ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED MUMIAS-RANGALA-KISUMU 132KV TRAMISSION LINE

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Otieno Odongo & Partners Consulting Engineers a registered firm of experts by the National Environment Management Authority, confirm that the contents of this report are a true representation of the Environmental and Social Impact Assessment of the proposed Mumias – Rangala - Kisumu 132 kV Transmission Line

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EXECUTIVE SUMMARY

Introduction

The Government of Kenya plans to increase access to electricity in Kenya tenfold from the current 4% in the rural areas to about 40% by 2020. To achieve this, the transmission lines network are being considered for construction and upgrading which will have the communication system required for line protection and management purposes. The Kenya Power and Lighting Company Limited (KPLC) least cost power development plan identified various 132 KV developments for improving the performance of the national grid network to cater for the increasing load growth and meet the objectives of 2030. KPLC is planning to construct a new single circuit 132 kV transmission line from Mumias Sugar Company through Rangala to Kisumu Mamboleo substation Power Transmission, comprising the following:

- 132 kV line Mumias – Rangala - Kisumu, 97 km

The proposed line will serve the Rangala, Kisumu and its surrounding environment. The Kenya Government policy on all new projects requires that an Environmental and Social Impact Assessment (ESIA) study be carried out at the project planning phase in order to ensure that significant impacts on the environment are taken into consideration at the construction, operations and decommissioning stages. Otieno Odongo & Partners Consulting Engineers (OOP) was contracted by KPLC to carry out an Environmental and Social Impact Assessment (ESIA) and Resettlement Action Plan (RAP) for the proposed 132kV transmission line.

Scope of Study

The project in its entirity comprises of feasibility studies for the Energy Access Scale-Up Program to include initial system studies of the KPLC transmission system; metering system; previous studies and data collection; and the load forecast. Transmission system planning and an economic and financial analysis was also carried out, as well as cost estimates and justification and the establishment of ranking and performance targets. This study covers the 132kV Transmission Line from Mumias – Rangala - Kisumu.

Study Objectives

The main objective of KPLC is to construct a 132kV electricity transmission line from the Mumias sugar company through Rangala to Kisumu Mamboleo substation in order to meet the increasing demand for electricity in Kisumu city and its surrounding

environments while attaining the objectives of vision 2030. The specific objectives of this project include the following;

- Identify and assess all potential environmental and social impacts of the proposed project;
- Identify all potential significant adverse environmental and social impacts of the project and recommend measures for mitigation;
- Verify compliance with the environmental regulations and relevant standards;
- Identify problems (non-conformity) and recommend measures to improve the environmental management system;
- Generate baseline data that will be used to monitor and evaluate the mitigation measures implemented during the project cycle;
- Recommend cost effective measures to be used to mitigate against the anticipated negative impacts;
- Prepare an Environmental Impact Assessment Report compliant to the Environmental Management and Coordination Act (1999) and the Environmental (Impact Assessment and Audit) Regulations (2003), detailing findings and recommendations.
- Identify and quantify different categories of project affected people (PAPs) who would require some form of assistance, compensation, rehabilitation or relocation.
- Provide guidelines to stakeholders participating in the mitigation of adverse social impacts of the project.
- Verify the adherence and compliance of the World Bank's safeguard policies.

Otieno Odongo & Partners Consulting Engineers (OOP) was assigned by The Kenya Power& Lighting Company Limited to conduct an Environmental and Social Impact Assessment (ESIA) study for the proposed 132kV transmission line from Mumias – Rangala - Kisumu. This is in compliance with the legal requirements stipulated in the Environmental Management and Coordination Act of 1999 and its subsequent Legal supplements that require a proponent of a proposed project to assign a Lead expert or Firm of Expert to undertake an ESIA study.

The objective of this E&SIA study is to evaluate the potential environmental and social impacts of the proposed project and develop mitigation measures that aim at minimizing the negative impacts of the project while optimizing the positive impacts. The ESIA study findings cumulated into this ESIA report and a RAP document produced as a separate report.

KPLC's main function in the energy sector is to transmit, distribute and retail electricity to the end users. The electric power is sourced from power generating companies such as the Kenya Electricity Generating Power Company (KENGEN) a governmental body and Independent Power Producers such as the AGGRECO, Uganda Electricity Transmission Company (UETCL) located in Uganda among others.

Project Objective and Justification

According to the Least Coast Power Development Plan, KPLC customer base is expected to grow by 200,000 connections every year creating an annual demand growth of about 150 MW. The national economic growths have also been on the upward trend rising from 1.8% in 2003 to 5.8% in 2005. Significant effects of this growth are notable in agriculture, tourism and construction among others with a corresponding increase in power generation that rose from 4,852 GWh in 2003 (with sales of 3,801 GWh) to 5,195 GWh in 2004 (sales of 4,090 GWh). Maximum energy demand was projected at 5,641 GWh in 2006 and 24,957 GWh by year 2026. This overview gives a strong justification for the proposed Mumias – Rangala – Kisumu 132 Kv transmission line. However, environmental and social implications as outlined under this report will give a detailed of environmental and social impact assessment and their integrated into the project design.

The main objective of KPLC is to construct a 132kV electricity transmission line from the Mumias Sugar Company through Rangala to Kisumu Mamboleo substation in order to meet the increasing demand for electricity in the project area while attaining the objectives of vision 2030.

The Objective of undertaking the ESIA study is to:

- Identify and assess potential environmental and social impacts of the proposed project;
- Identify all potential significant adverse environmental and social impacts of the proposed project and recommend measures for mitigation measures;
- Verify compliance with the environmental regulations and industry's standards;
- Generate baseline data for monitoring and evaluation of how well the mitigation measures will be implemented during the project cycle;
- Recommend cost effective measures to be implemented to mitigate against the expected impacts;
- Prepare an Environmental Impact Assessment Report compliant to the Environmental Management and Coordination Act (1999) and detailing findings and recommendations;

- Identify and quantify different categories of project-affected people (PAPs) who would require some form of assistance, compensation, rehabilitation or relocation; and
- To provide guidelines to stakeholders participating in the mitigation of adverse social impacts of the project

The ESIA objectives were met by the team of experts while undertaking the study and during documentation of the findings.

Project Description

The proposed project is part of the project proponent's energy access scale-up program, which has the following objectives:

- Extending the transmission of new 132 kV line from Mumias – Rangala – Kisumu as well as new and reinforced transmission lines with the aim of reducing technical losses and improving voltage conditions, thereby coping with additional demand.
- Increasing access to electricity to 20% by 2010 by accelerating connection rates;
- Voltage upgrading to increase supply capacity and reduce system losses;
- Provide alternative electricity supply paths to increase reliability and improve power quality in the regions.

Currently electricity is accessible to less than 20% of the total population and approximately 5% of rural population. The Government's goal is to accelerate access rate to 20% of rural population by 2010 and to at least 40% by 2020. To achieve this goal, Government has prepared the Energy Scale up Program covering the period 2008 to 2017. This would be approached not only from improvement and expansion of the network, but also on raising the generation to match the demand. A main criterion when concluding on the adopted conceptual design has been to ensure that the transmission line is designed in a safe, cost effective and reliable manner. This study provides the project proponent with considerations on the environmental and social impacts of the project as proposed.

The proposed project involves construction of approximately ninety seven kilometers (97 km) stretch of a high voltage transmission line from Mumias – Rangala – Kisumu. The proposed transmission line will traverses through six districts namely Mumias, Ugenya, Gem, Emukhaya, Kisumu West and Kisumu East districts as shown on the way leave map under (Annex1). The installation of the proposed line will require a way leave of about 60m throughout its stretch. The proposed way leave will be expropriated from the community members as no public land exists in the project area to meet the

requirements of the proposed project. The area of land to be acquired from the community members' measures about 582 hectares (1455acreas).

The electricity to be transmitted will originate from the Mumias Sugar Company which generates its power from sugarcane baggase. The project development will include installation of components such as pylons/steel towers, dumpers, conductors, optical fibre, and circuit breakers among others. The project equipments to be used during construction will include crow bars, spanners and ropes, mixer, vibrators, compressors and drills. These equipments will depend on manpower, batteries or fossil fuels to power them.

Approach

The approach to this exercise was structured such as to cover the requirements under the EMCA 1999, the EIA Regulations as stipulated under the Gazette Notice No. 56 of 13th June 2003, and the World Bank Safeguard Policies. 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 areas, public consultations with members of the community in the project areas, survey, photography, and discussions with the Proponent.

Methodology

Environmental Screening: In screening the Consultant set out to confirm whether or not this project falls within a category that requires EIA prior to commencement. In addition, other considerations during the screening process included a preliminary assessment of the environmental sensitivity of the areas along the proposed transmission line route; this comprised of a desktop study involving the analysis of project maps and proposed line route, as well as literature review of previous studies along the proposed project.

It was determined that infrastructure development activities (such as the development of the proposed power transmission line) are listed under Schedule 2 of EMCA, 1999 among projects requiring an EIA study. The project proponent has therefore commissioned this study in line with the provisions of EMCA, 1999.

Environmental Scoping: The screening exercise helped to narrow down the most critical environmental and social issues requiring detailed evaluation. Below are the key activities that were undertaken during the study:

- Consultations with the Proponent and regarding the proposed project details, the site planning and implementation plan,

- Desk review of available documentation on t he project,
- Thorough field investigations along the proposed line route, photography, surveys, informal and discussions with people from the immediate neighbourhood.
- A participatory rapid assessment method using tools including literature review, questionnaires, observation, geographical positioning system device (GPS), and in-depth interviews as well as public consultative meetings were used as follows:
- 225 household interviews were conducted along the project corridor
- In-depth interviews were held with district heads of departments, provincial administration, NGOs, CBOs and Faith based Organizations.
- Evaluation of the project setting and baseline conditions;
- Consultative Public Participation in Kipkaren, Kamagut, Soy, Mukunga, Moi Bridge, Waitaluk and Kibomet
- Analysis of the potential impacts of the proposed project on the biophysical and socio cultural/ economic environment;
- Formulation of appropriate mitigation measures and development of an environmental and social management plan, monitoring plan, and guidelines for capacity building in environmental and social management;
- Report writing;
- Submission of Project Report to NEMA;

Study Team

As required by the Environmental Regulations (2003), this ESIA study was conducted by a NEMA-registered 'Firm of Experts' – Otieno Odongo & Partners Consulting Engineers. NEMA Reg. No. 0033. The team had the following professionals:

- Lead EIA Experts (Environmental Scientists)
- Electrical Engineer
- Occupational Health and Safety Expert
- Ecologist/Natural Resource Expert
- Sociologist/Socio-Economist.
- Surveyors

Policy, Legal and Regulatory Framework

The Environmental Management and Co-ordination Act 1999, is the legislation that governs EIA studies in Kenya. This project falls under the Second Schedule of EMCA 1999, which lists the type of projects that are required to undergo EIA studies in accordance with Section 58 (1- 4) of the Act. Various other key national laws that govern the management of environmental resources in the country have been discussed in the report. This study is also based on internationally respected procedures recommended by the World Bank, covering environmental guidelines. Reference has been made to the

World Bank Safeguard Policies and Environmental Assessment Source Book Volume II, which provide relevant sectoral guidelines.

Study Findings

Land Use: The site walk assessment and surveys indicated that, the proposed transmission line traverse about 97km of land currently under different land uses. The major land use traversed by the proposed line is privately owned agricultural land. Other land uses along the project area included private and governmental institutions, schools, trading centers, public infrastructure and industrial use among other uses. It was noted that the individuals with large parcels of lands including agricultural land can still be put their land under the same purpose or other project friendly purposes after the installation of the transmission line.

Sensitive biological environmental: Environmental receptors identified within the project area during the site visits included wetlands (rivers, steams and springs) and wild animals (hippopotamus, crocodiles and kingfisher resident birds). Site walks revealed that the project impacts on the sensitive environment will be minimum as they could be avoided or mitigated against during the construction phase. No forest reserves were seen in the project area apart from small scale private forests and individual trees on private farms.

Public Consultations: The consultants held discussions with several stakeholders including the head of departments in the districts, the district administration and the community members. The objectives of the discussions were to collect the stakeholders' views on the proposed project. The discussions evaluated in depth the proposed project sites, the project impacts and mitigation measures for the project impacts. The general response of the stakeholders was that the proposed project is good for the economic development of the area. Despite that, they also gave their opinion on issues they would like to be mitigated against in order to ensure sustainability of the project. The issues requiring consideration according to the stakeholders included land expropriation and compensation; re vegetation of the project area, prevention of soil erosion and rehabilitation/reinstallation of public amenities affected by the project. It was noted that issues of land expropriation will need special attention in Kongony sub-location in Kisumu East district as the community members had just been relocated to create space for the development of the new Kisumu airport which is currently under construction.

Increased Development

During the study, it was noted that the project areas is fast developing especially the first 24kms between the substation and Maseno town. The area was seen to be attracting

several developers both private home owners and institutions. The area has also been earmarked for several roads projects by the Ministry of Roads (MoR), the Kenya Civil Aviation (KCA) and the Kenya Airports Authority (KAA). The KCA has also proposed to develop a flight communication centre within the area near Riat Market in the vicinity of the proposed power line way leave.

Flight Path:-The study also found out that a flight path for planes landing at Kisumu airport is located in East Kisumu location between Kanyakwar and Kogony sub-locations.

Alternative project routes: According to the field survey, about 65-70% of the selected route for the transmission line was within farm land and the remaining 35% was in settlement or trading areas. Despite the fact that the line passed through farmland, it is likely to lead to a significant number of displacement and relocation of PAPs as the areas were seen to be densely populated. It was also noted that the route avoided sensitive environmental receptors as much as possible examples are Lake Victoria and Kisian Hills. Despite the afore-mentioned, the field observation and public consultation indicated that some project sections will require re-routing and these sections were:

Areas with high valued development: - It was noted that the project will traverse high valued houses on plot 1257 in Lureko village in South Wanga Division in Mumias. The land owners stated that the total property on the plot is valued at over 50 million and would be expensive to replace in addition the land owners stated that the line cuts through the family homestead which will lead to separation of the family. The property is neighboured by Lureko Secondary and Primary School. It was suggested that the line be re-aligned to pass after the secondary school on undeveloped land with a plantation of few eucalyptus trees.

Trading Centres-Community members who own plots number 747, 2885, 2802, 2801, 421 and 422 (Sheet 15 Cadastral map Mumias-Rangala in Lureko) also suggested that the line be re-routed to plot 2081 away from their business facilities found on plot 421.

Flight Path:- It was recommended by KCA that the proposed power transmission line be diverted or buried underground to avoid the flight path found in Kisumu East location. The organization has also proposed to develop a communication centre for the new Kisumu airport located in the same area. The organization suggested that the proposed line be installed underground when traversing sections of Kogony sub-location. in order to reduce EMF interruption and impact on the centre's radio frequencies.

Potential Environmental Impacts Evaluation

The study team evaluated the anticipated potential and likely impacts of the project on the bio-physical and the socio-economic environment. The impacts were categorized as positive or negative and their level of effect on the environment were also gauged. In general the study findings indicated that the positive project impacts shall outweigh the negative impacts if the mitigation measures aimed at minimizing or eliminating the negative impacts are implemented. Below is an outline of the anticipated project impacts which have been categorized into either positive or negative. The impacts have further been grouped according to the phase in which they are likely to occur in the project's life cycle namely construction or operation phase.

Anticipated Positive Impacts during Construction

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

Anticipated Negative Impacts during Construction

- Increase in solid waste and effluent generation of
- Increase in fossil fuel consumption
- Increase in emissions ; for example, noise, Green House Gases (GHG)
- Risks of fossil fuel spills and leaks from project vehicles and equipments
- Increased exposure to risks and accidents
- Loss of incomes due to interference with socio-economic activities
- Loss of properties including land and housing
- Loss of vegetation including crops, shrubs, trees
- Relocation and separation of communities
- Degradation of cultural practices
- Increase in social vices and infectious disease including HIV/AIDS, STI's
- Increase in demand of materials including ballast, gravel among others

Anticipated Positive Impacts during Operation

- Application of Cleaner Development Mechanism/Cleaner Production Mechanism (CDM/CPM) at the electricity source thus will lead to reduced production of methane which will reduce generated GHG and, at the same time reduce amount of disposed waste and waste management cost for the Sugar Company.
- Creation of employment

- Increase in electricity supply
- Development of the project area for example opening of industries, increase in ICT use among others
- Provision of cleaner sources of energy to the Kenyan market thus shall lead to improved micro-climate and, consequently improve in health, increased food security and rejuvenation of water catchment areas.

Anticipated Negative Impacts during Operation

- Increased exposure to Electromagnetic fields (EMF)
- Impacts on resident birds
- Risks of fire
- Electromagnetic interference with radio telecommunications systems
- Corona effect/Noise (Humming) and Ozone Emissions
- Reduced source of energy for locals in Mumias who depend on baggase as wood fuel for domestic need.

Proposed Mitigation Measures

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

Socio-Economic Mitigation

- Work within the acquired way leave in order to reduce spillover effects of the project to surrounding community member's property and existing social facilities;
- work in collaboration with relevant government representative in the project area;
- Develop appropriate benefits for non-beneficiary community members residing in the project area. Benefits to include energy supply to existing substations; installation of transformers; employment by giving locals priority in terms of job allocations especially for activities requiring non-skilled labour; incorporate community members as shareholders of the KPLC among other possible benefits. It is recommended that the proponent consider project benefits that the community members can appreciate.
- Compensate land and property owners for acquired land and/or measurable disturbance; route the line to avoid community property that they consider to be very costly so as to reduce the compensation cost. Institute developed

resettlement action plan (RAP) and communicate project plans in acceptable time frame to majority of the stakeholders;

- Institute developed resettlement action plan (RAP) and communicate project plans in acceptable time frame to all stakeholders;
- Conduct workshops at community level to facilitate impact monitoring on the environment, socio-economic and socio-cultural aspects;
- Enhance security in project area through community policing in collaboration with local community members;
- Develop information education and communication (IEC) programmes on the projects social impacts and train community members to conduct awareness and training programmes with the help of the project team; and
- Develop programmes to enhance cohesion between project employees and the local communities for example development of sports activities.

Environment, Health and Safety Mitigation and EMF

- Avoid developing within the flight paths and areas with high EMF or Radio Frequencies (RF) for example near the proposed flight communication centre.
- Employ trained and certified workers to install, maintain and repair electrical equipment;
- Employ trained and qualified machine handlers and drivers;
- Ensure work concerning handling of live wires is conducted by trained workers with strict adherence to safety standards;
- Avoid developing in areas of weak soil structure such as river riparian;
- Develop safety programmes to reduce wildlife attacks by the hippopotamus, crocodiles and snakes when working in vicinity of their habitats or breeding sites;
- Ensure strict access and controls to the electricity power lines and enforce way leave requirements for power lines;
- Deactivate and ensure live power distribution lines are properly grounded before maintenance work commences;
- Ensure that structures are tested for integrity prior to commencing work; and
- Implement fall protection programmes that include training in climbing techniques and the use of fall protection measures.

Bio-Physical Mitigation Measures

Avian collision and Electrocution

- Install lines in horizontal circuit as opposed to vertical circuit;
- Maintaining a 1.5 meter spacing between energized components and grounded hardware;

- Install visibility enhancement objects such as marker balls, bird deterrents or diverters; and
- Schedule maintenance activities to avoid nesting sessions.

Wildlife, Vegetation and Soils

- Control soil erosion through timely clearing of excavations from project area; develop erosion control structure and excavate new areas only after finishing work at opened segments among other measures; and
- Develop afforestation programmes in collaboration with the community members;
- Avoid interfering with wildlife habitats and breeding sites.

Air Quality and Aquatic Environment

- Use clean fuels or catalytic convertors for project vehicles and equipments dependent on fossil fuels;
- Create awareness among drivers and machine operators on practices aimed at reducing emissions;
- Avoiding clearing in riparian areas and developing on them;
- Avoid interfering with aquatic wildlife habitats and breeding sites;
- Avoid using machinery in the vicinity of watercourses;
- Observe manufacturer machinery and equipment guidelines, procedures with regard to noise as well as oil spill prevention and emergency response;
- Use technological measures during installation to abate against corona effect during operation. Technological measures to implement during construction include; observation of the recommended distance between conductors; use of dampers to reduce vibration among other measures.

Environmental Management and Monitoring Plan

The consultants have developed an Environmental Management and Monitoring Plan (EM&MP) to guide the project team in eliminating or reducing the project impacts to acceptable minimum/ standards. The EM&MP is based on good environmental practices of project implementation and safety of the operations. The proposed EM&MP can be improved through continuous monitoring and audits during project implementation. The plan is provided in a matrix form under chapter 7 of this report and it identifies the anticipated impact; proposes measures to be undertaken; states monitoring indicators; states the party to implement the measures or control the indicators and states the estimated cost likely to be incurred to undertake the measures.

Conclusions and Recommendations

The consulting team's opinion is that the project is important for the economic development of the area and for its success; the proponent is advised to balance environmental and, social considerations and benefits through implementation of the proposed mitigation measures. It is recommended that preventive measures be given first consideration in order to reduce costs of undertaking the mitigation measures and at the same time reduce the overall project impacts. It is also recommended that, the project impacts be continuously monitored, and the monitoring results be documented, analyzed and reviewed against recommended standards to enable take appropriate action in good time.

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LIST OF ABBREVIATIONS

Abbreviation	Description
ASAL	Arid and Semi Arid Lands
ASL	Above Sea Level
BP	Bank Procedure
BOD	Biological Oxygen Demand
BOQ	Bill of Quantities
CAC	Catchment Area Committee
CBO	Community Based Organisation
CO_2	Carbon Dioxide
CTC	Child-to-Child
DCO	District Children's Officer
DC&SO	District Culture and Social Officer
D.O	District Officer
DEO	District Environment Officer
EA	Environmental Assessment
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Co-ordination Act
EMF	Electromagnetic Field
EMC	Electromagnetic Capability
EMS	Environmental Management System
ERC	Electricity Regulatory Commission
E&SMMP	Environmental and Social Management and Monitoring Plan
GHG	Green House Gases
HIV/AIDS	Human Immuno-Deficiency Virus/Acquired Immune Deficiency Syndrome
IBA	Important Bird Area
IEC	Information Education and Communication
IP	Indigenous People
IPM	Integrated Pest Management
IPP	Indigenous Peoples Plan
ISO	International Standards Organisation
IVM	Integrated Vector Management
Ha	Hectares
KENHA	Kenya National Highway Authority
KFS	Kenya Forestry Services
KOFC	Kenya Ordinance Factory Corporation
KPLC	Kenya Power and Lighting Company
KCC	Kitale County Council

Abbreviation	Description
KP	Kenya Police
Kshs.	Kenya Shillings
KWS	Kenya Wildlife Services
Km	Kilometre
LA	Local Authority
LO	Labour Officer
M	Metres
MoH	Ministry of Health
MoL	Ministry of Labour
MoR	Ministry of Roads
NEMA	National Environment Management Authority
NGO	Non-Governmental Organisations
9KR	Nine Kenya Rifles
NO	Nitrogen monoxide
NZOWASCO	Nzoia Water and Sewerage Company
OHS	Occupational Health and Safety
OHSO	Occupational Health and Safety Officer
PC	Public Consultation
PD	Public Disclosure
PH	Public Health
PIA	Project Implementing Agent
RAP	Resettlement Action Pan
RO	Road Officer
RTS	Recruitment Training School
RSC	Resettlement Steering Committee
SA	Social Assessment
TO	Traffic Officer
TOR	Terms of Reference
UNEP	United Nations Environment Programme
USD	United States of America Dollars
VAT	Value Added Tax
VCT	Voluntary Counseling and Testing
WHO	World Health Organization
WRMA	Water Resources Management Authority
LVNWSB	Lake Victoria North Water Service Board
WSP	Water Service Provider

LIST OF TABLES

CHAPTER 1 INTRODUCTION

1.1 Project Background

Kenya Power and Lighting Company Limited (KPLC), also referred to as the project proponent, is a limited liability company responsible for the transmission, distribution and retail of electricity throughout Kenya. The Proponent owns and operates the national transmission and distribution grid, and as at June 2009 was retailing electricity to approximately 1,262,309 customers throughout the nation. The Proponent proposes to construct and operate approximately 97 Km of single circuit 132 kV transmission line between Mumias – Rangala – Kisumu, comprising the following:

- 132 kV line Mumias – Rangala – Kisumu, 97 km

The registered office and contact addresses of the Proponent are:
Kenya Power and Lighting Company
Stima Plaza, Kolobot Road
P. O. Box 30099
00100 – NAIROBI.
Tel. 254 20 3201000
E-mail: jguda@kplc.co.ke

The Government of Kenya plans to increase access to electricity in Kenya tenfold from the current 4% in the rural areas to about 40% by 2020. To do this, the transmission lines network is being considered for construction and upgrading with the communication system required for line protection and management purposes.

The generating system in Kenya consists of hydropower as well as thermal power plants, in total 1,197 MW installed capacity. The largest power plant is Gitaru hydropower plant with an installed capacity at 225 MW (as at the end of FY 2007). The transmission system voltage as of June 2007 consisted of 1,323 km 220 kV and 2,122 km 132 kV. Almost all the 220 kV and 132 KV lines are single circuit lines with the conductor Goat at 220 kV and Wolf or Lynx for more than 50 % of the 132 kV lines. Kenya is today interconnected with Uganda through a 132 kV double circuit line. (Norconsult AS, August 2009).

