Kenya Electricity Transmission Company Limited

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ETHIOPIA – KENYA POWER SYSTEMS INTERCONNECTION PROJECT

Revision of Environmental and Social Impact Assessment and Resettlement Action Plan

FINAL ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT

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ABBREVIATIONS

^{0}C	Degress Centigrade
AC	Alternating Current
AFD	Agence Française de Développement
AfDB	African Development Bank
BP	Before Present
Cap	Chapter
CBOs	Community Based Organizations
CEO	Chief Executive Officer
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CR	Critically Endangered
DC	Direct Current
EAPP	East African Power Pool
EELPA	Ethiopian Electric Light and Power Authority (now EEPCo)
EEPCo	Ethiopian Electric Power Corporation
EHS	Environment Health and Safety
EHS	Environmental, Health & Safety
EIA	Environmental Impact Assessment
EM	Environment Manager
EMCA	Environmental Management and Coordination Act
EN	Endangered
EPA	Environmental Performance Assessment
EPI	Environmental Performance Indicator
ERC	Energy Regulatory Commission (Kenya)
ESA	Early Stone Age
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GDP	Gross Domestic Product
GIS	Geographic Information System
GPS	Global Positioning System
Ha	hectare (100 x 100 meters)
HV	High Voltage
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IBA	Important Bird Area
ICT	Information and Communication Technology
IDP	Internally Displaced People
IESA	Integrated Environmental and Social Assessment Guidelines
ILRI	International Livestock Research Institute
IUCN	International Union for Conservation of Nature
KES	Kenya Shillings
KFS	Kenya Forest Service
Km	kilometre
km^2	square kilometre
KPLC	Kenya Power & Lighting Company Ltd.
kV	Kilovolt
KWS	Kenya Wildlife Service
LIA	Later Iron Age
LSA	Later Stone Age
m	meters
masl	meters above sea-level

MoE	Ministry of Energy (Kenya)
MSA	Middle Stone Age
NIBI	Nile Basin Initiative
NELSAP	Nile Equatorial Lakes Subsidiary Action Program (NELSAP)
NEMA	National Environment Management Authority (Kenya)
NGOs	Non-governmental Organizations
NO_x	Nitrites
NYS	National Youth Service
O & M	Operation and Maintenance
OHTL	Overhead Transmission Line
OPGW	Optical Fibre Ground Wire
OSHA	Occupational Health and Safety Act
PAP	Project affected persons
PCBs	Polychlorinated Biphenyls
PCR	Physical Cultural Resources
PM	Particulate Matter
PM	Project Manager
PPA	Power Purchase Agreement
RAP	Resettlement Action Plan
RoW	Right-of-way
RPF	Reserrlement Policy Framework
SIA	Social Impact Assessment
SO_x	Sulphites
SPN	Savanna Pastoral Neolithic
TL	Transmission Line
ToR	Terms of Reference
VMGAP	Vulnerable, Marginalized Groups Action Plan
VU	Vulnerable

DECLARATION

This report is made in accordance to the requirements of the Environmental (Impact Assessment and Audit) Regulations, 2003, pursuant to The Environmental Management and Coordination Act, (EMCA) 1999 and those of the Donors, namely the World Bank (WB), African Development Bank (AfDB) and Agence Française de Développement (AFD).

Further, this report has been prepared in accordance with the terms and conditions of GAMMA SYSTEMS Contract with the KENYA ELECTRICITY TRANSMISSION COMPANY (KETRACO), Republic of Kenya.

To our knowledge, this report responds satisfactorily to the Terms of Reference as was provided by KETRACO and also to the requirements of the Environmental Management and Coordination Act, (EMCA) 1999 of the Republic of Kenya.

Signed for Date
KENYA ELECTRICITY TRANSMISSION COMPANY

Signed for Date
GAMMA SYSTEMS LTD
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1. EXECUTIVE SUMMARY

The Ethiopia Kenya Power interconnection project was conceived in 2006 when Ethiopia and Kenya signed a memorandum of understanding that agreed that a power system interconnection between the systems of Ethiopia and Kenya be established.

Ethiopia is endowed with a huge hydro generation potential which is estimated at approximately 45,000 MW. The Government of Ethiopia intends to develop these resources for domestic consumption and export and this proposed line is to act as a major highway to the southern countries such as Tanzania. The enormous potential for electricity trade in the Eastern Nile countries coupled with its socio-economic and environmental benefits will pioneer the idea of a regional power market and enhance the East African Power Pool (EAPP). A major setback to the development of such a market is insufficient transmission infrastructures. This project is expected to help overcome this setback and in addition, create transmission capacity needed in interchange of electric power between Ethiopia and Kenya, in the long run. Further, the project is expected to generate investment opportunities in electricity infrastructure and also give rise to development of other related industries.

Objective of the ESIA study

The objective of the ESIA study is to identify potential environmental and social impacts that could be associated with the project. Further the study is to propose measures to avoid, mitigate or/and offset the environmental and social potential negative impacts while enhancing the benefits arising from the interconnection. In addition, environmental and social management plan, monitoring program have been prepared.

