   - Not too much black out
   - Improves the overall quality of life

2. What Negative Environmental Impacts do you expect from the proposed project? (MADHARA)
   - Construction will bring dust, noise, entry into our children through love or friend ship

3. What actions should be taken to minimize /reduce the above negative impacts? (JINSI YA KUZUJA AU KUPUNGUZA MADHARA)
   - We be together, the Kenya power and the narrating citizens, proper drain age to the baseline proposed by the city council

4. Do you support the proposed project? Yes / No (Tick as appropriate)
   - If NO give reasons

Name of Respondent: George K. Njenga
ID. Number: 0274431
Location: Mutuini
Signature: George K. Njenga
Telephone No. 0728973769
Date: 1/6/2013
ENVIRONMENTAL IMPACT ASSESSMENT

Public Consultation Questionnaire for Proposed Dagoreti 66/11KV substation.

The Kenya Power and Lighting Company Limited intend to construct a Dagoreti 66/11KV substation in Nairobi County. The objective of the project is to reinforce and improve quality and reliability of power supply within Nairobi and its environs.

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3. What actions should be taken to minimize /reduce the above negative impacts? (JINSI YA KUZUJA AU KUPUNGUZA MADHARA)

4. Do you support the proposed project? Yes /No (Tick as appropriate)

If NO give reasons

Name of Respondent: GEOFFREY Njunga
ID Number: 5454237
Location: MUGA-NR

Signature: [Signature]
Telephone No: 07/23735137
Date: 16/8/2013
ENVIRONMNTAL IMPACT ASSESSMENT

Public Consultation Questionnaire for Proposed Dagoreti 66/11KV substation.

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Please respond to the following questions in relation to the proposed project.

1. What benefits do you expect from the construction and operation of Proposed Dagoreti 66/11KV substation (FAIDA)

   ![Positive Response]

2. What Negative Environmental Impacts do you expect from the proposed project? (MADHARA)

   ![None Response]

3. What actions should be taken to minimize /reduce the above negative impacts? (JINSI YA KUZUIJA AU KUPUNGUZA MADHARA)

   ![Cautious Response]

4. Do you support the proposed project? Yes [ ]/No [ ] (Tick as appropriate)

   If NO give reasons

   ![Reasons]

Name of Respondent: [ ] [ ] Signature: [ ]

ID. Number: [ ] [ ] Telephone No.: [ ]

Location: [ ] [ ] Date: [ ] [ ]
ENVIROMENTAL IMPACT ASSESSMENT

Public Consultation Questionnaire for Proposed Dagoreti 66/11KV substation.

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2. What Negative Environmental impacts do you expect from the proposed project? (MADHARA).

3. What actions should be taken to minimize /reduce the above negative impacts? (JINSI YA KUZUJA AY KUPUNGUZA MADHARA).

4. Do you support the proposed project? Yes/No (Tick as appropriate)

Name of Respondent: Wanjiru Grace
ID Number: 84720273
Location: Mutuini

Signature: [Signature]
Telephone No: 0722928827
Date: 16-8-2013
ENVIRONMENTAL IMPACT ASSESSMENT

Public Consultation Questionnaire for Proposed Dagoreti 66/11KV substation.

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4. Do you support the proposed project? Yes /No (Tick as appropriate)

If NO give reasons

Name of Respondent:.................. Signature:..........................

ID. Number:.................. Telephone No. ...........

Location:.................. Date:...............

20007983
0721665755
Mukuru
ENVIRONMENTAL IMPACT ASSESSMENT

Public Consultation Questionnaire for Proposed Dagoreti 66/11KV substation.

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3. What actions should be taken to minimize /reduce the above negative impacts? (JINSI YA KUZUIJA AU KUPUNGUZA MADHARA)

4. Do you support the proposed project? Yes /No

Name of Respondent: SIMON MWAMUA
ID. Number: 0374046
Location: MUTHU-INYI
Phone: 0715459255
Date: 16-8-13

Signature: 

ENVIRONMENTAL IMPACT ASSESSMENT

Public Consultation Questionnaire for Proposed Dagoreti 66/11KV substation.

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3. What actions should be taken to minimize /reduce the above negative impacts? (JINSI YA KUZUJA AU KUPUNGUZA MADHARA)

4. Do you support the proposed project? Yes ......../No....... (Tick as appropriate)

If NO give reasons

Name of Respondent: .................................................................
ID. Number: .................................................................
Location: .................................................................
Signature: .................................................................
Telephone No.: .................................................................
Date: .................................................................
ENVIRONMENTAL IMPACT ASSESSMENT

Public Consultation Questionnaire for Proposed Dagoreti 66/11KV substation.