The KPLC least cost power development plan identified various 132 KV developments for improving the performance of the national grid network to cater for the increasing load growth and meet the objectives of 2030. To meet this objective KPLC intends to construct a single circuit 132KV transmission line from Mumias – Rangala – Kisumu. The proposed transmission line offers an opportunity to expand the dedicated

telecommunications network so as to offer enhanced protection of the lines and upgrade the communication system. (Norconsult AS, August 2009)

1.2 Institutional Arrangements

Kenya's Power Sector falls under the ministry of Energy, which offers the general oversight and policy direction. The Kenyan interconnected power transmission and distribution network is owned and operated by KPLC. The Energy Regulatory Commission (ERC) is an independent body responsible for the Regulatory function of the energy sector. The Kenya Electricity Generation Company Limited (KenGen) provides 85% of the electricity generated in Kenya.

KPLC is responsible for electricity transmission, distribution and supply to customers. KPLC purchases bulk power through power purchase agreements with KenGen, Independent Power Producers (IPPs) and the Uganda Electricity Transmission Company (UETCL). The interconnected system has an installed capacity of 1310MW comprising 737MW hydro, 115MW geothermal. 0.4 MW wind and 443 MW thermal and 30MW non-firm import from Uganda. The effective capacity or the interconnected system is about 1,134MW; while the highest peak attained to date is 1071MW. KenGen has an installed interconnected capacity of 1,006MW while the IPPs have 295MW. The Contract with UETCL is for purchase of 30MW on a non-firm basis. Seven isolated mini-grids are supplied by small Power plants with a total of 9.4MW. Consumption in the year ending June 30, 2008 was 6.385 GWh. (Norconsult AS, August 2009)

1.3 ESIA Study

The Kenya Government policy on all new projects requires that an Environmental and Social Impact Assessment (ESIA) study be carried out at the project planning phase in order to ensure that significant impacts on the environment are taken into consideration at the construction and operations stages.

Otieno Odongo & Partners Consulting Engineers, also referred to as the Consultant, was contracted by KPLC to carry out an Environmental and Social Impact Assessment (ESIA) and Resettlement Action Plan (RAP) for the proposed 132kV transmission line. The goal of this assignment is to ensure that any potentially adverse environmental and social impacts can be minimized to the extent feasible, and the positive impacts can be enhanced. The RAP exercise on the other hand will set out the framework for policies, principles, institutional arrangements, schedules, and other indicative budgets to facilitate any resettlement process that will be necessitated as a result of this project.

The ESIA assignment has been implemented in accordance with the requirements or the Environment Management and Coordination Act (1999) of Kenya and the Environmental Impact Assessment and Audit Regulations of Kenya (2003). The study also incorporates The World Bank Safeguard Policy guidelines. The Consultant shall seek to obtain approval of this Project Report from the National Environment Management Authority (NEMA). The Terms of Reference for carrying out the ESIA and RAP studies provided detailed information on the scope of the studies and the expected outputs.

1.4 Study Objectives

The broad objective of this assessment was to identify potential environment and social impacts of the project and formulate recommendations to ensure that the proposed development takes into consideration appropriate measures to mitigate/minimize any adverse impacts through all phases of its implementation.

The assessment was undertaken in compliance with the Environmental Management and Coordination Act (EMCA) 1999 and also the Environmental (Impact Assessment and Audit) Regulations under the Kenya Gazette Supplement No. 56 of 13th June, 2003.

The specific objectives of this ESIA are to:

- Identify and assess all potential environmental and social impacts of the proposed project;
- Identify all potential significant adverse environmental and social impacts of the project and recommend measures for mitigation;
- Verify compliance with the environmental regulations and relevant standards;
- Identify problems (non-conformity) and recommend measures to improve the environmental management system;
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- Recommend cost effective measures to be used to mitigate against the anticipated negative impacts;
- Prepare an Environmental Impact Assessment Report compliant to the Environmental Management and Coordination Act (1999) and the Environmental (Impact Assessment and Audit) Regulations (2003), detailing findings and recommendations.
- Identify and quantify different categories of project affected people (PAPs) who would require some form of assistance, compensation, rehabilitation or relocation.
- Provide guidelines to stakeholders participating in the mitigation of adverse social impacts of the project.

- Verify the adherence and compliance of the World Bank's safeguard policies.

1.5 Scope of the Study

The project in its entirity comprises of feasibility studies for the Energy Access Scale-Up Program to include initial system studies of the KPLC transmission system; metering system; previous studies and data collection; and the load forecast. Transmission system planning and an economic and financial analysis was also carried out, as well as cost estimates and justification and the establishment of ranking and performance targets. This study covers the 132kV Transmission Line from Mumias – Rangala – Kisumu.

The study has been structured such as to cover the requirements under the EMCA 1999, the EIA Regulations as stipulated under the Gazette Notice No. 56 of 13th June 2003. The study also takes into consideration the World Bank Safeguard Policies, specifically: OP 4.01 Environmental Assessment; OP 4.04 Natural Habitats; OP 4.10 Indigenous Peoples; OP 4.11 Physical Resources; OP 4.12 Involuntary Resettlements; OP 4.36 Forests; OP 4.37 Safety of Dams; OP 7.50 International Waterways; and OP 7.60 Projects in Disputed Areas.

1.6 Study Approach

The approach to this exercise was structured such as to cover the requirements under the EMCA 1999, the EIA Regulations as stipulated under the Gazette Notice No. 56 of 13th June 2003, and the World Bank Safeguard Policies. 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 project site areas, desktop studies, public consultations with members of the community in the project areas, survey, photography, and discussions with the project Proponent.

1.7 Study Methodology

1.7.1 Environmental Screening:

In screening the Consultant set out to confirm whether or not this project falls within a category that requires EIA prior to commencement. In addition, other considerations during the screening process included a preliminary assessment of the environmental sensitivity of the areas along the proposed transmission line route; this comprised of a desk study involving the analysis of project maps and proposed line route, as well as literature review of previous studies on the proposed project. It was determined that infrastructure development activities (such as the development of the proposed power transmission line) are listed under Schedule 2 of EMCA, 1999 among projects requiring

an EIA study. The project proponent therefore commissioned this study in line with the provisions of EMCA, 1999.

The consultants used screening, scoping and detail analysis methodology for the ESIA study. The approach and methodology applied during the study enabled collection of both primary and secondary data. The consultant used both qualitative and quantitative methods to obtain the primary data. Qualitative data was obtained through filed visits/site walks, photography, and stakeholders' consultation while quantitative data was obtained through the use of predefined questionnaires.

The key activities undertaken during the assessment included the following:

- Consultations with the key project stakeholder including the project proponent, community members, administrative authority, opinion leader and district departmental heads. The consultations were based on the proposed project, site planning and the project implementation plan;
- Physical inspections of the proposed project area which included observation of available land marks, photography and interviews with the local residents;
- Evaluation of the activities around the project site and the environmental setting of the wider area through physical observations and literature review;
- Review of available project documents; and
- Report writing, review and submissions.

1.8 Data collection tools and equipments

Several data collection tools were used to document available data during the study these included use of checklists, photography, geographical positioning systems (GPS), questionnaires and computers among others. All data collected were analyzed for production of the ESIA report. Samples of the questionnaires used during the study are provided under Annex of this report.

The main steps undertaken to meet the objective of the study were as follows:

Step 1: Environmental Screening

Screening of the project was undertaken to evaluate the need of conducting an EIA study and the level of study. The screening stage was concluded based on the requirements of the second schedule of EMCA which requires transmission lines to undergo an EIA study.

Step 2: Environmental Scoping

The project scoping stage which followed the screening stage was applied to narrow down the project issues to that requiring detail analysis. The process involved conducting discussions with the proponent on the project issues and, collection of primary and secondary data. The primary data was collected through the qualitative and quantitative methods of data collection. Qualitative data was collected through filed visits/site walks, public and stakeholders consultation while quantitative data was collected through the use of sampled questionnaires. The secondary data was collected through literature review which included study of the following documents:

- Policies, Acts and Regulations;
- District Development Plans;
- Project area topographical and cadastral maps;
- Previous project study documents; and
- Literature materials on project including those on IBA, Plant Species, Culture, Power Project Installation and Management among other project parameters.

Step 3: Desk study

Desktop studies were conducted through review of secondary data to establish the following:

- Legal Policies, Legislative and Institutional Framework governing the proposed project;
- Licenses and permits requirements and conditions;
- Project area baseline information including documented sensitive environmental receptors;
- Types of waste to be generated, proposed management and disposal methods; and
- Potential positive and negative impacts.

The secondary data was obtained by reviewing several literature materials including:

- Policies, Acts and Regulations
- District Development Plans for Siaya District
- District Development Plan for Kisumu District
- District Development Plans for Mumias-Butere District
- District Development Plans for Vihiga District
- State of Environment for Siaya District
- State of Environment for Kisumu District
- State of Environment for Mumias-Butere District
- State of Environment for Vihiga District
- The Energy Scale-Up Programme Report, April 2009 by SMEC
- The Sectoral Environmental Impact Assessment Study, August 2009

- Project area cadastral and topographical maps

Step 4:-Field Assessment and baseline survey

Detailed field surveys for this study were the 7th October 2009 to 11th November 2009. This involved conducting systematic field traversing to quantify perceived undertaken within the proposed project area and its surrounding from impacts on:

- Land ownership, usage and conflicts;
- Vegetation cover of the area;
- Underground and surface waters;
- Waste management; and
- The general environment and its sensitive receptors found within the project area.

The EIA study experts traversed the whole project area and identified the status of the environment and socio-economic indicators which included the following:

- Baseline data on the bio-physical environment
- Socio-economic and cultural environment;
- Project Affected Persons (PAP) and Project Affected Households (PAH);
- The level of project impact on affected persons and the environment;
- The opinion of the stakeholders including the local communities and on the proposed project; and
- The project alternatives routes

Site walks also indicated that the proposed line will traverse areas of different land uses including agricultural land, schools, trading centres, public land owned by institutions, road reserves among other areas.

Step 5: Public Consultations

Detailed stakeholders consultations for this study were also undertaken from the 24th September to 7th October 2009. These consultations were conducted in the form of:

- Focus group discussions (FGDs):- FGD were conducted with men, women and the youth. The composition of the groups were determined after consultation with the Chiefs and Assistant Chiefs of the areas;
- key Informant Interviews and Semi-Structured Interviews:- These interviews were conducted with the District Officers (D.Os), Chiefs, Assistant Chiefs, Councilors and Village Elders;

- Open-ended and Pre-coded questionnaires: -These questionnaires were administered to target groups in order to obtain their views on the proposed project and its perceived impacts. The main target groups were the PAPs along the proposed transmission line way leave and to some extent the households surrounding the proposed project area. The PAPs were picked systematically for interviews with the aim of reaching up to 100% of those within a radius of 100m of the proposed line. The general public was also interviewed and this involved reaching communities members with property outside the way leave area through random sampling. The Chiefs and Assistant Chiefs gave the team an estimated number of households, names and the villages that were not reachable during the interview. The names of all those interviewed during the consultation are found under Annexes of this report.
- Public Barazas which were organized by the D.Os and Chiefs; and transect walks were also done to confirm the information from the discussions and observations were made on physical and environmental conditions. Minutes of the meeting held during the public forums is attached in this report too.

The main target groups were the PAPs along the proposed transmission line way leave and to some extent the households surrounding the proposed project area. The PAPs were picked systematically for interviews with the aim of reaching up to 100% of those within a radius of 100m of the proposed line. The general public was also interviewed and this involved reaching communities members with property outside the way leave area through random sampling. For those households which were on the proposed transmission line and were not reachable to be interviewed, the Chiefs and Assistant Chiefs gave the team an estimated number of households, names and the villages. The names of all those interviewed during the consultation are found under public consultation chapter of this report too.

Public Barazas which were organized by the D.Os and Chiefs; and transect walks were also done to confirm the information from the discussions and observations were made on physical and environmental conditions. In addition to constant briefing of the client, this environmental impact assessment project report was prepared. The contents were presented for submission to NEMA as required by law.

1.6 Scope and Content of Project

The E&SIA investigates and analyses the anticipated environmental impacts of the proposed development in line with the Environmental (Impact Assessment and Audit) regulations 2003 and in particular part II S 7(1) a-k.

The following information has been provided in the EIA report as a pre-requisite of the EIA Regulations:

- Nature of project;
- The location of the project including the physical area that may be affected by the project's activities;
- The activities that shall be undertaken during the project design, construction and operation phases;
- The materials and products to be used in the project and evaluation of the by-products generated;
- The potential project environmental impacts and, proposed mitigation measures to be undertaken during and after the project implementation; including consideration to safeguard the health and safety of the workers and the neighboring communities through prevention and management of possible accidents during the project cycle;
- The economic and social cultural impacts of the project on the local community and the nation in general; and
- The project budget.

All environmental and social issues related to the proposed project are considered separately and accordingly in compliance with the provision of the EMCA 1999, the Environmental (Impact assessment and Audit) Regulations 2003 and other pertinent regulations related to the project. The main objective of this report is to ensure that all the potential environmental and social impacts have been identified and workable mitigation measures proposed for adoption during project implementation.

CHAPTER 2 POLICY, LEGAL AND INSTITUTION FRAMEWORK

2.1 Introduction

According to the Kenya National Environment Action Plan (NEAP, 1994) the Government recognized the negative impacts on ecosystems emanating from economic and social development programmes that disregarded environmental sustainability. Following on this, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been accomplished or is in the process of development. The NEAP process introduced environmental assessments in the country culminating into the enactment of the Policy on Environment and Development under the Sessional Paper No. 6 of 1999.

An EIA is a legal requirement in Kenya for all development projects. The Environmental Management and Co-ordination Act 1999, is the legislation that governs EIA studies. This project falls under the Second Schedule that lists the type of projects that are required to undergo EIA studies in accordance with section 58 (1- 4) of the Act. Projects under the Second Schedule comprise those considered to pose potentially negative environmental impacts.

Kenyan law has made provisions for the establishment of the National Environment Management Authority (NEMA), which has the statutory mandate to supervise and co-ordinate all environmental activities. Policies and legislation highlighting the legal and administrative requirements pertinent to this study are presented below.

2.2 NATIONAL POLICY AND LEGAL FRAMEWORK

2.2.1 Policy

Kenya Government's environmental policy aims at integrating environmental aspects into national development plans. The broad objectives of the national environmental policy include:

- Optimal use of natural land and water resources in improving the quality of human environment
- Sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations
- Conservation and management of the natural resources of Kenya including air, water, land, flora and fauna

- Promotion of environmental conservation through the sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations
- Meeting national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.

2.2.2 Legal Framework

Application of national statutes and regulations on environmental conservation suggest that the Proponent has a legal duty and social responsibility to ensure that the proposed development be implemented without compromising the status of the environment, natural resources, public health and safety. This position enhances the importance of this environmental impact assessment for the proposed site to provide a benchmark for its sustainable operation.

Kenya has approximately 77 statutes that relate to environmental concerns. Environmental management activities were previously implemented through a variety of instruments such as policy statements and sectoral laws as well as through permits and licenses. Most of these statutes are sector-specific, covering issues such as public health, soil erosion, protected areas, endangered species, water rights and water quality, air quality, noise and vibration, cultural, historical, scientific and archaeological sites, land use, resettlement, etc.

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

2.2.3 The Environment Management and Co-ordination Act, 1999

Provides for the establishment of appropriate legal and institutional framework for the management of the environment and related matters. 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 an EIA license as appropriate. The approval process time frame for Project Reports is 45 days and for full EIA Study is 90 days.

This Project falls within Schedule 2 of EMCA 1999 and therefore requires an EIA. The Proponent has commissioned the environmental and social impact assessment study in compliance with the Act. The Proponent shall be required to commit to implementing the environmental management plan laid out in this report and any other conditions laid out by NEMA, prior to being issued an EIA license.

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

The Regulation provides the guidelines that have been established to govern the conduct of environmental assessments and environmental audits in Kenya. The guidelines require that the EIA study be conducted in accordance with the issues and general guidelines spelt out in the Second and Third schedules. These include coverage of the issues on schedule 2 (ecological, social, landscape, land use and water considerations) and general guidelines on schedule 3 (impacts and their sources, project details, national legislation, mitigation measures, a management plan and environmental auditing schedules and procedures.

This Report complies with the requirements of the Environmental Regulations in the coverage of environmental issues, project details, impacts, legislation, mitigation measures, management plans and procedures. The Proponent shall be required to commit to implementing the environmental management plan laid out in this report and any other conditions laid out by NEMA.

2.2.5 The Occupational Health and Safety Act, 2007

This is an Act of Parliament to provide for the safety, health and welfare of 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. The Act has the following functions among others:

- Secures safety and health for people legally in all workplaces by minimization of exposure of workers to hazards (gases, fumes & vapors, energies, dangerous machinery/equipment, temperatures, and biological agents) at their workplaces.
- Prevents employment of children in workplaces where their safety and health is at risk.
- Encourages entrepreneurs to set achievable safety targets for their enterprises.
- Promotes reporting of work-place accidents, dangerous occurrences and ill health with a view to finding out their causes and preventing of similar occurrences in future.
- Promotes creation of a safety culture at workplaces through education and training in occupational safety and health.

Failure to comply with the OSHA, 2007 attracts penalties of up to KES 300,000 or 3 months jail term or both or penalties of KES 1,000,000 or 12 months jail term or both for cases where death occurs and is in consequence of the employer

The report advices the Proponent on safety and health aspects, potential impacts, personnel responsible for implementation and monitoring, frequency of monitoring, and estimated cost, as a basic guideline for the management of Health and Safety issues in the proposed project.

2.2.6 Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009.

These Regulations determine that no person or activity shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise that annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. In determining whether noise is loud, unreasonable, unnecessary or unusual, the following factors may be considered:

- Time of the day;
- Proximity to residential area;
- Whether the noise is recurrent, intermittent or constant;
- The level and intensity of the noise;
- Whether the noise has been enhanced in level or range by any type of electronic or mechanical means; and,
- Whether the noise is subject to be controlled without unreasonable effort or expense to the person making the noise.

These regulations also relate noise to its vibrational effects and seek to ensure no harmful vibrations are caused by controlling the level of noise. Any person(s) intending to undertake activities in which noise suspected to be injurious or endangers the comfort, repose, health or safety of others and the environment must make an application to NEMA and acquire a license subject to payment of requisite fees and meeting the license conditions. Failure to comply with these regulations attracts a fine of KES 350,000 or 18 months jail term or both.

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

2.2.7 Draft Environmental Management and Coordination (Air Quality) Regulations, 2008

The objective of these Regulations is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. The general prohibitions state that no person shall cause the emission of air pollutants listed under First Schedule (Priority air pollutants) to exceed the ambient air quality levels as required stipulated under the provisions of the Seventh Schedule (Emission limits for controlled and non-controlled facilities) and Second Schedule (Ambient air quality tolerance limits).

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

2.2.8 The Water Act 2002

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

The project shall have no adverse impact on the local water supply during operations as there are no requirements for the installation of water supply and sanitation facilities on-site. Observation of the requirements of the act shall be observed by the Proponent especially during the construction phase.

2.2.9 The Lakes and Rivers Act Chapter 409 Laws of Kenya

This Act provides for protection of river, lakes and associated flora and fauna. The provisions of this Act may be applied in the management of the project.

The proposed project traverses through streams and the requirements of this Act shall be observed by the Proponent to ensure protection of such water bodies and associated flora and fauna.

2.2.10 The Wildlife Conservation and Management Act, Cap 376

This Act provides for the protection, conservation and management of wildlife in Kenya. The Act deals with areas declared as National Parks, under the Act. The Act controls activities within the park, which may lead to the disturbance of animals. Unauthorized entry, residence, burning, damage to objects of scientific interest, introduction of plants and animals and damage to structure are prohibited. The provisions of this Act should be applied in the management of the project. The proposed project has wildlife habitats on

River Nzoia in Mumais District and River Yala in Gem District. Crocodiles and impalas are animals found on Yala River while the hippopotamus and the kingfisher birds are found on Nzoia River. The project area was found to be outside the IBA

The Proponent shall implement the proposed measures in this document towards protection and conservation of wildlife in the project areas.

2.2.11 The Public Health Act (Cap. 242)

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

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

2.2.12 Waste Management Regulations (2006)

The Waste Management Regulations are meant to streamline the handling, transportation and disposal of various types of waste. The aim of the Waste Management Regulations is to protect human health and the environment. The regulations place emphasis on waste minimization, cleaner production and segregation of waste at source.

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

2.2.13 Physical Planning Act (Cap286)

The Act provides for the preparation and implementation of physical development plans and for related purposes. It gives provisions for the development of local physical development plan for guiding and coordinating development of infrastructure facilities and services within the area of authority of County, municipal and town council and for specific control of the use and development of land.

The site layout plan appended to this report shows the proposed route for the transmission line. The Proponent shall secure all mandatory approvals and permits as required by the law.

2.2.14 Occupiers Liability Act (Cap. 34)

Rules of Common Law regulates the duty which an occupier of 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.

The Proponent shall acquire Way leave along the transmission line corridor. The Proponent shall endeavor to ensure that the management of health and safety issues is of high priority during the operational phase of the project.

2.2.15 Way Leaves Act (Cap. 292)

The Act provides for certain undertakings to be constructed e.g. transmission lines, pipelines, canals, pathways etc., through, over or under any lands. This project is under the provision of the Act. Section 3 of the Act states that the Government may carry any works through, over or under any land whatsoever provided it shall not interfere with any existing building or structures of an ongoing activity.

In accordance with the Act (section 4), notice will be given before carrying out works with full description of the intended works and targeted place for inspection. Any damages caused by the works would then be compensated to the owner as per section.

2.2.16 Land Acquisition Act (Cap. 295)

This 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 things such as survey upon necessary authorization 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:

- Area of land acquired,
- The value of the property in the opinion of the Commissioner of land (after valuation),
- Amount of the compensation payable,
- Market value of the property,
- Damages sustained from the severance of the land parcel from the land,
- Damages to other property in the process of acquiring the said land parcel,
- Consequences of changing residence or place of business by the land owners,

- Damages from diminution of profits of the land acquired.

The Proponent has undertaken a survey and developed a Resettlement Action Plan (RAP) for those who will be affected by the proposed project. The Proponent shall adhere to the requirements of the Act in the implementation of land acquisition.

2.2.17 Public Roads and Roads of Access Act (Cap. 399)

Sections 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 land owners seeking permission to construct the respective roads.

During the construction phase of the project, access to the site areas will be required for the construction vehicles. Where existing roads do not exist, the Proponent shall seek permission from the appropriate authorities to create such access during the construction phase.

2.2.18 The Limitations of Actions Act (Cap. 22)

This Act provides for recognition of squatters and the conditions under which they would have rights for compensation for loss of land. If squatters have been in occupation of private land for over twelve (12) years, then they would have acquired rights as adverse possessors of that land as provided under the limitation of Actions Act, section 7.

The Proponent has undertaken a survey and developed a Resettlement Action Plan (RAP) for those who will be affected by the proposed project. The Proponent shall adhere to the requirements of the Act in dealing with any squatters that will be displaced by the proposed project.

2.2.19 The Registered Land Act Chapter 300 Laws of Kenya:

This Act provides for the absolute proprietorship over land (exclusive rights). Such land can be acquired by the state under the Land Acquisition Act in the project area.

The project traverses some areas with Registered Land. The Proponent shall comply with the provisions of the Act in the acquisition of Registered Land.

2.2.20 The Land Adjudication Act Chapter 95 Laws of Kenya

This Act provides for ascertainment of interests prior to land registrations under the Registered Land Act.

The Proponent has undertaken a survey and commissioned a Resettlement Action Plan (RAP) study which complies with the provisions of the Act. Public consultations have also been undertaken extensively in the affected project area

2.2.21 The Standards Act Cap 496

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

The Act contains various specifications touching on electrical products. The Proponent shall ensure that commodities and codes of practice utilized in the project adhere to the provisions of this Act.

2.2.22 The Antiquities and Monuments Act, 1983 Cap 215

The Act aim 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 of Kenya is the custodian of the country's cultural heritage, its principal mission being to collect, document, preserve and enhance knowledge, appreciation, management and the use of these resources for the benefit of Kenya and the world. Through the National Museums of Kenya many of these sites are protected by law by having them gazetted under the Act.

The report includes consultations held with the National Museums of Kenya to identify physical cultural resources that may be impacted by the implementation of the proposed project as well as the appropriate mitigation measures to protect such resources.

2.2.23 The Civil Aviation Act, Cap 394

Under this Act, the Kenya Civil Aviation Authority (KCAA) has to authorize and approve the height of the mast for the purpose of ensuring the safety of flying aircraft over the proposed project area.

The Proponent shall comply with the provisions of the Act in seeking authorization from KCAA for the installation of the lattice steel self-supporting towers along the transmission line route.

2.2.24 The Environmental Management and Co-Ordination (Conservation of Biological Diversity And Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006

The Act states that no person shall not engage in any activity that may have an adverse impact on any ecosystem, lead to the introduction of any exotic species, or lead to unsustainable use of natural resources, without an Environmental Impact Assessment License issued by the Authority under the Act.

The Proponent has commissioned this environmental assessment study and seeks to obtain an EIA License from the Authority (NEMA) in compliance with the Act; the environmental management plan included in this report provides guidelines for the mitigation of potentially adverse impacts on natural resources.

2.2.25 Environmental Management and Coordination (Controlled Substances) Regulation, 2007, Legal Notice No. 73

The Controlled Substances Regulations defines controlled substances and provides guidance on how to handle them. The regulations stipulate that controlled substances must be clearly labeled with among other words, "Controlled Substance-Not ozone friendly'') to indicate that the substance or product is harmful to the ozone layer. Advertisement of such substances must carry the words, "Warning: Contains chemical materials or substances that deplete or have the potential to deplete the ozone layer." Persons handling controlled substances are required to apply for a permit from NEMA.