Project Description and Justification

The Project Location

The proposed transmission line right-of-way (RoW) crosses from Ethiopia into Kenya approximately 90 km West of Moyale town (grid E 421519, N 397867) and traverses Marsabit, Samburu, Isiolo, Laikipia, Nyandarua and Nakuru. From Moyale the transmission line route runs adjacent to the Great North Highway (Marsabit – Moyale) in a southerly direction avoiding Marsabit National Park. From Marsabit area the route runs southwards at a maximum distance of 500 m parallel to the main Isiolo – Marsabit Highway to Laisamis.

At Laisamis Town the proposed RoW runs close to the road as it enters Losai game reserve keeping a range of about 400 m to 800 m off the road reserve then runs further on to Merille where it diverts slightly westwards running east of Matthews Range, 6 km east of the Lololokwe Mountain peak. It then runs through a stretch of fairly flat land covered by thorny shrubs and bushes, and then turns southwards to the Ngoborbit plateaus and ridges dropping altitude down into Laikipia.

In Laikipia, the propsed RoW continues through the extreme western section of Mpala Ranch which is covered by scattered thickets and bushes. Then it crosses Mutara River into Ndaragwa. The line runs on top ridge of Shamata and then sharply drops altitude to the flat plains of Olobolossat, 3.7 kilometres eastwards of Lake Ol Bolossat. It then traverses the Olkalou Settlement Scheme and cuts across Malewa River, climbing a steep hill then drops altitude to the flat land of Marangishu (karati) and on-wards to Kijabe after crossing the

Nakuru – Nairobi highways into plains east of Mt. Longonot into the proposed Suswa Substation.

The Ethiopia-Kenya Transmission Line Route

Technical Description

A completely new transmission line with self-supporting steel lattice towers with concrete foundations will be built from Sodo in Ethiopia to Suswa in Kenya. Substations will be built at Sodo (Ethiopia), and Suswa in Kenya. Approximate average construction span length of the line is 400 m and with 65m RoW corridor. The 2009 technical feasibility study recommends adopting a conceptual design featuring:

- ±500 kV HVDC bipolar overhead line, from Wolayta/Sodo S/S on the Ethiopian side to Suswa Kenyan side.
- Ground electrode lines at Wolayta/Sodo and Suswa
- Five 400 kV 1½ breaker diameters at Wolayta/Sodo on the Ethiopian side,
- Seven 400 kV 1½ breaker diameters at Longonot on the Kenyan side, including switched shunt compensation, dynamic compensation and stepdown transformers
- One synchronous condenser rated 200 MVAr at Longonot S/S.

Project Justification

The Ethiopia – Kenya Power Interconnection Project will usher in the regional energy trade which has for a long time been envisaged with the formation of the Eastern African Power Pool (EAPP). The overall objective of the EAPP is to facilitate regional integration and hence to realize sustainable growth and development.

The Project helps Ethiopia mobilize the necessary financial resources to exploit fully its enormous hydro-energy resources and thereby improving its economic growth and livelihood of its people. Kenya too will benefit from increasing its currently low level of power interconnection and also raise its level of industrial growth which has been hampered by the dearth and affordability of grid-connected power. . This development will help prepel Kenya towards achieving the Millennium Development Goals (MDGs) through improved economic growth, hence improved living conditions of its citizens and to acheve mid-level industrialized status in line with the Vision 2030 Strategy.

The transmission line will conduct power from clean energy sources in Ethiopia, thereby reducing the fossil fuel based thermal energy that is currently complementing hydro power energy in Kenya. This will mitigate emission of green house gases (GHG) and local pollutants associated with thermal energy and the project has the potential to earn both countries carbon credits.

Legislative Framework

The Constitution of Kenya 2010: under which environmental issues, land issues and compensation have been given prominence. The Bill of Rights, Article 42 provides for the rights of environmental protection of persons and the right to enact environmental laws.

The Environmental Management and Coordination Act No. 8 of 1999 (EMCA) & Associated Regulations: governs environmental issues including ESIA.

Applicable sector-specific legal framework will include provisions of the Energy Act 2006, environmental policies of KPLC and KETRACO and KPLC's Resettlement/Land Acquisition Framework.

Other relevant statutes and regulations are:

- Energy Act No. 12 of 2006 of the Laws of Kenya
- Transfer of Property Act Chapter Group 8

World Bank and African Development Bank Safeguard Policies:

The following Bank policies are triggered for the proposed Ethiopia-Kenya Power Interconnection Project:

1) *Environmental Assessment (OP/BP 4.01,)*
2) *Involuntary Resettlement (OP/BP 4.12)*
3) *Natural Habitats (OP/ BP 4.04)*
4) *Indigenous Peoples (OP/BP 4.10)*

A complete description of the World Bank safeguards and their triggers for applicability can be found on the World Bank's official web site www.worldbank.org and are summarized in the main text of this document.