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4. Do you support the proposed project? Yes ☑/No.... (Tick as appropriate)

   If NO give reasons

Name of Respondent: ___________________________  Signature: ___________________________

ID. Number: 1024421S  Telephone No. 0720 302333

Location: MUTUKU  Date: 16th Aug 2013
Proposed 66/11 kV Dagoretti Substation

ENVIRONMENTAL IMPACT ASSESSMENT

Public Consultation Questionnaire for Proposed Dagoretti 66/11KV substation.

The Kenya Power and Lighting Company Limited intend to construct a Dagoreti 66/11KV substation in Nairobi County. The objective of the project is to reinforce and improve quality and reliability of power supply within Nairobi and its environs.

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3. What actions should be taken to minimize /reduce the above negative impacts? (JINSI YA KUZUIJA AU KUPUNGUZA MADHARA)

4. Do you support the proposed project? Yes √/No....... (Tick as appropriate)

If NO give reasons

Name of Respondent: ____________________________
ID. Number: __________________________________
Location: ____________________________

Signature: ____________________________
Telephone No.: ____________________________
Date: ____________________________
ENVIRONMENTAL IMPACT ASSESSMENT

Public Consultation Questionnaire for Proposed Dagoreti 66/11KV substation.

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Please respond to the following questions in relation to the proposed project.

1. What benefits do you expect from the construction and operation of Proposed Dagoreti 66/11KV substation (FAIDA)

   - project site near to power can be reliable
   - ..........................................................
   - ..........................................................

2. What Negative Environmental impacts do you expect from the proposed project? (MADHARA)

   - effects on wildlife who will be playing
   - ................................................................
   - ................................................................

3. What actions should be taken to minimize /reduce the above negative impacts? (JINSI YA KUZUJA ALI KUPUNGUZA MADHARA)

   - promote issues on the site
   - what is to take to address
   - ................................................................
   - ................................................................

4. Do you support the proposed project? Yes /No

   - ..........................................................
   - ..........................................................
   - ..........................................................
   - ..........................................................

   (Tick as appropriate)

   If NO give reasons
   - ..........................................................
   - ..........................................................
   - ..........................................................
   - ..........................................................

Name of Respondent: James Ambote

ID. Number: 0333 585

Location: Mutoloki Mangatta

Signature: ...........................................

Telephone No. 0729471967

Date: 16/8/2013
ENVIRONMENTAL IMPACT ASSESSMENT

Public Consultation Questionnaire for Proposed Dagoreti 66/11KV substation.

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   ...

2. What Negative Environmental Impacts do you expect from the proposed project? (MADHARA)
   None

3. What actions should be taken to minimize / reduce the above negative impacts? (JINSI YA KUZUIJA AU KUPUNGUZA MADHARA)

4. Do you support the proposed project? Yes / No (Tick as appropriate)
   Yes

Name of Respondent: .................................................. Signature: ..................................................
ID. Number: .................................................. Telephone No. ..................................................
Location: .................................................. Date: ..................................................
ENVIRONMENTAL IMPACT ASSESSMENT

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3. What actions should be taken to minimize /reduce the above negative impacts? (JINSI YA KUZUJA AU KUPUNGUZA MADHARA)

4. Do you support the proposed project? Yes □ No □ (Tick as appropriate)

If NO give reasons

__________________________
__________________________

Name of Respondent

ID. Number: 684968

Location:

Signature: 67 2044 46 88

Telephone No.

Date: 16-8-2013
Annex 6: Expert practising license

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

THE ENVIRONMENTAL MANAGEMENT AND COORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT / AUDIT (EIA / EA) PRACTICING LICENSE

M/S SAMUEL GETARO ABAYA

Address: P.O BOX 35822-00200

NAIROBI

is licensed to practice in the capacity of a (Lead Expert / Associate Expert / Firm of Experts)

 LEAD

in accordance with the provisions of the Environmental Management and Coordination Act, 1999

Dated this 08TH FEBRUARY 13

Signature

(Seal)

Director General

The National Environment Management Authority

CONDITIONS OF LICENSE

1. This license expires on 31st December of the year it is issued.
2. The expert shall comply with the code of practice and professional Ethics for EIA/EA experts.
3. The expert shall comply with the attached conditions.

P.T.O.