Proponent will not use controlled substances in the operation of the project. Hazardous materials such as PCB based coolants will not be used in the transformers, capacitors, or other equipment.

2.2.26 Environmental Management and Coordination, Fossil Fuel Emission Control Regulation 2006

This Act deals with internal combustion engines, their emission standards, inspections etc.

The Proponent shall comply with the provisions of this Act. The environmental management plan included in this report provides guidelines on the management of air emissions from the combustion of petroleum products used.

2.2.27 Environmental Management and Coordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulation, 2009.

This Act applies to all wetlands in Kenya whether occurring in private or public land. It contains provisions for the utilization of wetland resources in a sustainable manner compatible with the continued presence of wetlands and their hydrological, ecological, social and economic functions and services.

The project traverses several rivers and streams. The Proponent shall comply with the provisions of the Act in protecting wetlands, preventing and controlling pollution and Siltation in rivers.

2.2.28 Local Authority Act (Cap. 265)

Under this act, the Local Authority is the custodian of Trust Land and has to authorized various sites where the lines could be passing.

The Proponent has commissioned a RAP study to identify such Trust Lands that may be affected by the construction of the transmission line. The Proponent shall comply with the provisions of the Act in seeking the required authorizations from the Local Authorities as stipulated in the Act.

2.2.29 Penal Code Act (Cap.63)

The Act 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 is dwelling or business premises in the neighbourhood or those passing along public way, commit 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/ minimization/ avoidance of adverse impacts arising from the project activities.

2.2.30 Energy Act, 2006

The Act prescribes the manner with which licenses shall be obtained for generating, transmitting and distributing electricity. The provisions of this Act apply to every person or body of persons importing, exporting, generating, transmitting, distributing, supplying or using electrical energy; importing, exporting, transporting, refining, storing and selling

petroleum or petroleum products; producing, transporting, distributing and supplying of any other form of energy, and to all works or apparatus for any or all of these purposes. The Act establishes an energy commission, which is expected to become the main policy maker and enforcer in the energy sector. This commission among other things shall be responsible for issuing all the different licenses in the energy sector.

2.3 ADMINISTRATIVE FRAMEWORK

2.3.1 The National Environment Council

The National Environmental Council (the Council) is responsible for policy formulation and directions for the purposes of the Act. The Council also sets national goals and objectives, and determines policies and priorities for the protection of the environment.

2.3.2 The National Environment Management Authority

The responsibility of the National Environmental Management Authority (NEMA) is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of government in the implementation of all policies relating to the environment.

2.3.3 The Standards and Enforcement Review Committee

In addition to NEMA, EMCA 1999 provides for the establishment and enforcement of environmental quality standards to be set by a technical committee of NEMA known as the Standards and Enforcement Review Committee (SERC). A work plan was set up by SERC to include committees to draw up standards; these include the following:

- Water Quality Regulations
- Waste Management Regulations
- Controlled Substances Regulations
- Conservation of Biological Diversity
- Noise Regulations
- [Draft] Air Pollution Regulations

2.3.4 The Provincial and District Environment Committees

The Provincial and District Environmental Committees also contribute to decentralized environmental management and enable the participation of local communities. These environmental committees consist of the following:

- Representatives from all the ministries;

- Representatives from local authorities within the province/district;
- Two representatives from NGOs involved in environmental management in the
- Province/district;
- A representative of each regional development authority in the province/ district.

2.3.5 The Public Complaints Committee

The Act (EMCA) has also established a Public Complaints Committee, which provides the administrative mechanism for addressing environmental harm. The Committee has the mandate to investigate complaints relating to environmental damage and degradation. Its members include representatives from the Law Society of Kenya, NGOs and the business community.

2.4 INTERNATIONAL ENVIRONMENTAL GUIDELINES

Kenya has ratified or acceded to numerous International treaties and conventions, as described below:

- Vienna Convention for the Protection of the Ozone Layer: Inter-governmental 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 assessments, 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 concentrations 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 (UN) Framework Convention on Climate Change, in which the developed nations agreed to limit their greenhouse gas emissions, relative to the levels emitted in 1990.

This EIA is also based on internationally respected procedures recommended by the World Bank, covering environmental guidelines. Reference has been made to the Environmental Assessment Operational Policy (OP) 4.01, and Environmental

Assessment Source Book Volume II, which provides the relevant sectoral guidelines as discussed below.

2.5 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)

2.5.1 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.

2.5.2 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 triggered by the proposed project as the project area has wildlife conservation areas along the River Yala and aquatic habitats on the same river and on River Nzoia. The line shall also traverse several areas with springs, rivers and streams though the field visits indicated that the project impact on them will be minimal. This is because it was seen that the lines will traverse over the wetlands and the proponent has proposed not to install pylons on the wetlands riparian.

2.5.3 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 have privately owned tree plantations along the proposed project alignment; It is advisable that the trees be preserved as much as possible as the sections neighbouring the trees are open land that can be used to re-align the route of the transmission line. If other project factors necessitate the harvesting of the trees, then it is recommended that rehabilitation programmes be developed.

2.5.4 Bank Safeguard Policy 4.09-Pest Management

This policy promotes the use of ecologically based biological or environmental pest management practices. The policy requires that procured pesticides should meet the WHO recommendations and not be among those on the restricted list of formulated products found in the WHO Classes IA and IB or Class II. This policy is not triggered since routine maintenance of project line will not involve the use of pesticides or agrochemical materials to control vegetation growth. In practice clearance of vegetation growth along way leave is done using mechanical methods especially slashing of grass.

2.5.5 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. The communities members likely to be affected by the project have suggested that such sites should be avoided as much as possible through consultations with individual home owners before project implementation to enable develop appropriate mitigation measures.

2.5.6 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 triggers resettlement and relocation in the project area especially for community members with small parcels of land. The scope of study included development of a Resettlement Action Plan (RAP) as an integral part of the EIA study in order to facilitate evaluates the project impacts holistically.

2.5.7 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 IP who identifies with the areas.

2.5.8 Bank Safeguard Policy 4.37-Safety of Dams

This policy aims to assure quality and, safety in the design and, construction of new dams and, the rehabilitation of existing dams and in carrying out activities that may be affected by an existing dam. This policy is not triggered as the alignment of the proposed project was seen to leave an existing dam about 200m to the South West. The local administration stated the dam has not been in use for over ten (10) years. It was seen the construction of the power line will not affect the dam as the area have vast sections of open land which can be acquired and used for line installation.

2.5.9 Bank Safeguard Policy 7.50-Project on International Waterways

This policy applies to the international waterways that forms boundaries or flows between two or more states that can be bank members or not. The policy lists projects that require its observation. The policy is not triggered by the project as the proposed project is not listed under sub-section 2 (a) of the OP as projects required to observe the safeguard policy. Despite that, the project will traverse across River Nzoia and Yala at some points; are tributaries of Lake Victoria a water body shared by several countries thus appropriate measures of conservation should be developed and implemented to reduce impacts of river siltation, destruction of aquatic habitats among other impacts.

2.5.10 Bank Safeguard Policy 7.50- Project in Disputed Areas

It is known that projects in disputed areas may raise a number of delicate problems affecting relation not only between the bank and its member countries, but also between the countries in which the project is carried out. In order to reduce this impact, it is recommended any dispute over area earmarked for project development should be dealt with at the earliest possible stage. This policy is not been triggered by the proposed project as the project areas are not shared by any other country to grant such disputes.

2.5.11 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 3: DESCRIPTION OF THE PROJECT

3.1 GENERAL

The electric power transmission system is often referred to as a grid. Redundant paths and lines are provided so that power can be routed from any generation facility to any customer area through a variety of routes, based on the economics of the transmission path and the cost of power. The redundant paths and lines also allow power flow to be rerouted during planned maintenance and outages due to weather or accidents.

Power transmission occurs via a system of aboveground power lines and towers located between a power plant and a substation. Transmission networks can cover thousands of kilometers and encompass tens of thousands of towers. For long distance transmission, electricity is usually transmitted at voltages between 110 and 1200 kV. Transmission towers or pylons are utilized to suspend high-voltage overhead power lines. These systems usually transmit three-phase electric power (the common method for transmission of high-voltage lines of over 50 kV) and, therefore, are designed to carry three (or multiples of three) conductors.

3.2 PROJECT OBJECTIVES

Power generated by KENGEN, IPPs and other smaller plants is sold to KPLC in bulk under a Power Purchase Agreement for distribution. The current transmission capacity comprises of 1,323 Km of 220 kV and 2,035 Km of 132 kV main transmission lines and also about 600 Km of 66 kV sub- transmission lines. The proposed project is part of the Proponent's energy access scale-up program, which has the following objectives:

- Extending the transmission and distribution lines and installation of new 132/33kV substations; as well as new and reinforced distribution lines with the aim of reducing technical losses and improving voltage conditions, thereby coping with additional demand.
- Increasing access to electricity to 20% by 2010 by accelerating connection rates;
- Voltage upgrading to increase supply capacity and reduce system losses;
- Providing alternative electricity supply paths to increase reliability and improve power quality in the regions.

3.3 PROJECT JUSTIFICATION

Currently electricity is accessible to less than 20% of the total population and approximately 5% of rural population. The Government's goal is to accelerate access rate to 20% of rural population by 2010 and to at least 40% by 2020. To achieve this

goal, Government has prepared the Energy Scale up Program covering the period 2008 to 2017. This would be approached not only from improvement and expansion of the network, but also on raising the generation to match the demand.

The KPLC customer base is expected to grow by 200,000 connections every year creating an annual demand growth of about 150 MW. The national economic growth has also been on the upward trend - rising from 1.8% in 2003 to 5.8% in 2005. Significant effects of this growth are notable in agriculture, tourism and construction among others with a corresponding increase in power generation that rose from 4,852GWh in 2003 (with sales of 3,801GWh) to 5,195GWh in 2004 (sales of 4,090GWh). Maximum energy demand was projected at 5,641GWh in 2006 and 24,957GWh by the year 2026 hence the proposed project.

3.4 DESIGN CONSIDERATIONS

The design criteria as adopted for the conceptual design are initially based on KPLC current practice, based on studies of recently composed specifications and in-situ inspections of existing transmission lines. Main criteria when concluding on the adopted conceptual design has been to ensure that the various line components are designed in a safe, cost effective and reliable manner.

3.4.1 Project Components

The proposed project will involve development of a 97 km 132kV transmission line between Mumias – Rangala – Kisumu. To ensure efficient functionality of the proposed line the following components will form part of the project installations; pylons/steel towers, dumpers, conductors, optical fibre, circuit breakers and lightening arrestors. All the project components will be installed using the best electrical engineering practices. The section below discusses on each of the project components in brief.

3.4.1.1 Conductors

The conductors recommended for the various sub-project options are Aluminum Conductor Steel Reinforced (ACSR) “Wolf” and “Lynx” conductors which are in accordance with KPLC’s standards. The operational performance of the selected conductors, both electrically and mechanically has proven satisfactory under Kenyan conditions. If the detailed line survey for particular sections result in limitations to the right of way resulting in a compact line design, lighter all aluminum alloy conductors (AAAC) will be considered to minimize pole sizes.

3.4.1.2 Overhead Earth Wires (OPGW)

According to KPLC practice, a single overhead shield wire is recommended for 132 kV lines. The wire would provide a 25 degree shielding angle for the line circuit which is considered satisfactory considering the anisokeraunic level in the region ranging from 120 to 180 thunderstorm days per year.

3.4.1.3 Support Structures

Lattice steel self-supporting towers are recommended for all transmission lines. The recommendation result from an overall evaluation of lattice steel structures versus pole structures (single pole or H-frames) of wood, concrete or steel. Although wood and concrete structures could involve a 20-30% cost savings on structures compared to conventional lattice steel structures the performance of wooden poles has proved poor due to their short life time and subsequent poor reliability and very high operational and maintenance costs.

Solid concrete poles are manufactured locally but their reliability is low. The high weight (above 4 tons) of these poles also involves higher transport and erection costs as heavy lifting and erection equipment is required emphasizing line sections with poor access conditions. Internationally manufactured hollow spun concrete poles or steel poles could prove competitive to lattice steel structures due to lower maintenance and way leave costs but the same considerations with respect to transport and erections costs would apply.

3.4.1.4 Conductor Configuration

KPLC current practice is to use a triangle conductor configuration on their single circuit lines with the two lower phases on the same horizontal plane. The configuration results in a slightly lower and lighter tower with a modest cost saving compared to the typical triangular configuration with the three phases on three levels.

3.4.1.5 Foundations

Based on the observation of the ground conditions during the line route surveys conventional pad & chimney foundations, and reinforced concrete pad & chimney foundations are recommended by the design engineer. On certain sections where poor soils or submerged conditions are identified a raft type design will be required. Hard rock foundations are not foreseen but weathered rock exists which might require heavy excavation equipment and supply of imported backfill for the pad & chimney foundations.

3.4.1.6 Grounding

All towers will be permanently grounded with an individual tower footing resistance aimed to be less than 20 Ohm. Over the first 1.5 km or 3 to 4 spans out of any substation, all towers, including the terminal towers, would be connected together by continuous counterpoise cable, which also should be connected to the substation-earthing grid. At tower sites in urban areas often frequented by people, additional protective earthing would be carried out aimed at less than 10 Ohm.

3.4.1.7 Insulator Strings

Composite silicone/polymer long rod insulators are to be used in the insulator strings for the support of the line conductors. Besides being competitive in price their low weight and compact configuration result in lower transport, installation and maintenance costs. The electromechanical ratings of the insulators to be installed are U70 and U120 according to IEC standard.

3.4.1.8 Circuit Breakers

The operation of circuit breakers causes switching surges that can result in interruption of inductive current, energization of lines with trapped charges, and single-phase ground fault. Modern circuit breakers, operating in two steps, reduce switching surges to 1.5–2 times the 60-Hz voltage.

3.4.1.9 Lightning Arresters

Lightning strikes produce high voltages and traveling waves on transmission lines, causing insulator flashovers and interruption of operation. Steel grounded shield conductors at the tops of the towers significantly reduce, but do not eliminate, the probability of direct lightning strikes to phase conductors. The shield wire is designed to protect the power line from lightning.

3.4.1.10 Pylons/Steel towers

Different transmission structures have different material and construction costs, and require different right-of-way widths, distances between structures (span length), and pole height. These issues also vary with different voltages. In areas where single-pole structures are preferred, weak or wet soils may require concrete foundations for support. Where a transmission line must cross a street or slightly change direction, large angle structures or guy wires may be required. Poles with guy wires impact a much larger area. Steel structures are used in transmission structures wood structures are used for distribution structures. Pylons/steel towers are preferred due to their longer life span.

3.4.1.11 Dampers

The conductors are protected by dampers which prevent the vibrations from reaching the conductors at the clamps or supports. There are three types of vibrations; simple swinging, low frequency vibration and high frequency oscillations.

3.5 Project Activities

- The key activities in putting up the transmission line include digging of four holes, assembling of structures, concrete casting, and stringing of the conductor.
- Erection of the lattice structures (pylons) will involve delivery of complete structures, physical assembly at site and laying using cranes. The steel structures will be assembled on site. They will have rivets and will be bolted. Strong aluminum rollers will be used to hoist the structures and in exceptional situation helicopters can be used.
- The foundations of the lattice structures/pylons will be dug manually then casting concrete to be used. The depth will be a minimum of 5m. The depth will be determined after geotechnical study is undertaken.
- Vegetation clearing will be done manually by use of pangas and slashers. Where there are big trees, portable power saw mills (petrol powered) will be used.
- The average height of the line will be between 30-40 metres this will depend on clearance from KCAA.
- Modes and quantity of transport vehicles employed in the project will be approximately five Lorries and four 4x4 vehicles. Maintenance of these vehicles will be done through licensed garages found in the project area. There will be no on-site maintenance of vehicles.
- Powered equipment expected to be used in the construction include power saw mills, and compressor to break had ground (if required).
- The mode of cooling that will be used in transformers will be transformer mineral oil.
- During the operation phase of the project way leaves will be maintained through manual vegetation clearing. Once the lattice towers are erected and structural integrity established, minimal maintenance is required and a routine Aerial inspection and ground inspection will however be done annually.
- Approximately 10 unskilled labour, five artisans, 2 technicians and three engineers will be employed in the project.

3.6 Site Ownership

The proposed transmission line traverses a vast area comprising land owned by various public and private entities. There are a number of land uses along the line route,

including sparsely and densely populated settlements along the line route. It is anticipated that the most significant adverse social/socio-economic impact will be the need for compensation and relocation of people affected by the project.

3.7 Proposed Budget

It is estimated that the project will cost a total of **10 Million US Dollars** such as to include the following items:

- Lease of land,
- Various operational licenses and permits,
- Professional services,
- Equipment procurement (importation, local procurements, installation costs, etc.),
- Construction (materials and labour),
- Miscellaneous overheads.
- The Resettlement Action Plan (RAP) study provides an estimate of Kshs. 66 Million for the process of land acquisition and resettlement for the Project Affected People.

3.8 Project Location

The proposed Mumias-Rangala-Kisumu line will take off from the Mumias Sugar Company substation taking a western direction towards River Nzoia avoiding the factory's staff quarters. The line crosses the Mumias - Bungoma road and lands on the eastern side of the bridge over River Nzoia at Angola village in Township location. The way leave from Mumias-Rangala had been surveyed and beaconed while the section between Rangala and Kisumu has not been surveyed but the location of the proposed line was identified using data provided in the feasibility study report.

The proposed line has no alternative route from Mumias to Kisumu. The tables below gives a list of coordinated and their physical interpretation in the project area. The locations were found using a GPS set in metric units and ARC DATUM 1960 system. The GPS coordinates were established using information from the Energy Scale-Up Programme Feasibility Study Report of April 2009.

GPS Interpretation for the Mumias-Rangala Section of the Line

Point	Northing	Easting	Location	Farm Owner/Institution	District
AP1	649241	17710	Rangala	Mrs. Okoth	Ugenya
AP2	653497	23174	Simerro village,	Maize field	Ugenya

			Rangala sub-location		
AP3	659452	30708	Madungu village, East Uholo location	Mrs. Rispa Opondo Otieno	Ugenya
AP4	660732	32593	Matora Village, Buchifu sub-location ,Itenje location, South Wanga Division	Near a church	Mumias
AP5	663740	36745	Mataskha/Matawa village, Nabongo sub-location	Sugarcane plantation	Mumias
AP6	665317	40775	Angola/Shivale village, Mumias	Mr. Ramadhan Nyongesa	Mumias
AP7	667322	39947	Mumias Factory	Factory	Mumias

GPS Interpretation for the Rangala-Kisumu Section of the Line

Point	Northing	Easting	Location	District
AP401	9993760	698350	Mamboleo Substation	Kisumu East
AP402	9993089	697914	Kanyakwar	Kisumu East
AP403	9993109	697615	Kanyakwar	Kisumu East
AP404	9994388	697045	Kanyakwar/Kogony	Kisumu East
AP405	9997032	693781	Kogony	Kisumu East
AP406	9994441	684745	Chulaimbo	Kisumu North
AP407	9996024	676598	Maseno	Kisumu North
AP408	10008388	676598	Yala	Gem
AP409	10011756	672580		
AP410	10016447	662214		
AP411	10016896	652597		
AP412	10022468	648320	Rangala	Ugenya
		651668		

Plate1: River Nzoia at point AP1

Plate 2: Section of the proposed power line on agricultural land

Plate 3: Proposed project area in Ugenya Diitrict

Plate 4: Closer look at the vegetation shown in plate 3

3.9 Description of Project Area Environment

This section of the report gives details of the environmental and social facilities found within the project areas.

Details of Project Environment for the proposed Mumias-Rangala-Kisumu Power line

Section of the Line	Areas Traversed by the line	Land Use	Sensitive Environmental Receptor	Special Features	Institutions in the vicinity of the Project Area
AP6-AP7	Mumias Sugar Company, sugarcane plantation and Angola village	Agricultural Commercial and industrial	River Nzoia, Hippopotamus and King Fisher	- Mumias Sugar Factory, Mumias-Bungoma Road Bridge, Sugarcane Plantation, Sand harvesting, commercial trucks parking Yard	-Mumias Sugar
AP6-AP5	Angola, Shitukumu, Shivale, Matungu and Lureko villages	settlement, agricultural and institutional	River Nzoia, Kignfisher Birds *(locally known as Namlobi*) and Hippos	Densely populated area, River crossing point	-School
AP5-AP4	Lureko, Matsakha and Matawa villages	settlement, agricultural, commercial and institutional	Lusumu River,	-Relatively densely populated area, several high valued residential houses, sugarcane plantation, trading centre	-Schools -Churches -Local Administration Office
AP4-AP3	Buchifi, Masinjira Matora,	Settlement, agricultural and a few	-River Togo -Several steams and	sugarcane plantation	-School -Church -Local

Section of the Line	Areas Traversed by the line	Land Use	Sensitive Environmental Receptor	Special Features	Institutions in the vicinity of the Project Area
	Buchifi, Emaungu, Buyole, Masinjira, Emukanga, Lugunga, Uyundo,Umala Togo, Umala Gul and Umal Bar villages	commercial	springs including Muhando, Buranga, Agai, Mbakaya, Buyole Wamananda, Masinjira, Buyole Musumba and Sumba		Administration Office
AP2-AP1	Kit Luo/Lala Usenge, Umony, Sigul, Rabolo, Opata, Ragwer, Usenge and Simerro.	Settlement and agricultural	- Wuoroya River and streams	maize fields, cassava plantation, potatoes, shrubs and coffee, 1km stretch of Cider forest between Ugweyo and Simerro -33kv power line	-School -Area administration offices
AP412-AP408	Western side of Kisumu-Busia Highway traversing Dudi, Nyamninia, Muhoho	Agricultural	River Yala	Trading centres, Other power lines, communication mast	-Schools
AP408-AP407	Western side of Kisumu-Busia Highway from Maseno-Luanda-Yala -Emukhaya District	Institutional, Commercial and Agricultural	River Yala, Monkeys, hills/rock outcrops	-Densely populated areas -Some sections are rugged and rocky	Maseno University -Several schools
AP407-AP406	Southern side of the Busia-Kisumu road Maseno Chulaimbo	Institution, settlement, commercial and agricultural	-Monkeys, hills/rock outcrops	- Uninhabited vegetated rocky areas, Chulaimbo trading centre - Densely populated areas in Maseno and Chulaimbo	Maseno University
AP405-406	Central and South West	settlement, agricultural	- Kisian hills	- Kisumu-Busia Road	-Schools -Hospital

Section of the Line	Areas Traversed by the line	Land Use	Sensitive Environmental Receptor	Special Features	Institutions in the vicinity of the Project Area
	location in Winam Division of Kisumu East District	and institutional			
AP404-405	Kogony sub-location	Settlement, institutional, a few commercial and a few agricultural	Abusol River, Riat Hill	Railway line; Uzima University College Semi permanent houses, Riat market the Lake Victoria Kisumu-Busia road. Line Leaves Kisumu Sewage Treatment Works, Molasses factory, the existing and proposed airport and the Lake Victoria to the south of Kisumu-Busia Road	-Uzima University College -Factories -Airport
AP404-403	Kanyakwar and Kogony sub-location	Institutional, agricultural and institutional,	Shrubs *Lantana Camara*	Proposed flight communication centre, NGO-Health Centre, Telecommunication Mast	
AP403 to 402			Flight path, Riat Hill, Shrubs *Lantana Camara*	petrol station, quarry sites (some sections abandoned), several government offices, railway line, Uzima University College semi permanent houses	-University -NGO's
AP402 to 401	Mamboleo substation, Upper and Lower Sango, Upper and Lower Gabo, Riat and Hole villages	Settlement, commercial and institutional	Flight path	- dense settlement area with permanent residential houses, Kibos road, several transmission and distribution power lines, construction materials yard, open air market for construction	- Crusade Academy (school and church),

Section of the Line	Areas Traversed by the line	Land Use	Sensitive Environmental Receptor	Special Features	Institutions in the vicinity of the Project Area
				materials, Kisumu-Kakamega highway,	

3.10 Conclusion and Recommendations for the Proposed Transmission Line Routes

It is recommended that, the land acquisition process be completed before the proposed project commences. The main constraint that are likely to affect the project and those requiring streamlining during project designs are discussed as follows:

- Kingfisher birds were sited along River Nzoia in Mumias it is recommended that technological mitigation be implemented to reduce negative impacts on the birds at this section.
- The River Nzoia is known to flood and measures should be taken to mitigate against flooding
- Plot 1257 and a few other residential surveyed plots in Lureko have high valued residential houses which the owners wanted preserved. Owners of small-scale commercial properties also wanted their property preserved. The re-alignment of this section will move it closer to the school it is therefore recommended that the line move further down after the school on undeveloped land with eucalyptus trees; moving line towards the river will need reinforcement and mitigation against floods.
- The MoR and KCAA have proposed to develop a by-pass and, access road respectively and a flight communication centre has also be proposed between point AP404-405. The KCAA recommended that installation of the line at this section should be underground to reduce EMF interference with the proposed communication centre.
- Section AP402-404 of the proposed line is also within the flight path for planes landing at the Kisumu airport. KCAA recommended that the height of the tower should not exceed 6m to avoid interfering with low flying airports and plane communication. To harmonize the recommendation of KAA and KCAA it is preferable that the line be installed underground for the entire section or an officer working with both organization be seconded to the project engineer to guide on the radius of area to be avoided.
- It is recommended that extra care should be taken when working in animal habitats along River Nzoia and Yala.