The African Development Bank (AfDB) safeguard policies that are likely to be triggered include:

- Guidelines under the Handbook on Stakeholder Consultation and Participation in ADB Operations;
- Cooperation with Civil Society Organizations Policy and Guidelines;
- Environmental and Social Assessment Procedures for African Development Bank"s Public Sector Operations;
- Annex 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14,15, and 16 of the ESIA Procedures for AfDB Public Sector Operations;
- Gender Policy , 2001;
- Bank Group Policy on Power Reduction, 2004
- Involuntary Resettlement Policy, 2003;
- The African Development Bank Group Policy on Disclosure of Information, 2005; and
- African Development Bank Group"s Policy on the Environment; 2004

Physical Environment

Geography and Topography

The proposed transmission line route traverses across the country from North to South through Marsabit, Samburu, Laikipia, Nyandarua and Nakuru Counties. Most of Marsabit County is low-lying at 400 and 700 masl. Land use in the county is mostly nomadic livestock herding. The county is home to the Burji, Boran, Ariaal and Rendille communities who are mainly traders, pastoralists and also carry out some irrigation farming. Samburu County is

categorized into three agro-ecological zones with different climatic zones, landform and soils, and having a specific range of potentials and constraints for land use.

Samburu County lies between 1,600 and 2,300 masl but less than 1% of its total land mass is arable. There are no gazetted forests in the county, but the hills cover an area of approximately 9,933 ha and covered by dense vegetation which provides potential for wildlife conservation. The county is vulnerable to natural hazards such as drought and floods along the Ewaso Ng'iro River and which give rise to rampant human confrontations for pasture and water. Recurring drought has resulted in loss of range biodiversity resulting in low vegetation cover. Constant migrations by the pastoral communities in search of water and pasture have enhanced environmental degradation.

Laikipia is semi-humid and is principally a rangeland with only some parts being arable and support fairly high populations through agriculture and animal husbandry. Nyandarua County mainly lies in the Aberdares highland, comprising the Kinangop Plateau, Ol Kalou/Ol Joro Orok Plateau and Ol Kalou/Ol Joro Orok Salient. Nyandarua borders Nakuru County which lies at an average altitude of 1,890 masl, in the Rift Valley Province. Soil composition in the county is complex as it is influenced by intensive variation in relief rainfall climate, past volcanic activities and the underlying rocks.

Soil

The soil distribution in the project area is complex and is influenced by intensive variation in relief, climate, past volcanic activities and the underlying rocks. The main soil types are calcic gleysols, andohaplic pheozems, gleyic cambisols, ando-calcic regosols, lithosols, and calcic xerosols, from the lacustrine plain through the volcanic plain to the volcanic hills respectively.

Generally, the soils in the project area have high phosphorus, calcium, magnesium and potassium concentrations but are low in respect of nitrogen and carbon. Pyroclastics-ashes, agglomerates and tuffs cover a considerable proportion of the project area over the entire volcanic plain in the Rift Valley. During the volcanic period of eruptions of the Mt. Longonot, easterly winds caused the heaviest accumulations of the ejected ashes to settle in and around the project area. More recent pyroclastics flows have resulted in acidic soil compositions. The ashes are usually interbedded with other volcanic soils..

Climate

Climate in the project area ranges from desert areas of Chalbi receiving less than 100 mm of rainfall to semi humid areas receiving a mean maximum of 600 mm in Samburu, Isiolo and parts of Laikipia. Rainfall is much higher within Nyandarua highlands averaging 1200 – 1800 mm reducing to average 700 mm around Sasumua. The average temperatures range between 26 and 32°C with temperatures decreasing southwards and highest within the Chalbi Desert.

Water Resources

The northern part of Marsabit County is mainly dominated by the Chalbi Desert. There are no perennial rivers in the county, except seasonal rivers which are water-bearing when rare and usually torrential rain falls in the desert. Samburu County has potential for both surface and sub-surface water sources. It has four perennial rivers: Ewaso N'giro, Isiolo, Kama and Bisanadi. Isiolo River is extensively used and is the main water source for Isiolo Town.

Preliminary assessments indicate that ground water and surface water potential in the region is limited. 43.5% of households in the region have access to tap water, and 18% of households have access to good quality water sources within a distance of 5 km. Further south has some perennial rivers notably river Pesi which is a tributary of the Ewaso N'giro.

Biological Environment

Vegetation

The vegetation in Marsabit and Samburu Conties can be described in four categories: woodland, dwarf shrub bushland, shrubland and thickets. The dominant tree species is Acacia. Fire-adapted grassland is common in the semi-arid central parts of Samburu County, which is partly the result of human activities including frequent fires, charcoal burning and over-grazing. The bushland is characterized by *Acacia tortilisis*, *Commiphora africana*, *Grewia* species and dwarf shrubs such as *Lippia carviodora* and *Vernonia cinerascens.* Shrub or Bush Grassland consists of grassland with scattered trees and shrubs having a combined canopy cover of less than 20%.

Some sections have Deciduous forests which are characterized by trees that lose their leaves during the dry season (e.g. Acacia and *Combretum* spp.). These are found between Shamata and Ndaragwa areas of Nyandarua County. The area of Laikipia ranches has three main vegetation types mixed Acacia bushland, open grassland and Acacia woodland. Within Naivasha in Nakuru County, only little natural vegetation is left in the project area. River Malewa which flows into Lake Naivasha originates from the Aberdare National Park and the adjoining gazetted forest. Vegetation in this region is humid *Afromontane* forest and bamboo.

Wildlife

Marsabit County is largely a wide expanse of wildlife dispersal area accommodating a wide range of animals including some rare species, such as Reticulated Giraffe, Beisa Oryx, and Somali Ostrich. Others include elephants, elands, buffaloes, zebras, giraffes, lions, baboons, gravy zebras, greater kudu and a few rhinoceros. The Somali Ostrich is also common in the Chalbi Desert. Wild herbivores, such as buffaloes are unevenly distributed over the project area with concentrations in Laikipia and Samburu areas.

The Laikipia – Samburu ecosystem is an important conservation area hosting a large diversity of wildlife notably elephants, lions, giraffe and the vulnerable reticulated giraffe and the wild dog. The greatest population are found within private conservancies and group ranches.

Lake Ol Bolossat and the associated wetlands support a diverse range of water fowl, which are either resident or migratory. Lake Naivasha is also important for riparian mammals, primarily the population of approximately 600 - 700 Hippopotamus amphibious, which represents the largest meta-population of this specie in the Kenya Rift.

Socioeconomic and Cultural Environment

Land use

The land use types of the project area can be categorized as agricultural, pasture and rangelands, settlements, conservation areas and forests. In Kenya land is the most important and widely coveted factor of production. It offers security through abode, in old age and eventually upon death which all account for the huge interest that is vested upon land in Kenya. Under the Trust Land Act, Cap 288, land in the pastoral counties of Marsabit and Samburu is mostly held in trust for the local communities by the respective County Councils. The pastoral communities in those counties exercise communal ownership and utilization of natural resources. Against this background the requirement for land to be set aside for construction of the proposed transmission line is likely to impose a major impact within the traversed route.

Existing infrastructure

Along the entire RoW, diverse infrastructure is encountered and this includes many power distribution lines, airstrips, roads, railway lines, etc. For some distance the proposed RoW runs along the Mai-Mahiu – Naivasha – Gilgil and the Isiolo – Marsabit – Moyale highways and some other minor roads. These roads will be crucial for access during construction and maintenance phases of the project, implying they will assist in mitigating potential adverse impacts of the proposed transmission line since they will reduce the need for new access roads.

Between the proposed Suswa substation and Marmanet, the proposed transmission line route runs parallel east of the proposed 400 kV HVAC transmission line to the proposed Lake Turkana wind-turbine power generating site. Optimum separation of the two proposed transmission lines will be determined because although running the two lines is likely to reduce the negative impact, mutual technical effects of the two lines running in parallel will have to be investigated. All existing and planned structures are economically and strategically crucial hence the need to flag them to ensure planning for their mutual co-existence and harmony on the side of the project.

Socioeconomic Characteristics

The main ethnic groups distributed along the project area include Gabra, Rendille and Samburu, in Marsabit, Samburu and Laikipia Counties; Kikuyu in Laikipia, Nyandarua and Nakuru Counties and Maasai in Laikipia and Nakuru Counties. The Maasai, Samburu, Rendille and Gabbra are mainly nomadic pastoralists. While the longest portion of line route lies within the land occupied by Gabbra, Rendille and Samburu (all pastoralists) its effect on the communities is low because they are sparsely populated in density and due to their migratory tendencies. The Kikuyu are the most affected because they have a relatively higher population density and are mainly settled peasant farmers. Other ethnic groups are mainly migrants to the project area. They include Meru, Kisii, Luhya, Luo, Turkana and Somali.

The proposed transmission line route traverses mainly rural areas of five counties. Most of the counties traversed are sparsely populated except the settlement areas of Nakuru and

Nyandarua counties. On the overall, heavily populated areas have been avoided during route selection.

Economic Characteristics

The settlement pattern in the traversed districts are characterized by the potentiality of land, land use system and water availability. Agriculture is dominant in most of the affected counties, In Marsabit, Samburu, Laikipia and Nakuru Counties; nomadic pastoralism is the dominant occupation. In the area around Lake Naivasha horticultural farming for export market is intensely practiced. Crop-based peasant farming, ranching, traditional livestock keeping (pastoralism), trade and business are the principal sources of income and livelihood in the project area. Livestock raring includes cattle, goats, sheep, donkeys and camel. In Nyandarua, Nakuru and parts of Laikipia County mixed farming is the dominant occupation. Common crops include: maize (94.9%), Potatoes(2%), wheat(1%), beans, onions(1%), Cabbage(1%) and horticulture.

Potential Impact and Mitigation/Enhancement Measures

Potential Positive Impacts

Positive socio-economic effects of the project during construction on those communities located in the vicinity of the transmission line would include short term employment, income generation by transporters, food selling individuals and shops and accommodation. At national level Kenya will get sustainable electricity supply from green sources. With the additional substations and transmission line, there will be increased capacity and reliability of power supply which will have a positive impact by being able to meet the ever rising power demand. Provision of energy has an in direct link to better living standards.

Development of ICT Hubs

Under the Vision 2030 strategy, Kenya is developing rural-based ICT networks that are geared to benefit the local populations and supply local schools with ICT terminals as ICT is being integrated into school curriculum in line with the country's MDGs. KETRACO's policy is to incorporate optical-fibre ground wire (OPGW) in all new lines. The OPGW will therefore be able to supply broad-band communication telecommunication hubs, mobile telephone networks and digital television to population centres and ICT to schools and digital villages withinthe project area.