3.11 Description of the Project's Construction Activities

The main activities during the construction phase will be excavation of materials, installation of steel towers, conductors and their support components**.**

3.11.1 Seclusion of Project Way leave and Clearing

The acquisition of way leave will be carried out before the implementation of the project commences. Land acquisition will be followed by site preparation which will include bush clearing to pave way for the installations.

3.11.2 Excavation for Foundation Works

The project area is made of different types of soils and varying geological conditions. The excavations will be conducted to create holes for erecting or installing the pylons. After excavation, foundations will be constructed for supporting the pylons. The excavation and construction of the foundations shall involve the use of hand tools like crow bars, mixers, vibrators, trappers but in case of rocky areas compressors and drills will be used.

The equipments to be used in project construction will require various forms of energy which will include manpower, charged battery or fossil fuel. The manual equipments to be used in the development project include crow bars, spanners and ropes. Fuel based equipments to be used will include mixer will include mixer, vibrators, compressors and drills.

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

3.11.3 Structural Steel Works and Installations

The project will involve handling steel structures for the towers. The steel components will be purchased as parts from the manufacturer for bolting at the project site to make a complete steel tower/pylon.

3.11.4 Stinging and Tensioning

The conductors will be installed using a trolley to unwind them from the cable holders.

3.11.5 Landscaping

After successful completed the project construction work the project contractor should rehabilitate the project sites that could be subjected to clearing by planting indigenous plant species.

3.12 Description of the Project's Operation Activities

3.12.1 Way leave Clearance and General Maintenance

Activities undertaken during the project operations phase are minimal which will include clearing of overgrown vegetation and repairs of any defect that can be detected along the transmission line.

3.12.2 Waste Management

The project proponent will be required to manage the waste generated during the operation phase of the project appropriately. This can be done by providing facilities for temporary storage or handling of the solid and liquid waste generated during the maintenance period.

3.13 Description of the Project's Decommissioning Activities

3.13.1 Demolition works

Upon decommissioning, the components of the transmission will be uninstalled. This will produce a lot of solid waste, which can be reused for other project and construction works or if not reusable, disposed off appropriately by a licensed waste disposal company.

3.13.2 Site Restoration

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

3.14 Analysis of Project Alternatives

This section analyses the project alternatives in terms of site, technology scale and waste management options.

3.14.1 No Project Alternative

The No Project Option in respect to the proposed project implies that the status quo is maintained. This option is the most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. This option will however, involve several losses in opportunities both to the community and the country as a whole. The no project option is the least preferred option from the socio-economic and partly environmental perspective due to the following factors:

- Exploitation of cleaner energy sources will not take place and this will in turn mean continuous destruction of the environment
- The economic status of the Kenyans and the local people would remain unchanged.

- The local skills would remain under utilized.
- Reduced business development due to lack of initiative by regulating authorities to existing opportunities
- Reduced technology advancement in the country and interaction both at local, national and international levels.
- No employment opportunities will be created for thousands of Kenyans who will work in the project area.
- Increased poverty and hence insecurity in Kenya.

From the analysis above, it becomes apparent that the No Project alternative is no alternative to the local people, Kenyans, the government of Kenya and East African region as a whole.

3.14.2 Project Alternatives

3.14.2.1 Land

The EIA study for the proposed Mumias-Rangala-Kisumu transmission line indicated that alternative routes for the line need to be considered for some sections of the proposed alignment. Sections of the proposed transmission line that will need re-alignment or technology consideration include:

- Section traversing high valued houses in Lureko.
- Sections traversing the flight path in Kanyakwar; sections along the proposed Kisumu-Busia road by-pass and the flight communication centre.

3.14.2.2 Alternative Technology

3.14.2.2.1 Safety

All technological measures concerning safety should be observed during the designed and construction phases of the project in order to reduce anticipated negative impacts during the operation phase. Alternatives to be evaluated with the aim of enhancing safety should include the following:

- Use of double or single circuit- Double circuit lines are known to be safer than single circuit lines but the former is known to be more costly to develop as it requires more conductors. The double circuits are considered safe as they are visible and chances of not noticing them are low. Since the proposed project is a least cost project, the client aims to develop a single circuit line but it is recommended that project monitoring be conducted to enable gauge the need of enhancing safety in future.

- The height of the proposed line should meet the minimum requirements in order to ensure safety. Adequate tension should be provided to prevent sagging of lines.
- In areas with birds habitats use of horizontal circuits is encouraged in order to reduce incidences of bird's electrocution which is common in areas where parallel lines or vertical circuits are used. The use of double circuit towers will increase the visual impact and cause a greater risk for bird collisions. Other measures to increase visibility in bird areas include use of ball markers, bird deterrents, or diverters.

Corona Effects

Corona effect is induced when conductor are close to each other and when the conductors vibrate due to interaction of EMF. It is recommended that the minimum recommended distance between conductors be observed in order to reduce the humming noise or the corona effect. In addition dumpers should also be installed on the conductors in order to reduce vibration and hence reduce corona effects.

Installation Techniques

Cables can be installed underground or above the ground. Installation of underground cables can be used as an alternative in areas where EMF radiation is likely to affect other activities in the project area for example the proposed flight communication centre and along the flight path. Installation of underground cables reduces or enhances the project impacts. Negative impacts reduced by underground installations include;

- Far less visual damage after installation;
- No physical obstacle to human, animals or birds.
- Minimum interference with land use
- Minimum effect on landscape and visual impact
- Minimum interference on geology and soils
- Minimum interference with water resources

The major positive impact of the underground cables is in the ability to engineer external fields to almost zero and minimal magnetic fields beyond 10 meters from the cable. The main challenge of using underground cable is that during repairs the line will have to be unearthed which leads to several environmental impacts.

It is recommended that the proponent take into consideration the project alternative during the project planning phase in order to ensure sustainable operation of the project.

For instance underground cables can be considered when working in areas with large populations of resident birds and even human population.

CHAPTER 4 PUBLIC PARTICIPATION

4.1 Legal Requirement

Section 17 of the Environmental (Impact Assessment and Audit) Regulations of 2003, requires that all E&SIA Studies undertake Public Consultation (PC) as part of the study. The aim of the PC is to ensure that all stakeholders interested in a proposed project (including project beneficiaries and the general public in the vicinity of the proposed project) be identified and their opinion considered during project planning, design, construction, operation and decommission phase.

In compliance to the requirements of the regulations, the consulting team conducted PC from 7th October 2009 to 11th November 2009 consulting community members in the whole project area.

4.2 Objectives of Public Consultations

The main objective of the PC was to:

- inform the local administration (District Commissioners, District Officers, Chiefs, Assistant Chiefs, Councilors and Village Elders) on the proposed project and collect their views on the same.;
- provide an opportunity to all the stakeholders and communities in the proposed project area to raise issues and concerns pertaining to the project,
- conduct socio-economic survey and
- identify alternatives for the proposed project

4.3 Methodology and Data Collection

The public consultation for the proposed project was conducted simultaneously with the field work targeting the various groups of stakeholders. The consultations were conducted through use of questionnaire and public forums/*Barazas*. The consultants developed several formats of questionnaires to target the various groups of stakeholders which included the community members, the local administration and departmental heads.

The key stakeholders were interviewed through holding consultative discussions and administration of questionnaires. Samples of questionnaires administered are annexed to this report. Consultation of community members was done both at household and communal level. List of names of all those consulted is also annexed to the report.

The household interviews were conducted inform of socio-economic survey by data enumerators who managed to interview over 60% of households located within the proposed project route using pre-developed questionnaires. The interviewers also targeted the general public residing in the vicinity of the proposed project route. Data collected during the PC included data on the particulars of the community members and their opinion on the proposed project.

Public forums were also held with the assistance of the local leaders in several areas within the proposed project area. The agenda of the meetings were divided into five main sections namely:

- Project Introduction
- Questions and discussion sessions
- Project Socio-Economic and Environmental Impact Discussions
- Questions and discussion sessions
- Closing of the meeting

First section namely project description was conducted by the experts who introduced the proposed project stating its aim, components, length and locations as described in the Terms of Reference. After the project introduction phase, the community members were given a chance to comment on the proposed project.

Plate 5: Community members attending a public consultation forum at Simerro Trading Centre at Rangala location, Ugenya Disitrct

Plate 6: Community members attending a public consultation forum at Simerro Trading Centre at Rangala location, Ugenya Disitrct

Plate 7: Community members viewing cadastral maps indicating project location in Lureko, Nabongo Location South Wanga Division, Mumias Disitrct

Plate 8: Area Chief and community members viewing project map during public consultation at Simerro Trading Centre Rangala location Disitrct

The socio-economic survey was conducted by data enumerators through the use of pre-defined questionnaires targeting the PAP. The data enumerators covered 100% of the almost 40km between Mumias and Rangala and over 35% of the 50km between Kisumu and Rangala by interviewing about 250 likely PAP's. The stakeholders were identified and consulted with the objective of understanding the existing socio-economic conditions of the area of influence and the immediate surroundings of the proposed project. The Project Affected Persons were grouped into four broad categories namely:

- PAP's whose land were entirely within the proposed project corridor this included the farms and housing structures
- PAP's whose land and farms will be partially acquired excluding the housing structures
- PAP's whose land and farms will partially be acquired including housing structures
- PAP's who will be entirely affected due to acquisition

The responses received from the local community, the local administration and departmental heads from the public consultation and socio-economic survey.

4.4 Responses from the Public Consultations and Socio-Economic Survey

The following sections present the views of the stakeholders on the proposed project. The views are presented as issues requiring clarification, the anticipated benefits of the project, its negative impacts and proposed recommendations to abate the negative impacts or enhance the project benefits. The views are presented in a tabular form indicating dates and locations at which the discussions were held and, the names of persons interviewed and their views.

4.4.1 Response of Departmental Heads on the Proposed Project

This section presents the views collected from the key stakeholders in the project area which includes departmental heads representing the various ministries in the district.

Stakeholders Response to Proposed Project

Date	Department/ Representative	Name	Location	Contacts	Views
22/10/2009	Water Resources Management Authority (WRMA)		Kisumu		
26/10/2009	Kisumu Municipal Council , Physical Planning Town Planner	Absalom Ayan	Kisumu	0724402256	
26/10/2009	Town Engineer-Kisumu Municipal	John Mazuri	Kisumu	0734321816	

Date	Department/ Representative	Name	Location	Contacts	Views
	Council				
	Water Services Board SIBO		Yala	0726658072	-Have water pipeline from Yala works to Sidindi area
5/11/2009	District Agriculture Officer-	Joseph Boru	Mumias	0724323333	
5/11/2009	District Public Health Officer-Mumias	Peter Onderi	Mumias	0720882291	
5/11/2009	Water Resources Management Authority (WRMA)-Sub-Regional Office	Edward Wekesa	Butere	0722481966	
5/11/2009	Lave Victoria North Water Services Board District Water Officer	Samuel Ngungi	Mumias	0716333714	
5/11/2009	District Development Officer	Grevas Ogutu	Mumias	0734768852	
5/11/2009	Plant Manager Mumias Sugar Company		Mumias	akaruga@mumias-sugar.com	
9/11/2009	Nyanza Conservancy, Kenya Forestry Services Senior Assistant Director	Otieno Dominic	Kisumu		-Have had bad experience with proponent as they clear wayleaves and they do not replant trees or they clear trees haphazardly; especially bad for trees grown with community members

Date	Department/ Representative	Name	Location	Contacts	Views
					-Area to be cleared is massive and rehabilitation programme with participation of the community should be undertaken; should also engage displaced community members in the programnme -Project area has no forests but have individual trees on farms but recommend to avoid Maragoli Hill around Emukhaya District as has a forest reserve
9/11/2009	Kenya Pipeline Company – Technical Electrical	Patrick Ochola	Kisumu	0733584969	Have pipeline around Kanyakwar
9/11/2009	Ministry of Fisheries		Kisumu		
9/11/2009	Kenya Airports Authority	Beatrice Ongoro	Kismu Airport Resident Engineer (ongoing development)		-Ensure line is not within the obstacle limit of planes maximum allowable height in the area is 6m -Prefer line to be installed underground since project is close to the airport and within air path thus the proposed line might collide with taking off planes -Recommend

Date	Department/ Representative	Name	Location	Contacts	Views
					pylons not to exceed 6m
10/11/2009	Snr. Warden Kenya Wildlife Service	William Sang	Kisumu	0711-615998	-Need to protect hippos, crocodiles, birds, monkeys etc along River Yala and at the hills -Proposing to put up a conservancy around River Yala
11/11/2009	Kenya Civil Aviation – Aeronautical Technical Officer	Tito Shihule	Kisumu	0724912252	-Proposed line is within the flight path as airplanes approach from Mamboleo -Have proposed airplane communication centre near Riat market and expansion of the Riat-Mamboleo road -Line will be dangerous for low flying aircrafts -EMF will interfere with the communication centre -propose line to be installed underground or installed elsewhere
12/11/2009	Kenya National Highway Authority (KENHA)	Eng. Ngala and Surveyor Mr. Opondo	Kisumu	0728038470	-Proposed expansion and upgrade of by-pass from Mamboleo to Otonglo from 20m to 40m tar road road E1117 (map annex 5) -Proposed expansion of the

Date	Department/ Representative	Name	Location	Contacts	Views
					Kisumu-Busia road
12/11/2009	Kenya Railways-Permanent Way Leave Inspector	Ayub Moshi	Kisumu	072878257	-Existing railway reserve is 60m
12/11/2009	Lake Victoria South Water Board-Winam Gulf-				Water supply lines runs from Ojolla, Chulaimbo, Lela to Maseno -Proposing to expand network to serve Kanyakwar area

4.4.2 Response of Local Administration on the proposed project

This section presents the views of the local administration, community opinion leaders and village elders on the proposed project.

Local Administration Responses to Proposed Project

Date	Representative	Name	Location	Contacts	Views/Remarks
7/10/2009	Assistant Chief		Bukaya	0727629986/ 0723042876	-Currently rural electrification main transmission line being installed -Shall organize *baraza* for 9/11/2009
20/10/2009	Chief and Assistant Chief		South Ugenya/Rangala sub-location	Chief's Office, Rangala Market 0721297992/ 0721618079	-Project located in a newly formed district namely Ugenya district which has two divisions Ugunja and Ukwala -The district headquarters is located in Ukwala and divisional headquarters

Date	Representative	Name	Location	Contacts	Views/Remarks
					located at Ambira after Ugunja town on Busia highway -District neighbours Siaya, Butere, Mumias, Bunyala(former Busia) and Gem Districts -Project is located in Ugunja division traverses South Ugenya and East Uholo locations only -The two locations borders each other at Wuoroya River -Agreed to hold two *barasas* in the project area on 27/10/2009 for Simerro and on 28/10/2009 at 2pm for Rangala -Other locations in the division are East, West & North Uholo, and Central Ugenya not affected by project
20/10/2009	Chief	Opondo Victor	East Uholo	Chief's Office, Sigomre Market 0723866651	-Surveyors were almost beaten by police at Uholo East as community members were not aware of their intention and mistook them to be law offender.
0/10/2009	Senior Chief		North Uholo	0724521570 7	-Despite the fact that the project does not pass in

Date	Representative	Name	Location	Contacts	Views/Remarks
					his area he would like to join discussions to learn more about project as he is a sugarcane farmer
20/10/2009	Human Right Activist- Western Region Christian Community Services	Opara Benard	Nyapeta village, Masinjira sub-location, Itenje location, South Wanga Division, Mumias District	0710304858	-Guided the surveyors beaconing the proposed project route in the area -village formerly in Buchifu sub-location before sub-division of the sub-location into two namely Buchifu and Masinjira sub-location -Area Chief Mr. Joshua Adiwa- 0710926512 office is located at Imanga
20/10/2009	Assistant Chief	Patrick Toloi	Lureko/Matawa, Nabongo location	0711762019	-meeting to be held at Matawa on 27/10/2009 at 2pm next to Lureko Primary School
20/10/2009	Assistant Chief	Steven Aluva	Township Mumias sub-location	0736561972 0721618079	-Project passes Shivale and Shitukumu villages in Nabongo location -Cadastral map was old as several sub-divisions have been undertaken and area is very densely populated especially Shivale where people live upto
	Chief	Suleiman Mutiro	Nabongo location	0713812016	

Date	Representative	Name	Location	Contacts	Views/Remarks
					the river front -Shitukumu area is relatively densely populated and people have larger plots -Latest map of area can be obtained from the Municipal Council - The line passes through Angola village and crosses the River Nzoia after the bend and goes to Matungu a newly formed district though number of PAPS there are few - From Matungu line comes back to Shitukumu in Mumias then moves to Lureko -Stated the first response expected from the community is what benefits do they get from the project _They suggested power be supplied to the existing sub-station in Shivale for community members to accept the project -The sub-station is currently being fed with power from Jinja in Uganda

Date	Representative	Name	Location	Contacts	Views/Remarks
					-They stated previously the sugar company used to give 3MW to the community but it stopped -They added the only benefit the community has got from the sugar factory is street lighting which the community finds inadequate as they are rural dwellers and do not live in the town.
20/10/2009	Village Elder - Angola	Saidi Wesonga Wangatia		0715387539	
26/10/2009	Chief	Suleiman Mutiro	Nabongo location	0713812016	-Some farmers leave very close to the river within the 60m -Villages in the area are Angola, Shivale, Shitukumu and Lureko -Two barasas enough to cover PAPs in the area -Meetings to be held on 3/11/2009 at Shitukumu and 5/11/2009 at Shivale
	Assistant Chief	Steven Aluva	Township Mumias sub-location	0736561972 0721618079	
27/10/2009	Chief Representative	Chrispin Sijeny	Chief Office Sigomre	0723866651	-In the location, the proposed line moves within Mungao, Muriwa and Ugolwe sub locations -Shall chair public meeting on behalf of the area chief

Date	Representative	Name	Location	Contacts	Views/Remarks
27/10/2009	Assistant Chief	Fredrick Oduor Otieno	Bungasi	0735146671	-Will hold meeting on 9/11/2009
3/11/2009	Assistant Chief	Morris Ojwang	Kanyakwar	0714057478	-Sub-location located in East Kisumu location, Winam Division, Kisumu East District -He added Winam division will soon become Kisumu North district following the sub-division of the Kisumu East district into two. -The location is neighboured by Central and South West location while the sub-location is neighboured by Kongony sub-location -Villages to be affected as one moves from the substation are Upper and Lower Sango, Upper and Lower Gabo, Riat and Hole, -He added the existing sub-station is located in Upper Gabo in Konya sub-location, West Karule location -Konya sub-location borders East Kanyakwar location at the earth road leading to the showground in lower Gebo -Lower Gebo area gets

Date	Representative	Name	Location	Contacts	Views/Remarks
					flooded during rainy season -He added number of developers have increased in the last two years and most permanent development are found towards the hill and the line should pass south of the area -Sub-location ends just before the Nyanza farms organization
3/11/2009	Assistant Chief	Aloise Aboge	Kogony	0721836519	-Mentioned the project will affect his people as they have just been resettled at Kanyametha due to airport development -The chief suggests the project to be pass through the hill -The community has a land body called Kogony Land Council of Elders -Proposed to have meeting on 11/11/2009 -The sub-location is neighboured with Korondo A &B sub-location in Central location and South West Location
4/11/2009	DO Maseno Division	Dennis Kirui	Maseno	0720750612	-The division is located in Kisumu West

Date	Representative	Name	Location	Contacts	Views/Remarks
					district -The district starts at Daraja Mbili in Kisumu West location and ends at Maseno Township -District has two divisions Maseno and Kombewa towards Bondo district -Project touches only Maseno Division after which it enters Emukhaya district -The division has four locations and 16 sub-locations -The 1999 census population states division has 75,000 people and the district has 200,000 people -East Seme and Upper Otywenya location are rocky thus the land lies fallow. In those areas the community mainly graze livestock no crop growing is done there thus installation can be done there with minimum interruption -Area has electricity supply
4/11/2009	Assistant Chief	William Mathews Onana		0721934468	-Emukaya district starts at Luanda town in Ebusakami

Date	Representative	Name	Location	Contacts	Views/Remarks
					sub-location, South Bunyore location ,Luanda division -The district borders Kisumu West and Siaya Districts at Emalaba sub-location 8km from the highway -South Bunyore location is made up of Esabule, Egwanda, Maseno and Emaloba sub-location -South Bunyore borders two locations South West and West Bunyore locations -Along the highway Emuhaya ends at railway crossing near Yala town in Ebusyekwe sub-location in South West location - The project traverses Luanda division which is densely populated and average land size is 0.5acres -Landuse is subsistence farming mainly grow maize which does not last the farmers upto two months after the harvest -Living standards is very high

Date	Representative	Name	Location	Contacts	Views/Remarks
					-Community practice zero grazing even for local breeds due to lack of land -The area has just started receiving electricity through the rural electrification programme -Area chief is located in Emuyekhe town 1km South of the highway from Luanda town in West Bunyore partly in South West Bunyore
4/11/2009	DO Ukwala Division	Grace Opati			-Gave go ahead to hold meetings in the division
5/11/2009	Assistant Chief	Steven Aluva	Township sub-location	0736561972 0721618079	-Community has experienced several resettlement and compulsory acquisition when the Government was acquiring land for the expansion of Mumias town -Government took long to act on the expansion and generations changed over the years and it became hard to move the community after several years of purchase -Angola village was traditionally

Date	Representative	Name	Location	Contacts	Views/Remarks
					owned by three people, then a section was bought by the sugar factory and followed with subsequent sub-divisions and the area is now a densely populated area -Community is very attached to their land and culture -There is no land available for resettlement in the area -The problem with the project is that the community is not seeing the direct benefit -Community carry out sand harvesting on the riverbank and would be affected by the project -Landuse is mainly settlement, maize and sugarcane plantation -River is inhabited by Hippos and Kignfisher birds live by the river bank and feed on fish -Hippos are destructive and even attack community members
5/11/2009	DO South Wanga Division				-Need to hold barasas at Buchifu and Masinjira sub-location

Date	Representative	Name	Location	Contacts	Views/Remarks
					locations; gave contact of the area chief as 0725155995 and 0721388582 respectively. -Suggested line to follow the River Nzoia to Kisumu to avoid resettlement but the short coming will be floods which should be mitigated against
5/11/2009	Shivalle Environmental Programme	Onyange Henry Shaddrack		0710762824	-Members of the District Environment Committee
9/11/2009	Assistant Chief Bungasi	Fredrick Oduor Otieno		0735146671	-Bungasi sub-location, Musanda location , South Wanga Division, Mumias -Bungasi 5km from Sigomre Trading Centre -Line crosses the Musanda - Ugunja road between Sigomre and Bungasi exactly 3km from Sigomre. -Location has eighteen villages and borders East Uholo at River Togo -Line passes Lugunga, Uyundo,Umala Togo, Umala Gul and Umal Bar villages from where it enters next location Bukaya

Date	Representative	Name	Location	Contacts	Views/Remarks

4.4.3 Response of Local Community on the Proposed Project

This section gives the responses the community members gave during the public forums held for discussing the proposed project

Views of Community Members on the Proposed Project

Date	Location	Findings and Discussions
27/10/2009	Simerro	- Meeting was chaired by area chief who doubles as an assistant chief too -Community mentioned they have no problem with the proposed project as long as they are adequately compensated and resettled appropriately -They added that only monetary compensation is not suitable for them as money looses value they recommended that KPLC give them money for inconveniences and make them shareholders for future benefits -They added that they saw people beaconing their lands without explanations and this made them worried -Several parcels of land in the area have disputes among family members
27/10/2009	Matawa and Lureko	-Meeting chaired by area Assistant Chief Mr. Patrick Toloi -Meeting attended by community members of Lureko and Matawa village -Consultant gave a brief project description -Community members had problem with the way land surveyors approached them without consultation -Community wanted clarification on who owns the project if its Mumias Sugar or KPLC; there was misinterpretation of the project -Community is positive about the project but wants clear understanding on how they shall benefit from it, how they shall be compensated and how impacts like accidents, tree harvesting will be managed -They stated that the project is passing their land and also using their bagasse to benefit other areas and would like power supplied to their sub-station in Mumias before serving other areas -They added currently power leaves Mumias passing through Manyatta area to Siaya yet they have no power -They thus added they feel marginalized due to historical happenings as they further stated that they have never owned their land as the sugar company took land from them and never compensated them. -They mentioned that initially the sugar company leased land from them for 33 years and after the lease expired the company denied having a lease with them thus community does not want this to repeat -They wanted clarification if KPLC will buy or lease the land from them -Community stated they need the proponent to have