Conservation Measures

Access to adequate and affordable energy for households and industry will help in rolling back the rate of deforestation and thus help in conserving forest resources and realize the environmental benefits such as water resources and biodiversity functions. Access to affordable energy will improve performance in virtually all sectors of the Kenyan economy.

Climate Change and Regional and Local Pollution

Considering that the sources of power are renewable sources, the project will cut down carbon emissions and NO_X, SO_X, *and PM* that are associated with thermal energy, and thus help in reducing global warming and cut down on regional and local pollution.

Potential Negative Impacts & Mitigation measures

The table below presents a summary of the potential impacts and proposed mitigation measures.

Environmental Impact	Description of Adverse Effects of Impacts	Proposed Mitigation Measures	Nature and Severity of Impact
Settlements and Community Facilities	• In order to establish a clear wayleave, removal of residential houses and private buildings will be one of the negative impacts of the project. Some of the social structures affected by the project include 3 churches, 3 schools, 1 health facility, a police post and a children's home.	• Where it is not possible to realign the line route further than already achieved so as to avoid the affected facilities and structures, compensation and assistance shall be provided to the community or individuals affected • More details about resettlement and compensation is provided under the RAP brief.	High, direct, permanent but impact can be lessened
Potential Aesthetic Impacts	• Visual intrusion of transmission line across the Laikipia and Samburu natural wilderness especially for tourism views. • To some, new transmission lines are viewed in a positive light because it represents economic development. • No other impacts on landscape is expected	• The OHTL routes have been established so as to meet the co-inhabitancy requirements imposed by the natural landscape, objects, buildings and facilities in the neighborhoods by ensuring that they merge into the existing landscapes. In particular, most of the transmission line route has been selected to follow hilltops where there is minimum human settlements and where the view of the conductors will be against the sky and thereby having less impact than when viewed sideways or from above against the background of the horizon or the ground.	High, direct permanent, reversable only upon decommissioning
Natural Vegetation	• Loss of exotic trees including Eucalyptus, Grevellia Robusta, Cypress, Pine trees, etc. Found on individual land holdings • Loss of forest land at Ndaragwa • Transient loss of vegetation along the line during construction.	• Clearance during construction be done manually without burning the cleared vegetation. • Vegetation clearance within the Protected Areas be done under supervision of KWS and KFS personnel. • Compensate value trees according to RAP recommendations • Compensatory planting of trees that are cleared or whose height is limited to 4.5m.	Medium, direct, temporary, reversable
Fauna	• Potential of physical hazards to birds, climbing animals and people. • Potential bird strikes around Dida Galgalu and Lake Ol Bolossat during the operation stage of the project • Potential interference with wildlife migration if construction activities across the ligration corridors coincide withe migration period	• To be mitigated at specifically identified locations by use installation of coloured warning spheres on the ground conductors atop the towers. • The design to include building raptor platforms on top of pylons for roosting and nesting; • Collect monitoring data on avifauna electrocuted along the proposed transmission line. • Install danger sign and anti-climbing barbed wire for safety purposes on every steel tower.	Low, indirect, permanent for birds, temporary for other fauna

Environmental Impact	Description of Adverse Effects of Impacts	Proposed Mitigation Measures	Nature and Severity of Impact
		• Ensure a safety officer is present at all the times during the construction phase. Conduct safety campaigns periodically among the population along the entire RoW. • The span between towers is on average 400 m and minimum height of conductors is 11 m, thus, the infrastructure configuration does not limit animal movements including elephants • Schedule construction so as not to coincide with animal migrations across migration corriddors and this will be included as a clause in construction contract.	
Impacts on Agricultural Land	• Transmission lines will affect farm operations and increase costs to farmers. • For farmers on the ROW, there will be temporary cessation of farming during construction of tower pads and stringing • Tree plantations and orchards will be affected as they will not be permitted to grow beyond 4 m height.	• KETRACO to provide monetary compensation for cessation of land use and any loss associated with compromised land productivity. Compensation details are provided under the RAP. • Some of the access roads required during project implementation should not become permanent if not required by community.	Low, direct, temporary and reversible.
Impacts on Drainage, Surface Waters and Water Resources	• Construction of towers could interfere with the natural drainage systems and modify flow of surface water, • Altered drainage can contribute to soil erosion, flooding, channel modification, downstream scouring and sedimentation in streams and other drainage channels. • Poor effluent discharge from workers camp at the Suswa station	• Positioning of towers away from natural drainages and floodways • Position towers so as to leave a protection zone of 15 m at river and streams and 5 m when crossing any drainage channels. Channel effluents to sceptic tank and run-off from work surfaces to a retaining pond.	Low, direct temporary and reversable
Land Excavation, Access Roads and Campsite	• Construction of access roads has potential impact to the environment from clearance of vegetation, compaction of land and a permanent loss of farming and grazing land.	• Designing transmission line route close to existing roads or line corridors. Rehabilitate temporary acces roads after completion of works • Minimize the number of new roads required, • Locate the campsite in such a way that they can have residual values like turning them into schools and other public facilities.	Low, direct, temporaray, reversable
Soil Erosion	• Soil disturbance occassioned by construction of foundations for transmission line towers and substation at Suswa could exacerbate soil erosion	• Restrict use of heavy machinery and vehicles to designated work areas • Install soil protection works in areas sensitive to erosion prior to undertaking construction.	Low, direct, temporary, reversable

Environmental Impact	Description of Adverse Effects of Impacts	Proposed Mitigation Measures	Nature and Severity of Impact
Noise, Ozone and Corona	• Noise associated with operation of trucks and heavy equipment in the vicinity of huma settlements	• Work schedules to avoid working ours at night especially around health centres • Work schedules in the vicinity of schools to be restricted to off school hours • Ozone concentrations around power lines have no health consequences as they have purely localized impacts.	Low to insignificant, direct, permanent
Electric and Magnetic Fields	• Studies on High Voltage electric overhead lines have not come up with any conclusive evidence of impacts on human health. • Vibrations associated with the high voltage power transmission caused by the conductors exposed to the dynamic load of wind	• The electro-magnetic field (EMF) decays very rapidly with distance from source and there should be no potential health risks for people living outside the 65 m wide wayleave corridor. • The design should incorporate vibration dumpers along the entire OHTL length to damp vibration. In any case it is expected that vibration on a DC line will mainly be caused by wind and not power flow.	Low, direct, permanent, reversable only up on decommissioning
Substance Abuse and Communicable Disease Control	• Substance (alcohol and drugs) abuse and spread of HIV/AIDS/STI and other Communicable diseases could be occassioned by workers across rural areas. • Potential risk of spread of sexually transmitted diseases such as HIV/AIDS/STI in the project area by workers not staying with their families.	• Mount intensive campaign of awareness, prevention and treatment will be undertaken among the workers and the communities living in the vicinity of the project. • Sensitization and education campaigns against substance abuse • The construction sites, contractor"s accommodation areas, offices and store facility to be supplied with portable water and well-maintained sanitation and wastewater installations. • Employ non-skilled labour from within the community	Low, indirect, reversable in some cases
Archaeological and Historical Sites	• Potential damage caused by construction and maintenance work through digging, crushing by heavy equipment, uprooting trees, exposing sites to erosion or the elements, or by making the sites more accessible to vandals.	• In the event that archaeological resources are discovered during the construction process, a Chance Find Procedure as described in Performance Standard 8 of IFC to be implemented. The procedure includes record keeping and expert verification procedures, chain of custody instructions for movable finds, and clear criteria for potential temporary work stoppages that will be potentially necessary for rapid disposition of issues related to the finds.	Uncertain
Solid Waste	• The project does not envisage major excavation works; solid waste will therefore be minimal. Topsoil excavated	• Re-use some of the excavated soil for backfilling while the rest to be disposed off at designated areas.	Low, direct, temporary, reversable

Environmental Impact	Description of Adverse Effects of Impacts	Proposed Mitigation Measures	Nature and Severity of Impact
	from construction sites will be the main form of solid waste. • Other solid wastes will include metallic pieces, wooden planks, and stone debris.	• Dispose of waste in accordance with the NEMA guidelines. • Take particular care in forest reserves, national parks and other protected areas where materials and plants brought in during construction must be taken out at completion of the works.	
Impact on Ambient Air	• The air emissions from construction machinery and traffic will be low and will therefore have negligible impact on ambient air quality.	• Set the route away from dense settlements	Low to insignificant, direct, permanent until decommissioning
Impacts on Aviation and Communication	• Not expected since the set back from airfields is substantial	• The Kenya Civil Aviation Authority to be requested to conduct a survey along the RoW and advise on the safety distances of the RoW from the aerodromes and safe tower heights and/or need for installation of warning lights and/or warning spheres in the vicinity of the aerodromes and at any other point along the entire RoW	Low, fine elements are unclear
Potential Hazards	• Electrocution and fire by line snapping • Transmission tower/pylon collapse • Flooding and fire hazards of substation and transmission line	• A number of hazard management mechanisms could be devised to prevent and control potential hazards along the transmission line corridor and substations. These include prevention, control and management mechanisms.	Uncertain

Monitoring Program

During the monitoring program the Contractor"s responsibility is to ensure that the construction works are carried out as per the detailed design, the measures defined in the ESMP, and the applicable National, AfDB and WB guidelines. All construction activities are carried out according to international best practice and adhere to the applicable requirements regarding health, safety and environment. Monitoring of the construction activities will be limited to the construction area, which includes the construction sites, temporary storage areas, workers camps and their adjacencies. The topics and parameters that will be considered as a minimum for the environmental monitoring of the Project are Water Quality Monitoring; Noise Levels Monitoring; Monitoring of Vegetation Clearing; Soil Erosion Monitoring; Monitoring Rehabilitation of Work Sites; and Monitoring of Health status and Accidents.

Public Consultation and Public Disclosure

The public and stakeholder consultations were carried out as follows:

- 11 public meetings at different locations on the proposed RoW,
- all Project Affected Persons (PAPs)were consulted (380 households)

- Two focus group discussions were held with the conservancies at Nanyuki and Wamba
- Key Government agencies consulted include Kenya Wildlife Service, Kenya Forest Service, National Environment Management Authority

During the consultations, the consultations focused on nature of potential environmental, social, historical and cultural, and economic impacts of the transmission line. Identification of major social impact issues, such as resettlement, community severance and vulnerable groups that are at particular risk of project impacts, and compensation for affected properties and assets. Data and information on the current usage and ownership of land in the RoW, fixed and movable structures, trees, wells and other assets, areas of significant squatting and/ or encroachment were sufficiently discussed. During Public consultations with PAPs and local communities people reaffirmed their support to the project. Officials and the local authorities agreed to ensure that no person will be allowed to encroach to the RoW after the cut-off date.