Date	Location	Findings and Discussions
		insurance to cover anyone who gets physically affected by the project -They also wanted to be guaranteed that they will not get health effects after 15 years of co-existing with the high voltage line. They stated they fear they might get cancer of the bones etc due to radiation -Locals living around land parcel 747-422 according to sheet number of the cadastral maps suggested that the section be avoided as plot 421 is developed with small-scale commercial projects on which they depend on e.g posho mills; They suggested once the line reaches parcel 421 it should go to parcel 2801 and follow the road -Community added they should have been consulted first before drawing the line on the maps or deciding on the alignment as they believe consulting them is to play with their minds because the project will still proceed as planned even if they give their opinion -They stated the project is more political than economical -They would like their properties valued at current market rate. They added they will not sign any contract before fully understanding the implication of the agreement as they have had bad past experiences with Mumias Sugar. -The community also mentioned they have large families on average 7 children and thus state that if only portions of their land is taken the remaining will not benefit them especially for families with sons who have to inherit land according to their tradition -They suggest KPLC to buy whole parcels in areas where people will be left with unsustainable pieces -They also added KPLC should build them better houses during resettlement -They also want to be employed as locals in the project and would like the contractor to be introduced to them before commencing work on the project. They added community members have no jobs even non-skilled labour at the sugar factory -Some members were resistant and wanted the transmission line to be installed on the River Nzoia riparian -Some community members added some land parcels are controversial -To end the meeting they stated that to enable streamline issues they need to have detailed consultation with KPLC and copy of the EIA report should be given to their chief to enable them have access.
28/10/2009	Rangala	- Meeting was chaired by area chief who doubles as an assistant chief -Community mentioned they have no problem with the proposed project as long as they are adequately compensated and resettled appropriately -They added that only monetary compensation is not suitable for them as money looses value they recommended that KPLC give them money for inconveniences and make them shareholders for future benefits -They added that they saw people beaconing their lands without explanations and this made them worried

Date	Location	Findings and Discussions
29/10/2009	Bukaya	Cancelled
3/11/2009	Shitukumu and Lureko	Cancelled as the local leaders were called for a provincial meeting and meeting was postponed to 5/11/2009
4/11/2009	Rangwar village, Mungao East Uholo	-Meeting was chaired by the area chief representative -The consultant gave a project brief as described above and community responded as follows -They stated that they have no problem with the project but need to see the direct benefits they will get from it -They asked if they will be allowed to use the way leave -How soon will the project take place -How will they benefit from the project as the area is traversed by several lines but the area has no power supply. They added they believe this project is out to use them then leave them without benefits -The cadastral map used was not updated as several sub-divisions have taken place. After studying the map the community stated that in Mungao the line passes through Umony, Sigul, Rabolo, Opata, Ragwer and Usenge cutting through 43 parcels of land. -Rangala already has a step-down so would like area considered allowing equal distribution of power. They added Simerro, the proposed substation site is 4km from Mungao and getting power from there will cost them a lot more then people in Simerro thus they would like the substation to be in their area or KPLC should reduce the cost of distribution or put up about four (4) transformers in the area -They added even the neighbouring sub-location Madungu has power and yet they don't have and were recently asked to pay 11 million inorder to have power supplied to the four schools and the community health centre in the area -The community ended by saying they will develop a committee to help coordinate the project activities
4/11/2009	Lala village Madungu sub-location, East Uholo	- Meeting was chaired by the area chief representative -The consultant gave a project brief as described above and community responded as follows -In their area the line passes through maize fields and sugarcane plantation mainly and a few settlements -A 33kv line passes through the village and community has no power. They added there is a step-down at Sigomre which could be used to help community get power. -They needed clarification on how the line will benefit them. They also added they are the cane farmers and should therefore benefit directly from the by-products through power supply -They added compensation should be comprehensive and include resettlement -They wanted to be educated on the risks and assured that the risks they will be exposed to will be timely solved as currently they are exposed to several risks especially due to breakdown of the existing power line which takes time to repair. They therefore need to know who will be responsible for maintaining the lines

Date	Location	Findings and Discussions
5/11/2009	Mzee Ramadhan Nyangweso Farm, Angola village	-Meeting was opened and chaired by the Assistant Chief and held for Angola and Shivale area though community members came from other neighbouring areas too. -Meeting was attended by the area Chief, Health NGO, Environmental NGO -The chief asked community members to take sugarcane farming as a serious business especially after having low maize harvest in recent years. He added they should add fertilizer and weed farms to increase production -He added cane poaching is on the rise in the community especially in neighbouring locations of East and North Wanga -Mr. Nyangweso a local leader and former chief requested that the process of project implementation need to go smoothly adding that since 1965 there has never been a peaceful land acquisition, relocation and resettlement in their community -The Chief also announced that a door to door HIV/AIDS testing will soon be initiated in the location in addition the health NGO stated a door to door circumcision for men will also be initiated to help curb increase in diseases and high cost of circumcising the young ones -The administration through the CDF is also introducing palm trees in the area as a pilot project which will be expanded depending on how well the community takes up the project. Once production of the fruits is adequate it is anticipated a palm oil factory will be set up in the area. The CDF is giving 5 seedlings per household but community is free to buy more seedlings. It was stated 500 trees need 100kg of fertilizer -In regards to the project the community members responded as follows: -What happens to people with small farms? -Will crops be compensated? -Would like to have a more detailed meeting with parties concerned and PAP's for them to really understand what action to take -Why is the line not going direct to Kisumu through Ekero (densely populated and trading centre) in Mumais and Butere -Is the 60m being considered including the River Nzoia Riparian zone? -Proponent should aim to reduce impacts on community land -What happens if KPLC allow them to use the wayleave on certain conditions and an accident occurs? Will they be compensated -What happens if land is not registered will they be compensated? -They added they require 60 days to process land documents do they have adequate time before project commences? -What happens to old people? Will KPLC develop for them houses before resettling them? -What valuation method will be used? Government or market value? -What happens if only small sections e.g 10m is taken from one's farm will they be compensated? -Will there be need to amend the title deed? -What benefits will the community get as currently they don't have power?

Date	Location	Findings and Discussions
		-They added that they depend on bagasse for firewood and if it is used to generate energy they will need an alternative source of energy which they stated should be electricity. -The land use is mainly residential in Shivale and sizes are very small less than 0.1Ha.
5/11/2009	Township Primary School, Shitukumu village, Township Location	-Meeting was held in the school as parents had gathered there to attend to a school function -The parents who are dwellers of the Shitukumu and Shivale villages were concerned about the following issues -Will they be allowed to use the land -On the success of land acquisition and resettlement they stated that, they would like the compensation to be successful as they have had bad experiences earlier -How will they be enlightened to avoid being swindled Why Kisumu? How will they benefit?
9/11/2009	Bungasi	-Meeting chaired by Assistant chief -Community raised the following issues -How much will they be paid for their land -They would like community to be given first priority for employment -What happens to community members without title deeds -How will they benefit from the project -How will they be protected from accidents -They suggested all visitors to the area should go through the area chief before starting to work in the area so as to be given security -What is the difference between the existing 33kv and the new line -They stated the 33kv comes from Sibembe from Bungoma which gets its power from Uganda and the power goes to Siaya and Busia -What happens to people carrying out brick making -What benefits will they get from bagasse as they are cane farmers? They suggested Mumias should pay them for the by-product -The CDF was also promoting palm trees in the area
9/11/2009	Bukaya	-Line passes Lukongo D &B, Nyalenya, Khushipare, Muchechera, Ebuyenjere then enters next location -Most land owners were present during the meeting -They also asked why Rangala and yet locally they have no power. They wanted to know how they will benefit -They were wondering if the survey works going along the road is the same as the proposed project. The chief clarified they are different as the survey going on along the roads is for rural electrification programme -Community members are worried about the project for several reasons including their lands are very small and they have big families especially families with boys due to the inheritance culture -They also don't know how to behave during compensation and what form of compensation should they choose. They are scared monetary settlement will not benefit them much especially due to devaluation of the currency and misuse by some community members -Community members are also scared of leaving their areas

Date	Location	Findings and Discussions
		as they are used to the place and settlement in new areas will be hard to adopt. -They suggested all people resettled form the area should be bought land at one place as a block -Majority of the communities have no legal documents for their land what happens to them -What distance should they observe for development after the 60m wayleave -They suggested the community members should be given work to reduce incidences of insecurity -They requested that KPLC should provide the chiefs with a map for the proposed line for their internal discussions. -Currently a programme on electrification of all schools in ongoing -They suggested project should come at the right time to avoid community from overstaying on the land which might lead to future conflicts -Most landuse is sugarcane plantation and land are long strip as sub-division is done longitudinally to give each family member access to resources namely water, roads etc
11/11/2009	Kanyakwar	-Emphasis of meeting was on anticipated benefits
12/11/2009	Kongony	Meeting canceled

4.4.4 Socio-Economic Survey and Findings

This section provides information on the dates and areas where the socio-economic survey was conducted.

Project Socio-Economic Survey and Study Area and dates of Study

Group Number	Date	Area
I	20/10/2009	Matora village, Buchifi sub-location Buchifi location, South Wanga Division in Mumias District
	21/10/2009	Buchifi, Emaunga, Buyole villages in Buchifi sub-location Buchifi location, South Wanga Division in Mumias District -Masinjira sub-location
	22/10/2009	Buchifi and Emukanga villages
II	20/10/2009	Bukhweso village in Masinjira sub-location, Buchifi location
	21/10/2009	Mundindi village in Masinjira sub-location, Buchifi location - Ebuyenjere, Mushechere, Khushipare villages in Bukaya sub-location, Itenje location
	22/10/2009	Kit Luiyo, Lukongo Bukaya sub-location, Itenje location
	23/10/2009	Kulumuayo, Bumala, Buhkwayo in Madungu-Sub-location , Uholo East location
III	21/10/2009	-Madungu and Simerro
	22/10/2009	Madungu, Ugolwe, Simerro and Rangala
	23/10/2009	Simerro and Simenya
IV	20/10/2009	-Shivale village, Nabongo location ,Mumias Division
	21/10/2009	Angola village, Township sub-location, Nabongo location , Mumias

		Division -Shitukumi Township sub-location, Nabongo location
	22/10/2009	Nyakwakwa, Lureko, Edokho A&B villages, Lureko sub-location , Nabongo location, Mumias Division
	23/10/2009	Yala
	22-23/10/2009	Kanyakwar

4.5 Major Environmental and Social Concerns Raised

In general the response of the stakeholders on the proposed project was positive since the community members and their representatives stated that the overall project objectives are good for the economic development of the area. Despite that the stakeholders raised some issues that they would like the proponents to incorporate in the project during project design and planning.

4.5.1 Land Acquisition and Compensation

The community members were concerned on the process that will be used to acquire their land and the compensation procedure. The communities based their arguments on historical treatment on the process of land acquisition and felt they have always been short changed. They stated that, they support the project but would like all measures taken to reduce negative impacts associated with land acquisition. Consideration need to be taken when acquisition is being undertaken:

- in densely populated areas where community members hold very small land parcels and have large families;
- on land occupied or owned by vulnerable community members especially widows
- In areas with valued investments and physical cultural resources like graves/burial sites

  Community members in Bungasi raised the wish that if community members are to be resettled they should be resettled in one area.

4.5.2 Human Resource /Employment Opportunities

The community members would like that the locals be considered for employment before immigrants are brought in to uptake the jobs positions that would be created. They emphasized non-skilled labour like bush clearing, excavation works, clerical works including socio-economic survey should be done by the locals.

The consults supporter the opinion of the community members and added that the proponent is known to have always given local communities in project area employment consideration.

4.5.3 Socio-Cultural Impacts

The community also noted that during project implementation several cultural activities are interfered with including dressing codes, alcoholism, drug use, school dropout, unwanted pregnancy among school pupils, increase in spread of diseases among other issues. They also added many a time resettlement methods go against their cultural settlement patterns. To mitigate against it the community members stated that labourers should be sourced from project area and in coming labourer should be trained on co-existence with community members.

4.5.4 Project Benefits

This issue was raised by majority of community members living along the route of proposed power line. The community members requested the proponent to come up with programmes that will ensure they benefit from the project. Some benefit proposals made by community members in the project area included;

- Supply of power to existing sub-station-This issue was raised by community members in Nabongo location in Mumias District for the proponents' consideration. The area has a substation in Mumias town which they stated if supplied with adequate power the community members will benefit by electrifying their homes
- Other areas like Madungu and Mungao location in Ugenya district suggested that transformers should be installed in the area to enable them get power from it as they added that currently they have to cover long distances to bring electricity to their area which is very costly for them.

  It is recommended as part of the design and project planning that the proponent come up with project mitigation support programmes that will ensure benefits are given to non- beneficiary community members.

CHAPTER 5 BASELINE INFORMATION OF THE STUDY AREA

5.1 Introduction

This section gives the baseline information of the project area based on available literature materials. During the study it was noted that the administrative structure of the project area had changed and several new districts had emerged due to sub-division of the older districts. The baseline information provided in this report is based on data available for the larger districts as the new districts have not developed baseline information for their areas. The new districts still share several governmental departments with their former head offices.

The Mumias-Rangala-Kisumu line currently traverses six districts namely Mumias, Ugenya, Gem, Emukhaya, Kisumu West and Kisumu East. The six districts were initially under four districts namely Mumias-Butere, Siaya, Vihiga and Kisumu currently referred to as the larger districts. The districts are located in Nyanza Province apart from Mumias-Butere and Vihiga which are located in Western Province.

5.2 Geographical Location and Size

5.2.1 Larger Kisumu

Kisumu District is in Nyanza Province and is currently divided into two districts namely Kisumu East and West but a third district namely Kisumu North has been proposed. The Larger Kisumu district lies within longitude 33 20'E and latitude 0 20'S and 0 50'S. The district covers a total area of 918.5 km^2 and had four administrative divisions.

5.2.2 Larger Siaya District

Siaya district is one of the districts of Nyanza Province. It borders Bunyala District to the north, Emuhaya, Mumias and Butere Districts to the north-east, Bondo District to the south and Kisumu West District to the south-east. The total area of the district is approximately 1520km^2. The district lies between latitude 0° 26' to 0° 18' north and longitude 33° 58' east and 34° 33' west.

The larger Siaya District was divided into seven administrative divisions namely; Yala, Wagai, Karemo, Ugunja, Uranga, Boro and Ukwala which have now be restructured to and belong to several new districts. Ukwala Division is the only division in Siaya through which the proposed project will traverse. The project area is now in Ugenya District covering an area

5.2.3 Butere-Mumias District

Butere-Mumias District was initially curved out of the larger Kakamega District and it covers a total area of 939.3km^2. Currently the district has been subdivided into two districts namely Butere and Mumias. The district is found in Western Kenya and is bordered by several other districts namely Busia and Bungoma to the West, Siaya and Vihiga to the South and Kakamega on the North. The District lies between longitude 34º 21' East and 34º 41' East and latitude 0º 15' North and 0º 29' North of the equator.

5.2.4 Larger Vihiga District

Vihiga district is one of the eight districts in Western Province. It lies between longitude 34, 30 east and 35, 0' east and between 0, and 0 15' North. Emuhaya District with an area of 173.2 sq. km was curved from Vihiga District and is the only region in the larger district that will be traversed by the proposed project. The District currently consists of one political constituency; Emuhaya Constituency. It is divided into two divisions of Luanda and Emuhaya and eight administrative locations, namely; South Bunyore, South-West Bunyore, West Bunyore, Central Bunyore, North Bunyore, North East Bunyore, East Bunyore and Wekhomo. The main market town is Luanda. It is located on Kisumu-Busia highway about 3 km from Maseno.

5.3 Land Use

5.3.1 Larger Kisumu District

Current Kisumu district has four major land uses namely industrial, agricultural, commercial and residential. Only 35% of total land area of the district is used for agriculture and food production, most of which is subsistence farming with maize and sorghum being the most grown crops. A small percentage is used for irrigation and mainly growing paddy rice. 14% is taken up by settlement mainly Winam and Maseno division found within the project area.

The industrial area is situated close to the lake and runs parallel to the lakeshore. The area is served mainly by the railway and acts as the terminus of the two railway lines that connect Kisumu with the rest of Kenya. The average plot sizes in the neighborhoods and estates are quarter acres, which are normally freeholds with titles issued. But in some estates, the residents have an average plot size of 0.8 acres and on a freehold ownership with no titles issued.

5.3.2 Larger Siaya District

High altitude areas forming Yala, Ukwala and Ugunja Divisions have higher rainfall hence suitable for agriculture and livestock keeping. Rivers Nzoia, Yala and Lake Kanyaboli have great potential for irrigation. The low altitude areas of Boro, Uranga and Wagai receive less rainfall and thus are suitable for cotton growing and drought resistant crop varieties.

5.3.3 Butere-Mumias District

The main land use in the district is Agricultural with some industrial use. The district fall within a rich agricultural zone with good soils to support a variety of crops. The main crops are sugarcane, maize, beans, sunflower, bananas, sweat potatoes, tea, coffee, finger millet, and cassava. Sugarcane is the main cash crop in the district. It is grown in four of the five divisions namely; Mumias, Matungu, South Wanga, and Butere.

5.3.4 Larger Vihiga District

Most settlements in the district are formal with people owing land mostly on freehold leases. However with advent of urbanization in the district, some informal settlements have now started cropping up especially at Mbale and Majengo Township. Agriculture is the backbone of the economy of Emuhaya District. Its growth has however, been retarded due to factors such as population increase, land fragmentation and lack of use of modern appropriate technology. Consequently, most of the peasants practice subsistence farming.

5.4 Topography, Drainage and Hydrology

5.4.1 Larger Kisumu District

The topography is divided into two zones that is Kano plains and midland areas of Maseno and Kombewa. East of Kisumu town do have low ridges and rivers occasionally break kano plains. The Kano plains formation due to the structure on the floor of the escarpment renders itself vulnerable to flooding by heavy rainfalls especially the lower plains. The outstanding features include overhanging huge granite rocks at Kisian, the legendery Kit Mikayi which act as a tourist attraction, Lake. Victoria which is the second largest fresh water lake, Kano Plains well known for rice growing and the lake islands e.g. Ndere. The major rivers in the area include Kibos, Awach and Magada both used majorly for irrigation purposes.

5.4.2 Larger Siaya District

The District has three major geomorphologic areas namely; dissected uplands, moderate lowlands and Yala Swamp. These have different relief, soils and land use. The altitude of the district rises from 1,140m in the eastern parts to 1,400m above sea level in the west. There are few hills found in the district namely; Mbaga, Odiado, Akara, Regea and Nyambare hills. Siaya Town lies on an altitude of about 1315 m above sea level with scattered low hills which characterize the rest of the district. The area has an enriched catchment and, the major rivers in the area include Nzoia and Yala.

5.4.3 Butere-Mumias District

The district has a varying topography with a few hills and valleys dissected by a number of rivers and small streams. The lowest part of the district stand at about 1240m above sees level. The major rivers dissecting the district include river Nzoia, Yala, Lusumu, Lairi, Viratsi, and their tributaries. All the rivers flow all year round contributing significantly to the flow into the Nile Basin.

5.4.4 Larger Vihiga District

The equator cuts across the southern tip of the district. It lies on the eastern fringes of the Rift Valley's lake basin. The district has altitude range between 1,300m-1,500m above sea level. Emuhaya falls within the jurisdiction of the Lake Basin Development Authority (LBDA) and its altitude ranges from 1300m in the west to more than 1500m above sea level in the east. The Bunyore Hills which rise above the general level are the source of the only main river (Nasibi) which runs westwards to join Etsaaba that empties its waters into River Yala. The Jordan River which has its source in Maragoli and Nandi Hills bisects Emuhaya from east to west. The destruction of forests on Maragoli Hills has had very adverse effects on the Jordan River and on the livelihood of the whole district.

5.5 Soils and Geology

5.5.1 Larger Kisumu District

The dominated soil type is vertisols. The outstanding features include overhanging huge granite rocks at Kisian, the legendery Kit Mikayi. The granite rocks are exploited to produce building ballets while the soil and river deposits are mined for building sand and moulding bricks.

5.5.2 Larger Siaya District

The geology of the area is composed of old Nyanzian system, forming exposed rocks in the district. These rocks include basalt, desites and rylites. The major soil types found in the district are luvisols, orthic ferralsols and vertoluric phaeozones (black cotton soils) with underlying laterite which are poor soils and cannot produce optimally without organic or inorganic fertilizers. In the Eastern to the Central parts of the District, much of the soils are developed on granite and mudstones with poor moisture retention. These soils range from deep well drained dark red to yellowish red friable soils to moderately deep dark brown firm clays. These soils type have great implications on the development as they will influence construction and excavation costs..

5.5.3 Butere-Mumias District

Granite rocks cover more than a half of the District roughly north of the Bukura –Butere road. Meta-sedimentary rocks of the kavirondian system, on the other than, cover most of the southern part of the area. The ecological rocks give the district a good mining potential with gold prospecting and mining activities having been carried out since 1930s.Large deposits of sand and clay also occur in various parts of the district. The district enjoys a variety of soil types ranging from loam in Mumias,South Wanga, and Matungu., sandy loams, clay loams and well drained loams in Butere, through to shallow sandy loams in Khwisero.

5.5.4 Larger Vihiga District

Major soil found in the district is Rystic acrisols which are well drained and slightly acidic covered with humic top soils from both volcanic and basement complex with yellowish red loams derived from sediments and basement. The soils are generally shallow and rocky and are favorable for oil, root, and cereal and horticultural crop production.

5.6 Climate conditions

5.6.1 Larger Kisumu District

The low land that is the Kano plains receives low minimum annual rainfall of between 100mm-1800mm. It experiences two rainy seasons with the longer rainy seasons falling between august and September(1000mm-1800mm) while the shorter rainy seasons falls between March and May (450mm-600mm).

Mean annual maximum temperature is between 20-30 degrees Celsius while the Mean annual minimum temperature is between 9-18 degrees Celsius. Highest temperature is experienced in December to February and the lowest temperatures experienced in July to September.

5.6.2 Larger Siaya District

The Climate of the District is semi-arid to arid area with very erratic and unreliable rainfall. The area is hot and dry leading to high rate of evaporation. The high rate of evaporation combined with a not reliable rainfall results into limited land use and associated development activities. Rainfall patterns within the entire Siaya District in terms of distribution and amounts are influence by the altitude and wind direction. The main types of rainfall are convectional and relief. The Northern parts of the district which are higher in altitude experience higher rainfall of between 1800-2000 mm. The Southern parts towards the Lake Victoria experience less rainfall of below 800 mm. Rainfall distribution is bimodal but in general terms the seasonal occurrence is continuous making it a bit difficult to distinguish the end of the short and long rains. Humidity levels are relatively high, with mean evaporation of 1800-2000 mm per annum.

Temperatures in the district also vary with altitude just like rainfall. The average temperatures range from 21°C in the northeast to 22.5 °C along the shores of Lake Victoria in the south.

5.6.3 Butere-Mumias District

The district has high rainfall almost throughout the year the annual rainfall ranges from 1,597-2873 mm per year. The maximum temperature is about 29 degrees Celsius.

5.6.4 Larger Vihiga District

The district experiences modified equatorial type of climate with high reliable rainfall of 1800mm to 2000mm. Rains are well distributed and bimodal showing two distinct seasons i.e. long and short rains. Long rains are experienced in April, May and June while a short rain comes in September, October and November. The temperature range of the district is between 14^0c and 32^0c with a mean of 23^0c.

5.7 Biological Diversity

5.7.1 Larger Kisumu District

Flora and Fauna

The district has no gazetted forests and has some wildlife at the Impala National Park.

Aquatic Ecosystems

The aquatic ecosystem of the District is made up of the Lake Victoria which is the second largest and the Kano Plains wetland. The wetland supports several species of fish, hippopotamus, birds and snakes.

5.7.2 Larger Siaya District

Flora and Fauna

The district has no gazetted forests apart from a few hilltops where trees have been planted by the forest department e.g Mbaga hill, Akala hill and Odiedo hill. Several other non-gazetted hilltops in the district are being encroached on by individuals. The area is characterized by increased land degradation due to human related activities mainly excessive logging, destruction of river banks through sand harvesting, sporadic but improper use of agrochemicals, uncontrolled brick making and rock quarrying. There is also poor attitude by the community towards environmental issues and little agro forestry is practiced in the farms. There is still need to gazette some of the hilltops and enforce environmental compliance. Wildlife in the district is found on the Yala River including of crocodiles, Impalas, snakes and a few monkeys.

Aquatic Ecosystems

The district is endowed with wetlands, the largest of which are Yala swamp covering an area of 17,500ha and Anyiko covering an approximate area of 3000ha. The area also has several springs, protected and unprotected especially in the highlands of Yala, Ugenya and part of Karemo.

River Nzoia and Yala traverse the district in Ugenya and Yala Divisions and enter Lake Victoria through the Yala Swamp in Karemo. These rivers are the principal source of water in the district. These rivers are able to facilitate large scale irrigation or power generation. The physical features have a bearing on the overall development potential of the district.

The Yala Swamp used for rice production was developed through land reclamation and was considered as a potential threat to the environmental. However, environmental impact assessment undertaken reveled that with mitigation measures instituted the rice project was viable and of little environmental consequences.

5.7.3 Butere-Mumias District

Flora and Fauna

Butere Mumias district does not have any natural or manmade forests. The last trace of what was known as Misango hills forest has been cleared for either agriculture or settlements. However, there remains a pocket of natural forests like the Nabongo Cultural Shrine which is still protected by the family. Eucalyptus is the most predominant trees species. It is mostly grown on river banks thus posing great danger to the rivers as they are beginning to show signs of drying up as a result of high water intake by the trees species. Wildlife in the district is found on the River Nzoia mainly hippopotamus.

Aquatic Ecosystem

A number of wetland exists in the district as tabulated below. However, most of them are faced with the threat of depletion due to encroachment.

wetlands	**division**	**acreage**
Sindusa	South Wanga	15
wetlands	**division**	**acreage**
Mukhuwa	South Wanga	10
Wang'nyang'	South Wanga	7
Mirere	Matungu	unknown
Namamali	Matungu	unknown
Khalaba.	Matungu	unknown

The sizes and river volumes have been declining in the recent past. A number of factors are responsible for this trend. The annual rain patterns are showing changes with reduced rainfall. The vegetation cover, wetlands and riverine catchments have been degraded considerably due to encroachment for farming and settlement. The poor farming methods have resulted in silting of most rivers and streams.