Resettlement Action Plan summary

The RAP study commenced with the review of Fichtner 2009 report and collection of baseline data which culminated in selecting of an optimized route which was approved by the EEPCO, KETRACO and the financiers. Field data in a proposed RoW band of 65 m wide was collected through household census and community consultations. During field data collection minor changes on the proposed RoW were effected so as to avoid physical and topographical structures. The field data was analyzed and results are discussed in this report.

Study findings indicate that the Kenyan section of RoW is 606 km long which gives a total land area within the RoW in Kenya as 39.39 km2. Some major community structures including schools, dispensaries, churches, etc were found to have been constructed on the proposed RoW established under the 2009 study. These structures have now been avoided and consequently the compensation cost has reduced drastically. A route change was also effected at the region near Wamba Town so as to avoid Matthews Range Forest Reserve. This deviation also resulted in drastic reduction of compensation requirements to households in the area. In particular, the route deviation in this area avoided many disadvantaged and marginalized groups that inhabit the area. Since some remote chances exist of interfering with cultural properties of these groups, under this RAP, a Vulnerable and Marginalized Groups Action Plan (VMGAP) was developed in line with the World Bank's OP 4.10 policy requirements.

Compensation has been worked out based on KETRACO's Resettlement Policy Framework (RPF), Kenyan statutes, WB and AfDB policies as well as other safeguard policies. Compensation for the affected land and property is worked out at the full market value. and worked out based on KPLC latest rates reviewed on 26th April 2011. Disturbance and assistance for the disadvantaged (marginalized and vulnerable), both at 15% was added to the assets value. For annual crops such as maize, beans, vegetables, etc and some perennial crops such as coffee, it was assumed that only 10% will be damaged during construction but actual compensation will be paid based on crops lost. Compensation for community assets was also computed using KPLC rates. The budget for compensation

worked out at approximately KShs. 1.2 billion which is equivalent to US$ 14,094,943 at exchange rate of KShs. 85 to the dollar.

The RAP report has set out a comprehensive governance structure, conflict resolution process and regular internal and external auditing of for RAP implementation process.

Conclusion

From a broader perspective, the project has low overall environmental impacts since it will source energy from green sources (hydro-electric) thus reducing environmental consequences of thermal energy production that is currently used to complement hydro-power production in Kenya. When alternatives are considered, it is clear that this project will provide Kenya the opportunity to reduce its carbon footprint over time.

The intensity of impacts will be relatively higher at the tower construction sites within the RoW and at the substation construction site at Suswa. These impacts are related to land degradation, noise, waste handling, air quality and vegetation clearance. These potential impacts are easy to mitigate through proper construction planning. However, impacts on vegetation could be locally substantial during construction phase since stringing may necessitate removal of some trees to create access. This impact on vegetation is transient and reversible. Impacts on wildlife during construction are related to possible effects on animal migration if tower construction and stringing across animal migration corridor coincide with their movements. This is easily mitigated by scheduling construction so that it does not coincide with animal migrations.This will be included in construction contracts.

Impacts on wildlife is rated as low during both construction and maintenance, partly because of the line has avoided important protected areas, but more importantly because the configuration of the line, with 400 m wide span between towers do not inhibit wildlife movements across the alignment. The potential increase in bird mortality occasioned by bird collision with the conductors around Lake Ol Bolossat is considered low because the line has been diverted by 3.7 km from the edge of lake Ol Bolossat to avoid flight path of birds coming in and out of the lake. For Dida Galgalu desert which is also considered an Important Bird Area, the ecological expanse is extremely large to the extent that deaths associated with bird collision will have insignificant impacts on the viability of avifauna in the area, although mitigatory measures will be implemented, such as coloured balls on the line. A thorough archaeological study was undertaken, and noarcheologically important sites were identified on the alignment. Nevertheless, a chance finds procedure will be followed, and a clause detailing such will be included in construction contracts.

During construction, potential impacts on local communities and enterprises are largely positive, as the construction activities provide direct job opportunities and indirectly create income from trading through supply contracts, food vendors, accomodation, entertainment etc. However these positive impacts are limited to the duration of the construction activities and would not have a significant sustainable positive impact on the local economy.

There are some 380 homesteads and 6 shops which will be wholly or partially affected. These have been identified and their compensation shall be undertaken as provided for in the RAP report.

The most important impact other than resettlement and impacts on livelihoods is the visual intrusion occasioned by the new power line. This may have adverse impacts on wilderness

tourism within the Laikipia – Samburu ecosystem. Attempts have been made to align the route to avoid proximity to tourist lodges and out of sight of tourist circuit. This impact is permanent throughout the life of the project. During Operation and maintenance, the constant pruning of trees to limit height to 4.5 m within the right of way will limit tree cover along the entire RoW. This latter impact can be mitigated by compensatory tree planting, especially in Nyandarua and Nakuru counties.