5.7.4 Larger Vihiga District

Flora and Fauna

Most of the forests in the district have been destructed apart from Maragoli Hills.

Aquatic Ecosystem

Most of the wetlands in the district have been destructed due to encroachment and several have dried.

5.8 Social Setting

5.8.1 Larger Kisumu District

5.8.1.1 Settlement Patterns

The latest national census (1999) showed Kisumu districts have a population of over 504,359 persons, with a growth rate of 2.9% per annum slightly below the national average of 3.2%. Winam has a high population density of 835 persons / km^2; an average household size of 4 persons and it is estimated that approximately 60% of the population lives in informal settlements. About 42% of the population is below 15 years while 73% is below 30 years. Those above 65 plus account for only 3.4% of the population. The district population is very youthful with very high dependency rate of 1:1.18.

Table 5.8.1.1 Population Distribution and density for Larger Kisumu District

Division	Area in km^2	Population	Population Density
Winam	395.0	550,365	887.0
Maseno	168.7	69,336	411.0
Kombewa	192.1	63,969	332.9
Kadibo	162.7	51,901	318.9
Total	918.5	535,571	549.0

Source: district Commissioner's Office, Kisumu 2001.

5.8.1.2 Poverty Status

It is estimated that 53 %(267,310) people live below the poverty line in the district. The economically active population is estimated to be approximately 53% of the total population. The dependency ratio in the town is 1:1.18; this is very high, as every 100 people who are working have to support 118 dependants Unemployment and poverty levels in the area are high, probably owing to its rurally oriented environment.

5.8.1.3 Health Aspect

There are few government health facilities in the district concentrated mainly within Kisumu CBD. Residents from other parts of the district must walk long distances to the government district hospitals, or municipal health centres. Use of alternative or traditional medicines to cater for various health needs is common place.

Several NGOs and CBOs operate in Kisumu district with programmes targeting the following areas: improvement of water and sanitation conditions, poverty alleviation

and addressing the social and economic impacts of HIV/AIDS. A number of organizations including KADET, WEDCO, KWFT and the Undugu Society.

5.8.1.4 Economic Activities

The larger Kisumu district has four main industries: agriculture, fishing, business and manufacturing, and civil service employment. Agriculture is the main source of income for the majority of the people in the hinterland. Cash crops such as sugarcane, rice and cotton are cultivated, in addition to maize and sorghum which are grown for food. Other crops that are grown on commercial basis include beans, bananas, pineapples, citrus, simsim and green grams. Subsistence farmers tend to produce maize, beans, millet, groundnut, sorghum, cassava, and vegetables. Livestock is farmed for meat and milk.

Public sector employment accounts for the largest proportion of the total labour force. The area has seen an increase in the public sector employment due to introduction of university campuses in Kisumu town. Private sector employment in business and manufacturing enterprises and informal sector, have both experienced substantial growth, particularly an increase in the informal transport sector (use of *bodabodas or bicycle- taxis).*

Informal sector activities such as fabrication of small household items, woodcraft, and basketry also provide substantial sources of income. Fishing also constitutes an important industry in Kisumu district as both a major source of food and of household income; employment in the fishing industry accounts for a large proportion of the total labour force, either as fishermen or fishmongers.

In contrast, in the suburban fringe areas, most residents work in the agricultural sector, despite the low productivity of the land. Others engage in informal employments and or provide cheap labour in town.

5.8.1.5 Gender and Equality

Gender disparity in Kisumu district is characterized by a situation in which women bear a disproportionately large share of both domestic and agricultural work. The 1999 census report indicated that women constitute the majority of the labour force in the district, providing mostly unskilled labour. This trend is predicated to remain unchanged over a period of years as more women join the local labour force whilst men migrate elsewhere in search of better employment opportunities.

Despite their considerable contributions to both family income and rural economy, women in the district continue to be faced with inhibitive cultural traditions relating to divisions of labour, lack of access to land and property, exclusion of women in decision making and restrictions on family inheritance. The result is that rather than being able to concentrate on activities that earn income, many women must spend the majority of their time undertaking domestic activities.

5.8.1.6 Tourism, Trade and Industry

The outstanding features include overhanging huge granite rocks at Kisian, the legendery Kit Mikayi, the Lake Victoria and its islands e.g. Ndere National Park which attract tourism to the district.

5.8.1.7 Social Services and Community Facilities

Social services such as community centres, health facilities, educational facilities, housing and social support are inadequate and unevenly distributed. There are large areas of low quality housing with poor access and there are no controls of rent increases, particularly in the low income areas.
Housing quality varies across the municipality like in any other urban centre in Kenya. Housing in the middle and upper class residential areas in Kisumu district is characterized by permanent structures made of brick or stone walls with iron sheet or tiled roofing. Most of the existing social facilities lack basic services such as water, sanitation, electricity and solid waste disposal. The situation is particularly grim in the informal settlements where approximately 60% of the population live.

5.8.1.8 Road Network and Water Supply

Roads
Kisumu's high-income residential areas and formal public housing areas are well served with infrastructure. However, poor road networks are a common feature in low income areas because the planning and capital input is minimal. Road reserves, which are primarily intended for the provision of service corridors for sewerage, storm drainage and piped water networks, are almost non-existent in slum areas. This is partially due the fact that the road networks are unplanned and also that the few planned road reserves have now been encroached upon by developers.

The roads are generally impassable due to poor drainage, inadequate spacing of houses and widespread sewers. Additionally, the roads are not clearly demarcated

and structures have been erected on the road reserves. Handcarts are the main modes of transport to access the main roads.

The suburban fringe areas of Kisumu such as Kibos, Usoma and Kanyakwar lack infrastructure services and the roads are of a similar condition to those in the slums. The road network is of rural standards of approximately 6m wide and encroachment on the road reserves is also common. This will pose challenges in the provision of infrastructure services, such as storm drainage, street lighting, sewage and water.

Water Supply

The water supply system in Kisumu can be categorized into three systems: that provided by KIWASCO, the peri-urban system and the system provided within the informal settlements. The existing water supply facilities provided by KIWASCO are in very poor condition and a large proportion of the population has no access to the service. The coverage of KIWASCO's current water supply network commands 40% - 50% and is mainly concentrated within the built up urban centre. The combined water supply capacity from the two water treatment systems amounts to 20,000m^3/day, which is less that half of the predicted demand of 50,OOOm^3/day (Department of the Environment strategic plan of 04-07). Peri-urban water supply systems consist of small-scale systems, outside the KMC service area, operated by MW&I, CBOs, NGOs, etc. Informal Settlements Systems are a combination of the Municipal System and Peri-urban Systems.

Only 7% (37232) people have access to portable water. The average distance that people cover to access water is 2km. The district water coverage is about 37% leaving the bulk of the population without safe drinking water. This reveals that coverage and accessibility to water in the District is one of the lowest. The quality of water is unacceptable for drinking from all sources except Boreholes and piped which are relatively safe.

5.8.2 Larger Siaya District

5.8.2.1 Settlement Patterns

Settlement patterns in the district follow the agro-ecological zones with the high potential areas having the highest population density in the district. High potential areas include Ukwala, Yala and Ugunja Divisions. Low potential divisions of Wagai, Uranga and Boro Divisions have low population densities.

Table 5.8.2.1 Population distributions by Division and Density (2008) Larger Siaya District

Constituency	Division	Area (km^2)	Density
Alego Usonga	Boro	180.1	286
	Karemo	235.1	355
	Uranga	183.4	245
Ugenya	Ukwala	319.5	336
	Ugunja	198.8	420
Gem	Wagai	193.3	305
	Yala	209.8	433
	Total	**1520**	**342.4**

Source: District Statistics Office, Siaya, 2008

The urban centers of the district including Siaya, Ugunja, Ukwala and Yala lack coordinated planning for towns' growth which has led to unplanned structures.

5.8.2.2 Poverty Status

Poverty levels have generally been erratic over the planned period 2002-2008, moving from 64 per cent in 2003 to 65 per cent and finally settling at 40 per cent in 2005/2006. The main pockets of poverty can be found in the lower parts of Boro, Lower Ukwala, Uranga and Karemo Divisions, which are characterized by low rainfall levels and poor soils. Food poverty reduced to below 35per cent of the population.

5.8.2.3 Health Aspect

The health indicators of the district are some of the worst in the whole country. Based on the 2003 KDHS, the survey show that the district Child Mortality rate is 234/1000, Infant Mortality Rate 135.6/1000, HIV/AIDS prevalence 24 per cent and Crude Birth rate and death rate at 42.7/1000 and 24.4/1000 respectively.

The existing health infrastructure includes;

- 4 Hospitals
- 29 Health centers
- 3 Nursing Homes
- 35 Dispensaries
- 12 Clinics

On the contrary, the distance to the closest health facility is on average 5km a justification for more health facilities at the community level. The total health facilities beds are 735 at all levels. The sector also experiences serious shortage of health person

with doctor to population ratio at 1:52,000. This figure varies continuously due to high turnover of doctors.

5.8.2.4 Economic Activities

The project Area has four main industries: agriculture, fishing, business and financial services and civil service employment. The Agriculture is characterized by a vast arable land of 1263Km^2. The main sources of water are Lake Kanyaboli, river Nzoia and Yala besides numerous streams. The main food crops include maize, sorghum, millet, beans, cowpeas, cassava, sweet potatoes, groundnuts and finger millets while the main cash crop include cotton, rice, sugar cane and groundnuts. The average small scale farm size is 1.02 ha. Irrigation based agriculture is also being practiced in the district characterized by about 200 individual irrigators, 50 small scale community projects of less that 50ha, 26 large scale community projects of more than 50 ha and one Large scale private irrigation project. In the past five years, the sub sector has carried out the following activities; Rehabilitation of Anyiko rice irrigation scheme to increase irrigable area from 50 ha to 80 ha, Rehabilitation of Kamalunga pump fed horticultural project covering 5ha, Implementation of Nyathi pump fed irrigation project, Implementation of Magoya runoff harvesting project covering 10 ha and Training of 200 farmers. Yala Swamp rice project being managed by Dominion Farm limited, has so far reclaimed over 3,600 ha of land which is currently used for rice production.

Livestock production and products like milk, meat, eggs, and honey has also increase in the area. Despite output from poultry and pig meat production has stagnated over the years.

Fisheries development programs have been initiated in the recent past which include; development of aquaculture inventory in the district, recruiting new fish farmers and establishing potential fish farmers, assisting fish farms in rehabilitation of fish farms, restocking of dams and Lake Kanyaboli, surveillance and monitoring and routine fish inspections on fish landing sites. In the period of program implementation, the fishing industry managed to record an increase in the number of fish farmers from 163 at the start of the plan in 2002 to 250 in 2008, increase in fish production and value that stood at 59,000 metric tonnes worth kshs.59 million and also increase in the number of fish ponds to 520 from 227 in 2002.

Public sector employment, account for a small proportion of the total labour force. Private sector employment in business, enterprises and informal sector has both experienced substantial growth. The Industrialization ministry also increased its investment in enterprise development by constructing more *jua Kali* sheds in Ugunja

town and Siaya town to promote micro, small and medium industries. The current labour force of the district stands at 257,848 people, 65 percent of who are employed in the agricultural sub-sector. Limited diversification in the agriculture sub-sector thus continues to limit the income of the sector, therefore the need to strengthen the trade and industry in the district.

5.8.2.5 Education and Training

Education sector has an underlying attachment with the district considering that the district recorded some of the best performances in the 1970s and 1980s followed by a decline in the 1990s and moderate improvements in 2000s. While the sector has picked up, the results being posted at primary and secondary levels show that there is still room to improve performance.

Siaya District KESSP outlines the need to achieve a transition rate of 70 per cent up from 55 per cent in primary schools and 25 per cent in secondary schools by 2012. It also emphasizes on enhancing access, equity and quality from 40 per cent to 70 per cent and provision of physical facilities in the learning institutions by 2010

The current education system in the district has the following characteristics; Administratively the district has 8 existing education divisions and a total of 21 educational zones, 385 primary schools, 92 secondary schools,2 tertiary institution and 2 special education schools and 13 special units in regular primary schools, School enrolment of 20, 751 pupils at ECD level, 154,332 pupils at primary school level, 16,068 students at secondary school level at 2008, a teaching staff establishment of 829 teachers at ECD level, 3365 teachers at primary school level, and 763 teachers at secondary school level.

Critical challenges faced by the education sub-sector include; understaffing in all schools, most schools operate with three or four teachers against eight classes, inadequate and or poor physical facilities in most primary schools, poor management of project funds by school administration, adverse effects of HIV/AIDS on teachers and pupils/students leading to high numbers of orphans, poor motivation among ECD teachers, poor facilitation of education officers to carry out supervisory responsibilities and lack of office accommodation at the district level for effective coordination.

Even though challenges exist, the sector has great potentials arising from; Political goodwill on education that can facilitate community and resource mobilization, Devolved funds mostly CDF and LATF that is available and can be use to facilitate expansion of facilities, Availability of government funds including free primary education funds, FSE, infrastructure development fund and A vibrant local community and development partners.

5.8.2.6 Social Services and Community Facilities

Siaya district has five (5) local authorities which are guided by the local authority Act and mandated to provide quality services by creating an enabling environment for investment and social facilities provision for the residents of the district. Service provision in the district is not impressive since the Local authorities' resource mobilization has not improved significantly over the years, however there has been consistent increase in transfer of LATF from central government.

Several challenges have hampered local authorities in their attempt to improve service provision and local revenue generation besides other core mandates. These challenges include; political interference in identification, planning and implementation of programs, lack of established framework for investment support and opportunities, inadequate resource base to support council program, lack of goodwill to undertake proper physical planning, under developed human resources capacity, lack of social support systems (markets, sewages, dumpsites and social centers), lack of enhanced development and management of social services, low adaptation to changing technology for example computerization of services, and corruption among council officials.

The district data sheet gives about 95% of the total household have mobile telephones, with only three hundred and four (304) fixed line telephone connections in both public and private organization, 80% of the total households have radios and the area has small coverage of internet connections mainly in cyber cafes. The district has local publications which highlight issues of HIV/AIDS, human rights, government and social-economic development issues. The towns in the district are currently exposed to solid waste pollution due lack of solid waste collection and disposal infrastructure and facilities (over 80 per cent of solid waste is not disposed at designated sites).

Over 90 per cent of rural households and 80 per cent of urban households use wood fuel (firewood and charcoal) as a source of energy and the demand of wood fuel is high and continues to rise.

5.8.2.7 Road Network and Water Supply

Road Network

Siaya district has a road network comprising of 97.9km Tarmacked, 400km Graveled and 667.2 kms earth road. However, the road condition in the district is very poor and a challenge to transportation of people and goods especially during rainy seasons. The

cost of transportation is one of the highest mostly during the rainy season and has often led to huge loses especially where perishable produce are involved.

Water Supply

Water resource management of the district is under Lake Victoria North Catchment's Area. The development and management of the water supply system is by the Siaya and Bondo (SIBO) Water and Sanitation who is the water service provider. Siaya has six water supplies clusters including Siaya, Sidindi/Malanga, Ugunja, Sega, Ukwala, and Mauna Dam. Critical issues in facing water supply and availability include: constricting and obsolete water infrastructure, diminishing service delivery, loss of employment opportunity in water sector, general stagnation of the sector and its inability to attract qualified personnel from the labor market and destruction of water catchments areas.

5.8.3 Butere-Mumias District

5.8.3.1 Settlement Patterns

The district has a population of 476,928(1999 census) and an area of 939km^2. Administratively area is divided into urban and country council; urban mainly constitute Mumias and section of Butere.

Table 5.8.3.1 Population Distribution Butere-Mumias District

Division	Population	Urban Population
Mumias	168,743	32,965
Butere	111,637	8,636
Matungu	108,314	414
Khwisero	88,234	0
Total	476,928	45919

Source Population and Housing Census, CBS, 1999

5.8.3.2 Poverty Status

According to the Kenya's economic survey of 2003, the per capita income in the area is Ksh. 50 per person per day (below the UN level of US $ 1/d). 60 % of the population therefore live below poverty line and adult dependency which is characterised by communal way of living is very high as a result of high level of unemployment thus poverty in the area.

5.8.3.3 Health Aspects

The district has some of the worst rankings health indicators in the country with mortality rate of 210 per 1,000. Fertility rate per woman is6.1 children and the average household size is at 6.5.Prevalent diseases in the district include; Malaria, Typhoid, amebiosis, and intestinal parasites/worms, Respiratory Tract Infections, TB, Venereal diseases, skin diseases, measles, arthritis, cancer and elephantiasis.HIV/AIDS prevalence is at a high of 33% while immunization coverage of children is at 65%.

The district has sub-district hospitals, health centre and mission dispensaries. 47.5% of households
take more than 1 hour to the nearest healthcare facility.

5.8.3.4 Economic Activities

The district depends on agriculture for its livelihood. It is the main source of income and employs about 90 per cent of the labour force. Therefore to exploit the full potential of the sector, efforts should be made to strengthen the delivery of services to farmers and improved infrastructure.

The major cash crop in the area is sugarcane which is milled at the nearby Mumias Sugar Company. Most of the inhabitants of the project area have turned their farms into small plantations of sugar cane with the average size of plot holdings of 4 acres in an effort to earn cash from the company. The sugar cane is harvested after 18-24 months, in the meantime therefore, farmers are left without a viable source of income till the next harvesting season. This type of farming has left many families with very small pieces of land that are used for food crops resulting into increased malnutrition in the area especially among children - hence increased family expenditure on health.

Agricultural activities in the district are both for cash crop and subsistence farming. The main cash crop is sugar cane while subsistence crops are maize, millet, cassava, sweet potatoes, beans and bananas. There is very little livestock farming (dairy cattle) in the area. As more farms have been placed under sugarcane, there is no grass available for livestock.

5.8.3.5 Education

5.8.3.6 Gender and Equality

There are many beliefs that hinder the advancement of women relating to land ownership, control and access to productive resources, sharing of household chores and selling of the farm produce. The determinants of gender disparities in the district may

include; culture, environment, economy and government policies among others. The gender concern in the district includes heavy workload for women and girls, and discrimination on land ownership by women and discrimination on access to credit facilities by women and youth.

Women generally have a heavy workload and work for longer hours than men. Women till the land but men get the proceeds. When the income of household is not properly utilized, this discourages the women and the family may lapse into poverty.

5.8.3.7 Tourism, Trade and Industry

5.8.3.8 Social Services and Community Facilities

The area has not developed an elaborate plan for development of provision of social facilities.
Most of the existing social facilities lack basic services such as water, sanitation, electricity and solid waste disposal. The situation is particularly grim in the informal settlement. Social facilities such as schools are inadequate.
The main source of energy in the district remains wood fuel. This has led to clearance of most vegetation to provide fuel wood. Most families have now reverted to use of dry sugarcane wastes as a source of fuel for domestic use.

Use of electricity is still restricted to urban areas, some markets and institutions. The district has a potential for generation of hydro power as it is served by several permanent rivers.

5.8.3.9 Road Network and Water Supply

Road Network

Butere/Mumias district is served by only one all weather road connecting Kakamega and Mumias town. The rest of the roads are not tarmac. Mumias town is linked by road to Kakamega (in east), Busia (west), Bungoma (north), Butere (south). The Butere-Mumias Road which connects the district to Kisumu is currently being upgraded to bitumen standard. The area has a considerably extensive road network but the roads are in a poor state and are often impassable during the rainy season.

Water Supply

Water plays a critical role in the development of the district. At domestic level, water is used for drinking, washing and cooking, it is also used to water livestock. On very small scale, it is used for irrigation mainly on horticultural crops. On average a total of 2,130 households in the district have access to piped water while 31,050 have access to portable water. The number of households with roof catchments stands at roughly 20,000 while the average distance to the nearest portable water point is 500 meters. The district has seven permanent rivers three of which are shared with the neighboring districts.351 wells, 373 protected springs and 184 boreholes.

5.8.4 Larger Vihiga District

5.8.4.1 Settlement Patterns

The total population of Vihiga District as per the 1999 population and housing census was 498,882 and this has been shown to increase to 58,1594 in 2004. Population growth rate in 1999 was 3.3%. The district has a population density of 1033 persons per kilometer square as at 2004. The district is one of the most densely populated rural areas in Kenya given that most of the people here are found in the rural area. The high population density is now forcing people to migrate to other districts to settle there.

According to the 1994-1996 District Development Plan, Emuhaya District had a population of 115,000. This was projected to increase to 150,000 by 2003, a population growth of 3% per annum. However, 1999 figures provided in the PRSP report showed a population of 161,712. Based on the area of 173.2 sq.km, Emuhaya has an average population density of 867 persons per square kilometer. The table below shows the population profiles of the two divisions of Luanda and Emuhaya in Emukhaya districts.

Table 5.8.4.1 1999 population by size and density

Division	No. of house holds	Area/size Sq. km	Density : No. of people /sq. km	Males	Females	Total
Luanda	20904	98.6	938	43096	49365	92462

Emuhaya	15525	74.6	928	31833	37417	69250

5.8.4.2 Poverty Status

The residents of Vihiga have for a long time experienced devastating effects of absolute poverty exacerbated by continued dwindling of resources and increase in the levels of unemployment. In Emuhaya, over 65% live below poverty line. During the 199 census poverty level was 65% and increased to 68% in 2002. Income level in the district is very low and as of 2002 per capita income recorded was 2000. The problem of poverty is further compounded by rampant HIV-AIDS, poor health facilities and infrastructure, declining education and literacy levels, breakdown in social and cultural structures, insecurity, declining land productivity, poor
Poverty and environmental degradation have been identified as the main causes of food insecurity prevalence in larger Vihiga District and especially in Emuhaya District.

5.8.4.3 Health Aspects

The residents of Emuhaya have previously depended on Mbale District Hospital in Vihiga District for their health services. However, since being curved off from Vihiga, it was now up to the new district to build its own hospital in addition to upgrading and equipping the existing health centres and dispensaries distributed throughout the district to cater for the people in the district. Emuhaya Health Centre has been identified for upgrading to a District Hospital.

Malaria, acute respiratory tract infections, diarrhoea, skin diseases, intestinal worms, ear and eye infections and AIDS are the common diseases found among the people of Emuhaya. In addition, cases of malnutrition have also been reported. Mechanisms of coping up with the management and control of the diseases and other health related problems are lacking.

The HIV/AIDS growth rate is about 5.1% of the population of Emuhaya District alone which translates to 10,074 as the number of people living with AIDS. Based on these figures, a number of service delivery points have been established in the various health facilities in the district. The total number of people on antiretroviral therapy (ART) by June 2008 stood at 2,446 (24.3% of those eligible).

5.8.4.4 Economic Activities

In the 1960s and 1970s, Emuhaya was well known for its business activities. Luanda was a business hub between Kenya and Uganda. Luanda market was the biggest market in the entire country after independence and the business nerve centre for Western and Nyanza provinces. The Emuhaya businessmen and women were shrewd and conducted various businesses in western Kenya. They were the first to run bus and lorry transport businesses in western Kenya. They traded in hides and skins and owned big merchant shops in Luanda and other markets like Maseno, Kima, Ebusiratsi/Esibuye, Mwichio, and Munjiti etc. However, business in Emuhaya has declined that currently there are very few businesses that one would say that they are doing well. Most of the earlier booming businesses at major markets have closed down due to major factors such as high levels of poverty, poor infrastructure, insecurity, the lack of entrepreneurship, access to capital, and market awareness. The crime rate in Emuhaya is high and is still on the increase. This has discouraged people from engaging in productive activities. Economic Activities and Employment

The climate of Vihiga has abundance of sunshine and adequate rainfall which make the district soil appropriate for cultivation of variety of agricultural crops and animal husbandry. Farmers in the district are basically subsistence farmers and a bit of fishery, poultry and dairy is also carried out in the district. Farmers in the district are basically subsistence farmers and a bit of fishery, poultry and dairy is also carried out in the district

Most farms in the district are not mechanized as the farms are very small. Human labour is mostly utilized in crop production. Tea is most important cash crop due to organized market and regular payment. Coffee production is on decline as farmers attitude is low due to non- payment of delivered produce.

5.8.4.5 Education and Training

The people of Emuhaya were among the first to be exposed to education during the missionary activities in Kenya when the first mission station was established at Kima (in 1905). Since then, Emuhaya has over 115 pre-primary schools, 92 primary schools and 26 secondary schools. Unfortunately, no post-secondary training college has been established. Despite the achievements, the general trend in education has been declining with some schools registering as low as 200 students in secondary schools compared to 1000 previously.

5.8.4.6 Gender and Equality

There are fundamental challenges of gender equality within the district. Domestic and social burden fall on the women as they are expected to undertake all the domestic

chores like fetching water and looking after the children in addition to feeding their families. The result is that rather than being able to concentrate on activities that earn income, many women spend majority of their time undertaking domestic activities. In regards to land and property ownership women are known to have a say on them.

5.8.4.7 Tourism, Trade and Industry

Vihiga district is not endowed with many industrial activities. There are a few industrial tea factories i.e. Mudete tea factory in sabatia division, a jaggery in Luanda division and nine coffee-pulping factories trotted in all divisions of the district. Other industries are Jua Kali. Trade is done on small scale involving mostly household goods. Some agricultural goods are sold out of the district on minimal scale. Cash crops i.e. tea and coffee are sold to tea factories and co-operating for forward prosing.

5.8.4.8 Social Services and Community Facilities

Most infrastructures are wanting. Provision of water and sanitation is inadequate The district has no sewage infrastructure in the urban areas and people use septic tanks and pit latrines. Although the district is lucky to have many schools that serve the settlement most of the schools luck facilities and this impact negatively on the quality of education. There are also inadequate health facilities in the district.
The district has developed plans to improve power supply and telecommunication in the district.

5.8.4.9 Road Network and Water Supply

Roads

Although there are some existing roads in the settlements their conditions are deplorable, as there is poor road maintenance. This has really hampered transportation in the district. Settlements along major roads in the district are served by public or personal vehicles. However most of the hinterland in the district is served by boda bodas (bicycles taxis). The current infrastructural development in Emuhaya is poor and several access roads and bridges have been earmarked for urgent development. Majority of the roads are in bad conditions and are impassable during the rainy seasons.

Water Supply

Considering the population of Vihiga District in relation to portable water availability, the percentage coverage is still demanding. The major sources of water in the district are:

a. Surface Water – Ministry has installed pumping units to convey water to consumers. They are mainly gazetted water supply covering approximately 15% of the district population mostly in the town and shopping centre.
b. Springs – In the rural areas spring have been constructed to cover approximately 8% of the district.
c. Ground Water – Bore holes are mainly in the institutions covering approximately 5%. Hand dug wells in some market areas and institutions also cover 5%.
d. Rain water- People have not fully exploited this resource. The available roof catchments are mainly in institutions and very few individuals covering 2%.
e. Basing on the above analysis, the total area/ population covered with adequate water in the whole district is approximately 35%. Remaining 65% drink water which is not wholesome.
f. More than 90% of the population of the district walk less than 1km to get to water source.

Majority of the people have no access to clean water and good sanitation.

CHAPTER 6 ANTICIPATED POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

6.1 Introduction

This Section identifies and discusses both negative and positive impacts associated with the proposed Mumias – Rangala – Kisumu transmission line. The impacts are identified according to Phases namely: Construction Phase, Operational Phase and Decommissioning Phase. The project being a national development agenda in the energy sector has immense benefits that could save the country losses in terms of power rationing due to increased number of customers across the country. However poor planning of the project could also affect the environment that supports millions of

Kenyans through the project potential hazards that the project could pose to the public like pollution of natural and atmospheric resources. The project impacts are classified as positive or adverse.

This chapter focuses on the impacts likely to occur as a result of the proposed construction works on the Mumias – Rangala – Kisumu 132 kV Transmission Line. For ease of reference, the impacts due to or affecting certain elements during construction and operation are presented in matrix form in the Environmental and Social Management and Monitoring Plan

6.2 Assessment of Impacts of the Proposed Development

The table below provides a snapshot view of the anticipated impacts (both positive and negative) of the proposed project:

Environmental & Social Impact	Negative /Positive	Direct /Indirect	Temporary /Permanent	Major /Minor	Occurrence	
					Construction	Operation
Socio-Economic Impacts						
Electricity supply	Positive	Direct	Permanent	Major		X
Creation of employment	Positive	Direct & indirect	Temporary /Permanent	Major	X	X
Security	Positive	Direct	Permanent /Temporary	Major	X	X
Revenues to Government	Positive	Direct	Permanent	Major	X	X
Development of Business opportunities	Positive	Direct	Temporary /Permanent	Major	X	X
Growth of agro-based industries	Positive	indirect	Temporary /Permanent	Major	X	X
Interference with cultural set-up	Negative	Direct	Permanent	Minor /Major	X	X
Interference with socio-economic activities due to relocation & resettlement	Negative	Direct & indirect	Temporary /Permanent	Major /Minor	X	X
Loss of property	Negative	Direct	Temporary /Permanent	Major /Minor	X	X
Interference with radio, television and	Negative	Direct	Temporary /Permanent	Major /Minor	X	X

Environmental & Social Impact	Negative /Positive	Direct /Indirect	Temporary /Permanent	Major /Minor	Occurrence	
					Construction	Operation
telecommunication frequency						
Visual Impact	Negative	Direct	Temporary /Permanent	Major /Minor	X	X
Biophysical Impacts						
Micro-climate	Positive	Indirect	Permanent	Major		X
Clearance of vegetation cover	Negative /Positive	Direct	Temporary	Major	X	X
Increased solid waste	Negative	Direct	Temporary	Minor	X	X
Interference with water quality	Negative	Direct	Temporary	Minor	X	
Increased demand of sanitation	Negative	Direct	Temporary	Major	X	
Natural habitats	Negative	Direct	Permanent /Temporary	Minor	X	X
Health and Safety Impacts						
Air pollution GHG	Negative	Direct	Temporary	Major/ Minor	X	X
Noise and Vibrations	Negative	Direct	Temporary	Major/ Minor	X	X
Dust	Negative	Direct	Temporary	Minor	X	X
EMF Public Health and psychological perception	Scientifically impacts on health not established and psychological impacts will be relative depending on project understanding					
Increase in social vices	Negative	Direct	Permanent /Temporary	Major /Minor	X	X
Injuries and accidents to animals and workers	Negative	Direct	Temporary /Permanent	Major	X	X
Clean Energy	Positive	Direct	Permanent	Major		X
Development of other sector such as health, education, industries among others	Positive	Direct/ Indirect	Permanent	Major		X

6.3 Potential Positive Impacts

- Possibility of connecting more households and institutions to the national grid;
- The major impacts of the transmission line will be reduced poverty and improved living standards within and beyond the district served. These will result from employment creation (direct and indirect) and increased investments especially in value addition processing of primary products.
- Improved incomes and poverty reduction will also occur through provision of opportunities to invest in heavy industries and facilitate direct and indirect employment
- Job creation for both skilled and unskilled labour for vegetation clearing, menial works, drivers and machine operators. The total number of local jobs created by this project as will depend on availability of labour and policies of the contractor and KPLC while casual wages range from Kshs. 250 to 800 per day
- Boost the economy through investment and expansion of businesses and income generation opportunities. This will increase productivity and competition
- Connect more households and institutions with electricity thereby providing household level lightning system. This will in effect create market for electronic goods
- Reduce power problems/outages especially Kitale town and its neighbourhood.
- Improve security in the beneficiary communities through better lighting.

The potentially adverse impacts have been discussed in greater detail the following section:

6.4 IMPACTS ON THE BIOPHYSICAL ENVIRONMENT

6.4.1 Terrestrial Habitat Alteration

6.4.1.1 Construction phase

The construction of transmission line rights-of-way will result in alteration and disruption to terrestrial habitat, including impacts to avian species and an increased risk of forest fires. Right-of way construction activities will transform habitats, depending on the characteristics of existing vegetation, topographic features, and installed height of the transmission lines. Examples of habitat alteration from these activities includes fragmentation of forested habitat; loss of wildlife habitat, including for nesting; establishment of non-native invasive plant species; and visual and auditory disturbance due to the presence of machinery, construction workers, transmission towers, and associated equipment. The construction phase is also expected to be associated with woody species removal along the proposed way-leave area resulting in destruction of species habitat or its simplification. Vegetation clearing will be done manually by use of *pangas* and slashers. Where there are big trees, portable power saw mills (petrol powered) will be used

The transmission line is passing through partially settled areas which do not possess any critical habitats. The numerous but dispersed hills are known to be habitats which may be termed as IBA's (Important bird Areas) at a landscape level. These scattered hills are important for conservation and preservation of raptors and their habitats. The transmission line is expected to affect a narrow width and therefore resulting to narrow vegetation denudation.

The habitat through which the transmission line passes is widespread and well represented within the landscape and therefore cannot be termed critical. Therefore, the construction of the transmission line will not have injurious effects to the habitat owing to its widespread nature and similarly will not have significant impacts to wildlife and human communities dependent these habitats. In summary the proposed project will not affect the integrity and ecological functions of the habitats traversed by the transmission line

6.4.1.2 Operation and Maintenance

Unchecked growth of tall trees and accumulation of vegetation within rights-of-way may result in a number of impacts, including power outages through contact of branches and trees with transmission lines and towers; ignition of forest and brush fires; corrosion of steel equipment; blocking of equipment access; and interference with critical grounding equipment. Regular maintenance of rights-of-way to control vegetation will involve the use of mechanical methods, such as mowing or pruning machinery that may disrupt wildlife and their habitats, in addition to manual hand clearing

6.4.2 Alteration of Aquatic Habitats

6.4.2.1 Construction

The route of the proposed transmission line crosses several rivers and streams. Soil erosion from construction activities may result in siltation of watercourses. This impact is however expected to be minimal and the removal of riparian vegetation temporary. At each tower site there will be four holes dug to a depth of approximately 5m; no major earthworks will be involved in this project.

6.4.3 Wildlife Species

6.4.3.1 Construction

The construction phase is not expected to have significant negative impact on wildlife owing to the short width of the way-leave and low wildlife density in the line route. Most of the wildlife in the general area is well protected in near-by conservation areas under the management of Kenya Wildlife Service and the County Councils. The behaviour of wildlife

species in this area precludes any significant negative impacts although some species may be affected during the construction phase.

6.4.3.2 Power line associated avifauna mortalities

Studies have shown that power line collision victims are birds of prey, ravens and thermal soars. Although power line designs have been suggested to be related to the possibility of collision accidents, there are no data available to support the hypothesis (Janss, et al., 2000). However, design of power line and pylons are important in determining the risk of avifauna death from electrocution, where for instance non-conductive pylons having less mortality incidences compared to metal pylons. Collision and electrocution incidences are species specific and depend on the species behaviour. Raptor for instance are known to have territories which may restrict their ranging behaviour therefore reducing chances of power line mortalities compared to waterfowls e.g. the cranes. Eagles are at low risk due to their solitary behaviour compared to flocking birds like the storks, cranes and vultures. However, eagles frequently use pylons for roosting, feeding and hunting resulting to electrocution. Flight performance is an important factor determining the chances of collision with power line where for instance birds with low wing loading are less exposed to electrocution risk, due to their agility. Poor visibility increases possibility of collision and electrocution accidents.

6.4.4 Soil

6.4.4.1 Construction

During the construction phase, the contractor is expected to loosen the soil along the way-leave for the pylons which may lead to soil erosion. Similarly, the way-leave will serve temporarily as a road to transport material between construction sites. The exposed soil will be prone to wind and water erosion during the construction phase. The soil problems may be exacerbated by topography of some areas, especially across riverine and dry river-beds, mainly during the wet season.

6.4.5 Air

6.4.5.1 Construction

During the process of construction, some dust will be generated from the few project vehicles (5 lorries and 4 off-road vehicles) as they make their way through the mainly murram roads leading to project sites. This dust may not be significant in the low population density areas but may become a nuisance as the vehicles cross the areas of dense settlements where the transmission line will pass close to houses and the road surface is murram which is in just a

fair condition (The foundations for the lattice structures shall be dug manually and so will be the concrete casting for their bases.

6.4.6 Water Quality

6.4.6.1 Construction and Operation

The proposed project will not affect local water resources during both construction and operation phases of the project. During construction, water demand will be minimal.

6.4.7 Hazardous Substances

6.4.7.1 Construction

Use of engines (construction vehicles) and other equipment on site has the potential to lead to spillage of petroleum products. It is however worth noting that the risks of a major oil spillages occurring are minimal because only a few construction vehicles (3-5no trucks and 4no 4WD vehicles) will be needed in the construction of the transmission line. Further, the maintenance of these vehicles will be undertaken at authorized garages and not on site. The impact during construction will not be significant.

6.4.7.2 Operation

Highly-refined, mineral insulating oils are used to cool transformers and provide electrical insulation between live components. They are typically found in the largest quantities at electrical substations and maintenance shops. Sulfur Hexafluoride (SF_6) will also be used as a gas insulator for electrical switching equipment and in cables, tubular transmission lines, and transformers. However, the use of SF_6, a greenhouse gas with a significantly higher global warming potential (GWP) than CO_2, should be minimized. In cases the gas is used for applications involving high voltages (>350 KV), equipment with a low leakage- rate (<99 percent) should be used.

6.4.8 Fire Risk

6.4.8.1 Operations

During operations, voltage power can cause a fire risk in the event of electrical faults with equipment. Bat and bird collisions with power lines may result in power outages and fires. Also, if underlying growth is left unchecked, or slash from routine maintenance is left to accumulate within right of way boundaries, sufficient fuel can accumulate and as such promote forest fires.

6.5 IMPACTS ON HEALTH AND SAFETY

The health and safety impacts of the presence of high-voltage power lines are detailed briefly in the following sections.

6.5.1 Noise

6.5.1.1 Construction

There will be noise and vibrations generated during the construction phase but it will be no different from that on any other typical construction site. The noise impact during construction is expected to be negative and short-term. The major receptors are expected to be the construction workers as well as any immediate neighbouring residential premises. Sources of noise will be trucks and the off-road vehicles in transit, use of compressor to break hard ground and the use of motorized chain saws for vegetation clearing.

The noise from the project vehicles is only significant in areas where the proposed line passes through dense settlements such as close to the towns' neighborhoods. The noise from compressors will only be significant where hard ground breaking is carried out close to settlements. Noise from the motorized chain saws will only be experienced in the wooded areas but it will not be a significant impact since the density of settlements is not very high. Impacts of noise include noise-induced hearing loss for the project employees and nuisance for the affected settlements.

6.5.1.2 Operation

The acoustic noise produced by transmission lines is greater with high voltage power lines; high voltage power lines (400-800kV) generate discharges producing what is known as a "corona effect" which in turn gives rise to crackling and frying noises that may even be audible in dry weather. With this project noise impact will be insignificant as it involves the installation of 132kV voltage lines.

6.5.2 Aircraft Navigation Safety

6.5.2.1 Construction and Operation

In Kenya, KCAA gives approval for tower heights to ensure safety of aircraft. Power transmission towers, if located near an airport, air strip, or known flight paths, can impact aircraft safety directly through collision, or indirectly through radar interference.

The tower heights for the tower structures to be erected are approximately 30-40m. Initial consultation with KCAA pointed out that that are about 10-15 airstrips within the study area; additionally there could be military installations also.

Based on consultations with KCAA officials, a full clarification on whether or not the facilities mentioned will be impacted by the project is yet to be established; clarification needs to be obtained through an official request by the Proponent to the Director General.

6.5.3 Electromagnetic Fields (EMFs)

6.5.3.1 Operation

Perhaps the greatest fear expressed by people living in very close proximity to high-voltage power lines is exposure to EMFs. Scientific research on the effects of EMFs on public health has not demonstrated clearly the existence of a significant risk, nor has it proven the complete absence of risk. The finding and conclusions are that the field strength on a 132 kV line at the distance of exposure (heights of 40-40m is less than what one would ordinarily be exposed to in a domestic setup. In this context, prudent avoidance is recommended.

6.5.4 Maintenance of Transmission Line System

6.5.4.1 Construction and Operation

The rights-of-way require annual maintenance to remove bush and tree growth beneath power lines so that towers and lines can be maintained. No phytocides will be used for clearing of vegetation and instead both manual (machetes and slashers) and power saws will be used. The impacts of these operations include physical hazards such as injuries sustained from the tools/equipment, ergonomical problems from poor working posture, dust inhalation, among others.

6.5.5 Electrocution from Live Power Lines

6.5.5.1 Operation

Lattice structure or conductor cable failure is the most catastrophic event that could occur in the operation of an electricity transmission system. It involves a sudden break in the structure and the rapid, uncontrolled exposure to medium to high currents leading to electrocution or loss of property through fires ignited by the fallen cables. Hazards most directly related to power transmission lines and facilities occur as a result of electrocution from direct contact with high-voltage electricity or from contact with tools, vehicles, ladders, or other devices that are in contact with high-voltage electricity during maintenance activities.

6.5.6 Physical Hazards

6.5.6.1 Construction and Operation

The main aspects to be considered in site preparation activities include manual clearing of bushes (using slashers and machetes) for access through which conductor cables will be strung, manual preparations for the foundations of the lattice structures (pylons), stringing and maintenance of conductor cables at heights of approximately 30 – 40m and breaking of hard ground using compressors.

During the manual clearing of vegetation using slashers and machetes, excessive or prolonged use leads to 'white hand syndrome' which affects the palms of the worker to an extent that they are unable to engage in further physical tasks involving the hands. The manual digging for the foundations of the lattice structures is a highly physical and energy sapping activity. Prolonged digging and overexertion will lead to ergonomic issues relating to pains in the lower back and in the joints (of legs and hands/arms). Stringing of conductor cables during construction or maintenance activities is a function of work at height. Potential injuries may result from slips and falls from heights of between 30 – 40 m which is the average height of the line in this project. Such falls will cause fractures that could lead to loss of ability to use limbs normally and in extreme cases fatalities. The use of compressors in the areas of hard ground, will subject the project employees to Whole-body vibrations that may impair functions of the chest, abdominal organs, and musculoskeletal systems, contribute to fatigue and decrease concentration.

6.6 SOCIO-CULTURAL IMPACTS

6.6.1 Community Public Participation

The Public consultation process involved visiting the areas along the 97 kilometers stretch along which the Way leave for the transmission line will be sought. The stakeholders were identified and consulted with the objective of describing the existing socio-economic conditions within the proposed project area of influence and the immediate surroundings.

Public consultations were conducted from 7th October 2009 to 11th November 2009. The specific objectives of the consultation process were:

- To create awareness on the proposed project
- To ask the local residents especially the Interested and Affected Parties about the problems they anticipate with the project and how these can be overcome
- To consult and gather recommendations from the local administration e.g. DC, D.Os, Chiefs, Assistant Chiefs, Councilors, Village Elders and communities that have a stake in the project
- To provide an opportunity to all the communities in the areas where the proposed transmission line is expected to pass to raise issues and concerns pertaining to the project, and allow the identification of alternatives and recommendations.

6.6.2 Data Collection Methodology

The social assessment team used both qualitative and quantitative techniques to collect data and information on the social and economic status of the community and area along the proposed 97 kilometer transmission line would pass. These included:

- A detailed desk study to establish and describe the socio-economic conditions of Kisumu, Siaya, Vihiga and Mumias districts. This secondary information was obtained from District Development Plans and the Poverty Reduction Strategy Papers. Most of these plans were drafts for the years 2008-2012.
- Key Informant Interviews and Semi-Structured Interviews were conducted with the D.Os, Chiefs, Assistant Chiefs, Councilors and Village Elders.
- Open-ended questionnaires were administered to obtain views about the proposed project and its perceived impacts from households along the proposed transmission line. For those households which were on the proposed transmission line and not reachable to be interviewed, the neighbours gave the team an estimated number of households, names and the villages.
- Public Barazas which were organized and chaired by the Chiefs and Assistant Chiefs.
- Transect walks, where possible were conducted to confirm the information from the discussion and observation were made on physical and environmental conditions.

Generally, all those consulted had no prior knowledge of the proposed project. The majority of the people consulted along the project corridor have positive attitude toward the project and approved the proposed project for they recognize the importance of electricity in development. The local leaders and other opinion leaders also gave the project their support. Majority want to know when it will start because they see an opportunity to gain financially due to the current harsh economic situations. The local population is willing to participate in ensuring success of the proposed project in a number of ways such as:

- Offering their land in exchange of “good” money
- Supplying both unskilled and skilled labour for the project
- Providing market for the electricity
- Reporting electric faults and vandalism
- Creating awareness among community members on dangers of electricity and tempering with electricity lines

The key issues specifically raised by the stakeholders consulted are as follows
Timeframe of the project

- Compensation process and values of property
- Need for adequate awareness creation and social engineering before and during project construction

- Employment of the local youth
- Putting appropriate signs “Danger” on each electric installation for information to residents
- Diversion of roads during construction which may reduce business
- Design route of the project to follow, as much as possible, uninhabited areas to ensure minimal disturbance, relocation, costs and electricity related accidents
- Clearance corridor required for the transmission line which is about 15m on either side of the centre line totaling to 30 meters. Each post will require 3mx3m for the foundation, each being 10 feet apart while depth of towers will go 2m depending on the soil type.
- How communities will benefit from the project in other ways other than power supply
- Compensation procedures and legal redress procedures through the land tribunal
- For those who will be relocated, what security will the people have over the new property that they will move to as some influential people may claim the property and fence it off
- The actual beneficiary to be compensated and documents required
- Actions to be taken if the transmission line crosses public facilities such as schools
- The dangers of having the power line pass near your home or on your land and the compensation provided if injured by the power line
- How will such the project affect the environment?
- Is there alternative power planned for provision before the proposed transmission line is completed

6.6.3 Perceived Challenges to the proposed project

The correspondents mentioned the following as being the challenges that the proposed project may be faced during construction, commissioning and operation:

Challenges during construction:

- Poor topography
- Inaccessibility and transportation of materials
- Land disputes in the acquisition process
- Inadequate skilled manpower
- Clearing of vegetation
- Language barrier
- Poor weather

Challenges during commissioning:

- Conflict over allocation of job opportunities
- Insecurity (vandalism, breakages and theft of cables/wires)

6.6.4 Visual Amenity

6.6.4.1 Operation

Power transmission lines and associated accessories are necessary to transport energy from power facilities to residential communities, but may be visually intrusive to local residents. Visual intrusion as a result of the transmission line and towers was however not a major issue of concern based on the public consultations held with communities in the project areas.

6.6.5 Spread of Disease

6.6.5.1 Construction

During the construction phase of the project, construction personnel brought in from outside the community may be infected with HIV/AIDS and other sexually transmitted diseases, and could introduce these diseases to the community members they interact with.

6.6.6 Induced Settlement

6.6.6.1 Construction

During construction works, there will be some direct employment opportunities for both skilled and unskilled labour. Furthermore, indirect employment opportunities are bound to arise from the provision of services to the construction teams. Construction teams have the potential to cause natural resource degradation in terms of accelerating tree felling, and vegetation clearance at the location, sewage, solid and oil/petroleum wastes are also usually produced at the camps.

6.6.6.2 Operation

The improved power supply will lead to further economic growth particularly in North West Kenya region; this will be coupled with subsequent growth in settlement in the area. There are a number of environmental and social issues that emanate from such increase in population, such as erection of unplanned structures, increased demand for sanitation and water supply, cultural disruption, among others.

6.6.7 Land Acquisition and Resettlement

6.6.7.1 Construction and Operation

The identified line route will lead to physical displacement of people, loss of shelter, assets, income sources and livelihood, and restriction of access to economic resources. World Bank

OP 4.12 - Involuntary Resettlement is triggered by this project and therefore requires the preparation of a Resettlement Action Plan (RAP).

- Involuntary resettlement under development projects, if unmitigated, will give rise to severe economic, social, and environmental risks;
- Production systems will be dismantled;
- Relocated groups will face impoverishment when their productive assets or income sources are lost, especially if relocated to environments where their productive skills may be less applicable and the competition for resources greater;
- Community institutions and social networks will be weakened, kin groups will be dispersed; and
- Cultural identity, traditional authority, and the potential for mutual assistance will be diminished or lost.

The Proponent is in the process of developing a Resettlement Action Plan (RAP) for the proposed 132kV transmission line. The RAP study has so far identified those persons within the project area who may be displaced as a result of the project, and those persons who may have to relinquish their land to the project.

The RAP outlines the guiding principles to be followed when involuntary land acquisition is undertaken, in order to minimize the adverse impacts to PAPs and enhance positive impacts. It applies to all displaced persons regardless of the total number affected, the severity of the impact and whether or not they have legal title to the land.
The RAP aims to promote participation of displaced people in resettlement planning and Implementation, and assists displaced persons in their efforts to improve or at least restore their incomes and standards of living after displacement. This is in compliance with the World Bank's OP 4.12 which states that: *"Where large-scale of population displacement is unavoidable, a detailed resettlement plan, timetable, and budget are required. Resettlement plans should be built around a development strategy and package aimed at improving or at least restoring the economic base for those relocated. Experience indicates that cash compensation alone is normally inadequate. Voluntary settlement may form part of a resettlement plan, provided measures to address the special circumstances of involuntary resettlers are included. Preference should be given to land-based resettlement strategies for people dislocated from agricultural settings. If suitable land is unavailable, non land-based strategies built around opportunities for employment or self-employment may be used".*

CHAPTER 7 IMPACT MITIGATION MEASURES

7.1 Introduction

This chapter focuses on measures that can be incorporated into the design, and taken during the improvement works and operation stages of the project in order to mitigate the negative environmental impacts and enhance the positive ones described in chapter 6.

7.2 MITIGATION MEASURES: BIOPHYSICAL ENVIRONMENT

7.2.1 Terrestrial Habitat Alteration

7.2.1.1 Construction

- Re-vegetation of disturbed areas with native plant species;
- Use human labour as opposed to heavy machinery to avoid herbaceous layer destruction and exposure of the soil to wind and water erosion
- Undertake selective clearance by removing tall woody species leaving saplings, for quick regeneration of vegetation along the way-leave
- Give the community priority on use of the removed vegetation for wood-fuel, construction or any other purpose.

7.2.1.2 Operation and Maintenance

- Implementation of an integrated vegetation management approach. The selective removal of tall growing tree species and the encouragement of low-growing grasses and shrubs is the common approach to vegetation management in transmission line rights-of-way;
- Avoiding clearing in riparian areas;

- Vegetation management should not eradicate all vegetation; excessive vegetation maintenance may remove unnecessary amounts of vegetation resulting in the continual replacement of successional species and an increased likelihood of the establishment of invasive specie

7.2.2 Aquatic Habitat Alteration

7.2.2.1 Construction

- Minimizing clearing and disruption to riparian vegetation.

7.2.3 Wildlife (Power line-associated Avifauna Mortalities)

The following mitigation measures address the issues on avifauna electrocution and collision along the proposed power line.

- To minimize collision, undertake wire-marking to alert birds to the presence of power line, allowing them time to avoid the collision.
- Build raptors platforms on top of pylons for roosting and nesting
- Undertake monitoring data on avifauna electrocuted along the proposed transmission line (responsible agencies KWS, NMK, Nature Kenya, NGO's, CBO's,)

7.2.4 Soil

7.2.4.1 Construction

- Soils excavated for the erection of pylons should be used for re-filling and should not be left exposed to wind or water for long periods
- The contractor should avoid steep terrain during the transportation of construction material by using alternative routes or use light vehicles where appropriate
- Riverine vegetation should be minimally disturbed during the construction phase to reduce soil erosion and safeguard riverbank protection
- Re-plant degraded areas with local species common in the area to complement natural vegetation regeneration to improve ground cover.

7.2.5 Air Pollution

7.2.5.1 Construction

- Regular maintenance of construction vehicles, plant and equipment to reduce emissions
- Control speed of construction vehicles to minimize generation of dust on access roads
- Prohibit idling of vehicles on site to reduce emissions.

7.2.6 Solid Waste

7.2.6.1 Construction

- The engineer should ensure that the contractor disposes any remaining solid wastes such as metals, paper, plastics, etc. away from the site to an approved disposal site.

7.2.7 Hazardous Substances

7.2.7.1 Construction

- Use of designated areas for repair and maintenance of vehicles (e.g. local licensed garages) and powered machinery to avoid fuel and lubricant spills at the construction site.

7.2.8 Fire Risk

7.2.8.1 Operations

- Carry out routine thinning, slashing, and other maintenance activities, within and adjacent to Rights-of-way in order to minimize the risk of fire.

7.3 MITIGATION MEASURES: HEALTH AND SAFETY

7.3.1 Noise

7.3.1.1 Construction and Operation

- Noise reduction technologies - silencers/mufflers and provision of hearing protection devices for workers using equipment such as power saws (for vegetation clearing) and compressors.
- Strict observance of the established way leaves or right of way.

7.3.2 Maintenance of Power Line Rights-of-way

7.3.2.1 Construction and Operation

- Workers engaged in the clearing of vegetation should be provided with PPE (e.g. gloves, boots, dust masks) to protect against injuries and infections.

7.3.3 Electrocution from Live Power Lines

7.3.3.1 Operation

- A maintenance system must be put into place to ensure the physical integrity of structures is maintained lest they give in to vagaries of weather and other physical factors.
- Deactivating and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines;

- Ensuring that live-wire work is conducted by trained workers with strict adherence to specific safety and insulation standards.
- Workers should not approach an exposed energized or conductive part even if properly trained unless: the worker is properly insulated from the energized part with gloves or other approved insulation; or energized part is properly insulated from the worker and any other conductive object; or, the worker is properly isolated and insulated from any other conductive object (live line work).
- Ensuring that all electrical safety precautions are adhered to and a tier system of authorization to handle or access energized parts will mitigate against accidental electrocution.

7.3.4 Falls from Height

7.3.4.1 Construction and Operation

- Testing structures for integrity prior to undertaking work;
- Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures;
- Inspection, maintenance, and replacement of fall protection equipment;
- Establishment of criteria for use of 100 percent fall protection (typically when working over 2 meters above the working surface, but sometimes extended to 7 meters, depending on the activity). The fall protection system should be appropriate for the tower structure and necessary movements, including ascent, descent, and moving from point to point;
- Installation of fixtures on tower components to facilitate the use of fall protection systems;
- Provision of an adequate work-positioning device system for workers. Connectors on positioning systems should be compatible with the tower components to which they are attached;
- Hoisting equipment should be properly rated and maintained and hoist operators properly trained;
- Safety belts should be of not less than 16 millimeters (mm) (5/8 inch) two-in-one nylon or material of equivalent strength. Rope safety belts should be replaced before signs of aging or fraying of fibers become evident;
- When operating power tools at height, workers should use a second (backup) safety strap;
- An approved tool bag should be used for raising or lowering tools or materials to workers on structures

7.3.5 Physical Hazards

7.3.5.1 Construction and Operation

- Appropriate hand and foot protection (PPE) during the manual clearing of vegetation
- Adopting ergonomic work flow designs that fit physical tasks to employees and not vice versa while maintaining a balance with productivity
- Training of workers on how to identify dangerous vibrations of the compressor

7.4 MITIGATION MEASURES: SOCIO-CULTURAL

7.4.1 Visual Impact

7.4.1.1 Operation

- To mitigate the visual impact of power distribution projects, the following mitigation measures should be implemented:
- Extensive public consultation during the planning of power line and power line right-of-way locations;
- Location of high-voltage transmission and distribution lines in less populated areas, where possible.

7.4.2 Spread of Disease

7.4.2.1 Construction

- Provide counseling and testing for HIV/AIDS to incoming construction personnel
- Strengthen advocacy through awareness training in HIV/AIDS and other STDs; encourage the use of preventive measures like condoms
- Avail condom dispensers to construction staff.

7.4.3 Land Acquisition and Involuntary Resettlement

7.4.3.1 Construction and Operation

Loss of land and crops will be compensated; the Commissioner for Lands determines the amount of compensation to be paid for private land. A Resettlement Action Plan (RAP) study has been commissioned for the proposed project. The RAP has been carried out in accordance with the legal framework of the Government of Kenya, and in line with the requirements of the World Bank's OP 4.12 (Involuntary Resettlement) and the IFC Performance Standard 5 on Land Acquisition and Involuntary Resettlement as required. Surveys are being conducted to establish which properties (land and buildings) lie within the zone affected by the proposed project. The exact number of PAPs affected and the types of properties affected will be determined. In addition, potential sites for the relocation of the PAPs will be identified, and an estimation of the total cost for the RAP obtained. The

resettlement plan or resettlement policy framework shall include measures to ensure that the displaced persons are:

- Informed about their options and rights pertaining to resettlement;
- Consulted on, offered choices among, and provided with technically and economically feasible resettlement alternatives; and
- Provided prompt and effective compensation at full replacement cost for losses of assets attributable directly to the project.

CHAPTER 8 ENVIRONMENTAL & SOCIAL MANAGEMENT AND MONITORING

8.1 ENVIRONMENTAL AND SOCIAL MANAGEMENT

Following the desk studies, field investigations and public consultations undertaken in this study, an Environmental and Social Management Plan (ESMP) has subsequently been developed. The ESMP provides a general outlay of the environmental and social aspects, potential impacts, mitigation measures, performance indicators, monitoring means and frequency, responsibility for monitoring and associated [estimate] costs.

The responsibility for the incorporation of mitigation measures for the project implementation lies with the Supervising Engineer, who must ensure that the Contractor implements all specified mitigation measures. In order for the Contractor to carry out environmental management activities during construction, the Contractor should draw up an environmental management plan of his own to show how he will address the mitigation measures during the construction period. The Supervising Engineer is responsible for assessing the Contractor's environmental management plan.

8.2 MONITORING ENVIRONMENTAL AND SOCIAL PERFORMANCE

Monitoring is a long-term process, which should begin the start of construction of the Transmission Line and should continue throughout the life of the project. Its purpose is to establish benchmarks so that the nature and magnitude of anticipated environmental and social impacts can be continually assessed. Monitoring involves the continuous or periodic review of construction, operation 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.

Simple monitoring systems should be set up during construction by the Supervising Engineer and Contractor and during operation by the Proponent, so that potentially environmentally problematic areas can be detected well in advance and the appropriate remedial action taken. This could simply be a checklist of items that need to be inspected as a matter of routine, or periodically, depending on the nature of the aspect. The types of parameters that can be monitored may include mitigation measures or design features, or actual impacts. In some cases, monitoring is fairly straightforward and can be done as part of routine or periodic maintenance. However, other parameters, particularly those related to socio-economic and ecological issues can only be effectively assessed over a more prolonged period of say 3 to 5 years.

The tables below overleaf summarize the ESMP for the proposed project. It describes parameters that can be monitored, and suggests how monitoring should be done, how frequently, and who should be responsible for monitoring and action.

8.3 Project design and Construction

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 project equipment installation and operational phases are outlined in table below

8.3.1 Design and Construction Phase

Potential Impact	Proposed Mitigation	Monitoring Means and frequency	Responsibility for Monitoring	Performance Indicator	Cost (Ksh)
Terrestrial Habitat Alteration	• Re-vegetation of disturbed areas with native plant species; • Undertake selective clearance by removing tall woody species leaving saplings, for quick regeneration of vegetation along the way-leave	Routine inspection	Supervising Engineer and Contractor	Re-vegetation of disturbed areas	Re vegetation approx. 100 per sq m.
Aquatic habitat alteration	• Minimizing clearing and disruption to riparian vegetation.	Inspection, routine	Design Engineer and Contractor	-Siltation of soil in rivers from construction activities. -Physical water quality	Routine Inspection Internal cost
Power line related avifauna mortalities	• To minimize collision, undertake wire-marking to alert birds to the presence of power line, allowing them time to avoid the collision. • Build raptors platforms on top of pylons for roosting and nesting	Inspection	Design Engineer, Supervising Engineer	Physical structures	Wire markers @ 5000 Platforms @ 5000
Soil erosion	• Soils excavated for the erection of towers should be used for re-filling and should not be left exposed to wind or water for long periods • The contractor should avoid steep terrain during the transportation of construction material by using	Inspection Routine Maintenance	Contractor Supervising engineer	Status of ground cover in constructed areas	Re-vegetation approx. 100/- per sq m.

	alternative routes or use light vehicles where appropriate • Riverine vegetation should be minimally disturbed during the construction phase to reduce soil erosion and safeguard riverbank protection • Re-plant degraded areas with local species common in the area to complement natural vegetation regeneration to improve ground cover.				
Air Pollution (dust, fuel emissions)	• Control speed of construction vehicles • Prohibit idling of vehicles Water should be sprayed during the construction phase on excavated areas • Regular maintenance of plant and equipment. • Provision of dust masks for use when working in dusty conditions	Daily inspection	Design Engineer, Supervising Engineer and Contractor	visible particulate matter in the air Increase in upper respiratory tract ailments Number and status of PPE Vehicle service tags	Respiratory protection devices @ 600-200 Vehicle service @ 3,000-10,000
Water Pollution	• Maintenance of construction vehicles should be carried out in the Contractor's camp.	Routine inspection, Maintenance records	Supervising Engineer and Contractor	Water quality	Routine inspection - Internal cost
Management of Solid Waste	• Contractor must dispose solid wastes away from the site to an approved disposal site.	Routine Maintenance	Contractor, Supervising Engineer	Nil visible solid waste heaps on site	Routine maintenance - Internal cost
Management of Hazardous substances	• Use of designated areas for repair and maintenance of machinery e.g. garages to avoid fuels and	Routine Maintenance,	Contractor, Supervising Engineer	Records	Not estimated depends on

	lubricant spills at the camp-site.				vehicle service and repair requirements
Risk of fire	• Establishing a network of fuel breaks of less flammable materials or cleared land to slow progress of fires and allow fire fighting access.	Routine maintenance	Contractor, Supervising Engineer	Records	Routine maintenance - Internal cost
Electrocution from Live Power Lines	• A maintenance system to ensure physical integrity of structures is maintained • Deactivating and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines; • Ensuring that live-wire work is conducted by trained • Workers should not approach an exposed energized or conductive part even if properly trained unless the worker is : - properly insulated from the energized part with gloves or other approved, insulation; the energized part is properly insulated from the worker and any other conductive object; the worker is properly isolated and insulated from any other conductive object (live-line work).	Inspection	Supervising Engineer Contractor	Medical Records	PPE @ 5,000 Training of staff @15,0000
Working at heights	• Testing structures for integrity prior to undertaking work; • Implementation of a fall protection program that includes training in	Routine Maintenance Inspection Records	Supervising Engineer Contractor	Medical Records Test records Training records	Climbing equipment @ 25,000 Initial

	climbing techniques and use of fall protection measures; • Inspection, maintenance, and replacement of fall protection equipment; • Installation of fixtures on tower components to facilitate fall protection systems; • An approved tool bag should be used for raising or lowering tools or materials to workers on structures • Use of helmets and other protective devices will mitigate against scratches, bruises, punctures, lacerations and head injuries due to dropping objects.				integrity tests 10,000 Training of staff @ 15,000
Spread of Diseases	• Education, guidance and counseling on HIV/AIDS and other STDs – construction staff • Avail condoms to construction staff	Routine examination Records	Contractor Supervising Engineer OHS Manager	Medical Records	screening approx. 1000 Education – approx. 2,000 per person per session Condoms @10/-
Land acquisition and Resettlement	Ensure that the displaced persons are: • Informed about their options and rights pertaining to resettlement; • Consulted on, offered choices among, and provided with alternatives;	Consultations Records Inspection Meetings	KPLC GoK	Relocation Compensation for loss Compliance with OP 4.12	Approx. 66 M for 1,661 acres of land

	• Provided prompt and effective compensation at full replacement cost for losses of assets attributable directly to the project. • offered support after displacement, for a transition period, based on a reasonable estimate of the time likely to be needed to restore their livelihood and standards of living; • Provided with development assistance in addition to compensation measures;				
Visual impact	• Extensive public consultation during the planning of power line and power line right-of-way locations;	Public Consultation	Environmental and Social Manager	Complaints	No associated costs

8.3.2 Operations and Maintenance Phase

Potential Impact/Aspect	**Proposed Mitigation**	**Monitoring Means**	**Responsibility for Monitoring**	**Performance indicator**	**Cost (KSh)**
Terrestrial habitat alteration	• The selective removal of tall-growing tree species and the encouragement of low growing grasses and shrubs in transmission line rights-of-way. • Removal of alien invasive plant species, • Cultivating native plant species;	Annual auditing	Environmental Manager	Vegetation cover	Audit cost approx. 100,000

	• Avoiding clearing in riparian areas; • Vegetation management should not eradicate all vegetation				
Risk of Fire	• Controlled burning of vegetation in transmission line rights-of-way should adhere to applicable burning regulations, fire suppression equipment requirements, and typically must be monitored	Routine maintenance	Maintenance Engineer	Records	Routine maintenance Internal cost
Electrocution from Live Power Lines	• Workers should not approach an exposed energized or conductive part even if properly trained unless the worker is properly insulated from the energized part with gloves or other approved insulation; the energized part is properly insulated from the worker and any other conductive object; the worker is properly isolated and insulated from any other conductive object (live-line work).	Routine Maintenance Records	Maintenance Engineer OHS Manager	Medical Records	PPE @ 5,000 Training – internal cost
Working at heights	• Testing structures for integrity prior to undertaking work; • Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; • Inspection, maintenance, and replacement of fall protection equipment; • Installation of fixtures on tower	Routine Maintenance Inspection Records	Supervising Engineer Contractor Maintenance Engineer OHS Manager	Medical Records Test records Training records	Climbing equipment @ 25,000 Initial integrity tests 10,000 Training of staff @ 15,000

	components to facilitate fall protection systems; • An approved tool bag should be used for raising or lowering tools or materials to workers on structures • Use of helmets and other protective devices will mitigate against scratches, bruises, punctures, lacerations and head injuries due to dropping objects. • Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; • Inspection, maintenance, and replacement of fall protection equipment; • Use of helmets and other protective devices will mitigate against scratches, bruises, punctures, lacerations and head injuries due to dropping objects.				
Rights of Way Maintenance	• Provision of appropriate PPE to the workers clearing the way leave (vegetation clearing activities which will involve use of machetes and/or power saws)	Routine Maintenance Inspection Records	Supervising Engineer Contractor Maintenance Engineer OHS Manager	Records	PPE: Gloves @ 500; Noise protection @ 50; Dust masks @ 20

8.3.3 Decommissioning Phase

Potential Impact/Aspect	Proposed Mitigation	Monitoring Means	Responsibility for Monitoring	Performance indicator	Cost (KSh)
NOISE					
Vehicular	Control of speed	Random checks	Supervising Engineer	Number of Public complaints	Nil
Compressor	Provision of hearing protection devices	Regular inspection	Supervising Engineer	Number of Public complaints	Nil
PHYSICAL HAZARDS					
Physical Hazards	adopting ergonomic work flow designs that tend to fit the physical tasks to the workers and not vice-versa while maintaining a balance with expected productivity	Regular inspection and redesign of work flow	Supervising Engineer	Number of ergonomic-related complaints	Nil
AIR POLLUTION					
Cement Dust	Provide appropriate hand, respiratory and body protective devices	Periodic inventory of personal protective equipment	Supervising Engineer	Number and status of existing PPE	@600 – 200 each for the hand, respiratory and body protection devices for each worker

Vehicular	Proper service of project vehicles	Service schedules e.g. every 5,000 km for off-road vehicles and every 3,000 km for truck	Supervising Engineer	Sevice tags	@ 5,000 and 10,000 for offroad vehicles and trucks respectively

8.4 DECOMMISSIONING PHASE

The decommissioning phase is part of the (eventual/ultimate) reversal phase, which has the additional and often dominant risk factors associated with the materials processed/produced during the life of the project (e.g., toxic and/or explosive chemicals, etc), as well as the potentially decreased structural integrity due to renovations and/or wear and tear.

Similar impacts encountered during the construction phase will be experienced in much the same way when the reverse process is set in motion. The table below gives an analysis of the decommissioning impacts expected in the proposed Mumias – Rangala – Kisumu 132 KV Transmission Line Project:

8.4.1 Impact Analysis – Decommissioning Phase

Aspect	Health And Safety Impact	Significance Level
Noise	Reduced hearing due to high noise from decommissioning activities – deconstruction such as vehicular noise and site remediation noises	Low
Air Pollutants	Acute/chronic respiratory disease caused by CO2, CO, NOx, and VOCs released by combustion engines during transportation and by obnoxious respirable particles released by speeding trucks during transportation of debris	Low
	Acute/chronic respiratory disease caused by pollutants (cement, caustics, isocyanates – lung sensitizers) released during deconstruction of storage facilities and disassembly of superstructures	Low
Water Pollutants	Public health problems as a result of consuming heavy metal contaminated drinking well water from oils, greases, hydrocarbons deposited on roads sides and leached into drinking water wells by rain water	Low
	Public health problems due to decommissioning activities that pollute potential drinking water wells	Low
Traffic Accidents	Traffic related mortality and morbidity from transportation activities	Low
Physical Hazards	Injuries resulting from physical hazards such as slips, trips, and falls from a tall cabin, cabin ladder, or trailer; Injuries due to accidental	Low

	bumping into unguarded rigid parts of truck or cargo; Injuries while performing field repair-work, tire change, unfastening tight bands and ropes, etc.)	
	Injuries resulting from physical hazards encountered by truck drivers such as chemical corrosion by dangerous chemicals such as transformer oil	Low
	Injuries resulting from physical hazards encountered by truck drivers such as explosion of over-inflated tires or car battery	Low
Ergonomic Hazards	Injuries due to poor ergonomic considerations such as pains in the low back and in the joints caused by prolonged driving; Over-exertion while moving or otherwise handling bulky and heavy loads/equipment; visual discomfort and eye problems caused by inadequate illumination and eyestrain; development of lumbago due to poor vehicle suspension/ uncomfortable seat, etc.	Low
Unstringing cables	Injuries/fatalities due to falls from height; puncture to the skin tissue and scratches	Low
Work at height	Injuries due to falls from height while maintaining power lines and base stations	Low

8.5 CAPACITY BUILDING AND TRAINING

The effective implementation of the Environmental Management Plan of the project will require capacity and awareness building. While the Proponent must ensure that capacity and awareness building, mitigation measures and monitoring concerns are implemented, actual training activities should be the responsibility of the Supervising Engineer, who may have to commission external consultants to carry out the training component. This can be achieved by targeting specific groups for the necessary training.

Target Group	**Description**
Group A	Transmission line (TL) Workers: This group consists of Engineers (Resident, Provincial, Project,) Contractors, Supervisors, Site Agents, Site Managers and the Environmental unit in KPLC. These are the top management staff concerned with the transmission line construction and maintenance.
Group B	TL Workers: Foremen, headmen, skilled and unskilled labourers.

Group C	Maintenance team: For this group of people, working on the TL is their core activity.
Group D	Project Affected People (PAP): area residents, farmers, pastoralists, people who have businesses that can potentially be affected by the TL, or they live close by the line route.

8.6 Training Objectives

Training will be based on modules aimed at:

- Developing awareness of the need to consider environmental issues during construction, operation and maintenance of the transmission line
- Creating awareness and understanding of the environmental legal framework pertaining to power transmission lines and energy
- Developing skills for identification and assessment of environmental, social, safety and health impacts of transmission line project
- Incorporation of mitigation measures at all stages of development
- Reviewing EIA reports and incorporating measures into decision making.

Arrangements for training in environmental awareness should be initiated as soon as possible. KPLC will either have to commission a consultant to carry out this training on site, at the Head Office, or personnel could undertake the environmental training and then in turn he/she trains other personnel.

The table below presents the recommended topic modules and costs for each of the four target groups necessary to implement the Environmental Management Plan.

Topic modules	**Target Group**	**Estimated Cost per person, per unit (KShs)**
• Understanding of legislation in Kenya, as relevant to the project • Understanding of the project cycle and how the EIA/incorporation of mitigation measures fits into the cycle • Develop awareness of the environmental implications of TL construction and maintenance activities and procedures for assessing them • Develop awareness and understanding of the human resource and institutional arrangements for pre-empting and managing environmental impacts • Importance of incorporating mitigation measures	Group A TL Workers	7,500

during planning and design and implementing an environmental monitoring programme • Impart skills on environmental monitoring and auditing during construction and maintenance • Need for gender balance during recruitment of labourers • Cultural aspects of target groups		
• General understanding of legislation in Kenya as relevant to the project • Sensitization on health (STDs including HIV/AIDS), littering, solid and liquid waste management • Types of environmental, social, occupational safety and health impacts that could be generated by these target groups • Cultural aspects of target groups	Group B / C TL Workers / Maintenance Team	5,500
• Brief overview of the project cycle • Understanding of EMCA 1999 and the EIA process • Legal implications of encroachment onto the TL reserve • Process for compensation and relocation/resettlement if necessary, (eligibility for compensation, compensation valuation and payment procedures; grievance redress mechanisms)	Group D PAP	2,500

9. CONCLUSIONS AND SUMMARY OF RECOMMENDATIONS

9.1 INTRODUCTION

As a result of the ESIA scoping, potentially significant environmental and social impacts have been identified including the need for land acquisition and resettlement. It is our recommendation that a full ESIA and Resettlement Action Plan (RAP) is carried out according to NEMA and World Bank requirements.

9.2 GENERAL MITIGATION AND INTERVENTION MEASURES

9.2.1 General Conclusions

- The proposed project is expected to have impacts on various aspects of the environment as well as the socio-cultural/economic status of the project affected parties. These anticipated impacts are discussed in Chapter 5.
- Mitigation of potential impacts (environmental and social) as described in Chapter 6, and implementation of the ESMP presented in Chapter 7 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 Supervising Engineer, who must ensure that the Contractor implements all specified mitigation measures.
- The World Bank's OP 4.12 on Involuntary Resettlement and Government of Kenya guidelines will be followed and used complementarily where applicable to avoid conflict.
- Community participation in planning and implementing resettlement will be encouraged;
- A Compensation and Resettlement Action Plan will be developed addressing land, housing, crops and other compensation to be provided to the adversely affected population.
- A monitoring and evaluation mechanism for resettlement activities will be carried out.
- Diligence on the part of the contractor and proper supervision by the Supervising Engineer during construction and the initial operation period is crucial for mitigating impacts. However all mitigation measures need to be specified in tender and contract documents, and must be included in the Engineering Drawings, Specifications and Bills of Quantities.

9.3 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 existing transmission lines 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.

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

However, many measures require an ongoing 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.

9.3.2 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 and compensatory 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 not be confined to the right-of-way, but should cover all sites affected by the project, including disposal sites, materials treatment areas, access roads, and work camps.

9.3.3 Effects Monitoring (Evaluation)

After mitigative measures are implemented, effects monitoring or evaluation can test the validity of hypotheses formulated in the environmental impact study; they can also determine 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.

9.3.3.1 Monitoring Guidelines

Continuous observations and assessment is essential for identification of impacts unforeseen during the E&SIA of the 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 include those listed in the table below. The monitoring parameters can be revised as the project development proceeds to enable incorporate and foreseen indicators.

Environmental Indicator	Parameter to Monitor
Occupational Health and Safety	-Threshold limits Values -Biological Exposure Indices -Minimum safe working distance -Number of occupational diseases and accidents
Socio-Economic Environment	-Development Projects -Alcoholism -Mortality rate -Trend of infectious diseases for example: HIV/AIDS, STI's -Correlation between project team and local community
Air Quality	-Humming Noise -Ozone -Interference with radio telecommunication waves
Fire	-Right of way vegetation -Waste
Aquatic habitat Alteration	-Existence of vegetation -Water quality and quantity -Water Borne Diseases -Complaint from community members
Vegetation Cover	-Invasive vegetation -Vegetation rate of growth
Waste Management	-Existence of solid waste - Complaint from community members
Soil Erosion	-Gulley formation -Increased sediments - Complaint from community members
Resident Birds	-Presence of resident birds -Mortality rate -Existence of nesting sites

The list of the environmental parameters and their measurable indicators will guide the proponent access the effective level of the EMP and need to modify it for appropriate action.

9.4 Reporting

Constant reporting by the site contractor to the proponent is necessary to ensure the project is executed as per the agreed plans. The safety officer/environment officer should always be available at the site to report any concerns for urgent mitigation. The officer should also ensure enforcement of Environment, Health and Safety requirements as per the relevant legislations. The contractor should always consult the project manager/engineer to maintain a clear understanding of all the project aspects and their mitigation measures.

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