In general the impacts associated with this project are relatively easy to avoid or mitigate. The only permanent impact of significance is the visual intrusion occasioned by the towers and the conductors. However the alignment has avoided most trafficked tourism routes and lodges.

2. INTRODUCTION

2.1 PROJECT BACKGROUND

Ethiopia and Kenya both have small electricity sectors, with a total installed capacity below 2,000 MW (Approximately 1,100 MW in Kenya and approximately 800 MW in Ethiopia). Despite the availability of enormous energy resources, per capita energy consumption is among the lowest in the world, about 40 kWh/yr in Ethiopia and 145 kWh in Kenya. Besides, power shortages and unreliability of supply are also common. This poor quality electricity supply is characterized by low voltage levels and voltage fluctuations beyond acceptable levels, resulting in frequent blackouts and brownouts.

Insufficient reserve capacity to meet fluctuations in hydro-generation (in case of severe drought conditions) has also led to unreliable power supply and need for industry to maintain costly back-up. This lack of reliable supply is contributing to reduced economic competitiveness.

Ethiopia is well endowed with a huge hydro generation potential which is estimated at approximately 45,000 MW. In line with the country's energy policy, the Government intends to develop these indigenous resources for domestic consumption and export. The Government of Ethiopia is in the process of effecting power system interconnection with its neighbouring countries as part of its export strategy and for mutual benefit.

2.2 HISTORY OF THE PROJECT

The Ethiopia – Kenya Transmission Interconnection Project was a part of the Power Planning Study carried out in October 1982 by Ethiopian Electric Light and Power Authority (EELPA), now Ethiopian Electric Power Corporation (EEPCo). The study recommended that feasibility study for the Ethiopia – Kenya Power Systems interconnection be undertaken. Taking into account recent developments in Ethiopian and Kenyan power systems and in the East African Power Pool (EAPP) member countries in general, the need of further assessment of the interconnection viability was identified.

The Nile Basin Initiative (NBI) of Nile Equatorial Lakes Subsidiary Action Program (NELSAP) with its a wider development mandate in the region, recognized the enormous potential for electricity trade in the Eastern Nile countries coupled with its socio-economic and environmental benefits and hence pioneered the idea of a regional power market. A major setback to the development of such a market is insufficient transmission infrastructures.

On May 7, 2006 Ethiopia and Kenya signed a memorandum of understanding (MoU) that underscored the need to recognize the comparative advantage of Ethiopia over Kenya in hydropower generation. It identified need for technical cooperation between the two countries in power generation, transmission, rural electrification and customer-relations services. In this regard, interconnection of Ethiopian and Kenyan electric power systems was agreed upon. The MoU between the Government of the Federal Democratic Republic of Ethiopia and the Government of the Republic of Kenya to implement interconnection of the two countries' power systems was motivated by recent developments within the countries and the region at large. Such developments included formation of the Nile basin initiative, Eastern Africa Power Pool, Eastern Africa Power Master Plan, etc.

In January 2008 Fichtner of Germany was awarded a contract to undertake feasibility, ESIA and RAP studies for the proposed Ethiopia – Kenya Power Systems Interconnection. The Ethiopian and Kenyan parts of the project were coordinated by a joint coordination office, hosted under the Ethiopian Electric Power Corporation, in Addis Ababa. Fichtner completed the task and submitted their final report in June 2009. The stakeholders have since found it necessary to revise the ESIA and RAP reports with a view to:

1. Solving newly identified environmental issues;
2. Reducing the length of the ultimate line route by 10 – 15%; and

3. Updating the report for purposes of a new route feasibility study.

With the above consideration, Tropics Engineering Consultants of Ethiopia and Gamma Systems Ltd of Kenya were on April 7, 2011 jointly awarded a contract to undertake the review of the Feasibility Report and the ESIA and RAP reports and identify alternative line routes.

2.3 JUSTIFICATION OF THE PROJECT

By constructing an interconnection line, the proposed project will increase reliability of supply in the two countries by taking advantage of the hydrothermal complementarities of the two systems, and the variability in peak demand. In addition, the two countries may trade not only energy but also reserve capacity that provides an incentive to coordinate outages so that the total reserve margin on the interconnected system can be reduced, resulting in capital and operating cost savings.

The envisaged project will support investments in infrastructure that will facilitate the coordinated development of interconnection facilities between the two countries and thus start to remove physical constraints to power system integration. The Nile Basin Initiative recognizes that the potential for improved electricity trade in the Eastern Nile countries is enormous and can provide significant economic, employment and environmental benefits. One of the impediments for the development of a regional market is insufficient transmission infrastructure. The project is expected to create the transmission capacity to deliver firm power between Ethiopia and Kenya in the long run.

The Ethiopia – Kenya Interconnection Project would also play its rightful role in the development of electric power exchange in the continent of Africa. The high voltage transmission line between Ethiopia and Kenya will close a major gap on the high voltage grid within the EAPP, because it will ultimately serve as a link for power connection between northern and southern regions of African.

2.4 SCOPE AND OBJECTIVES OF THE PROJECT

The project develops the establishment of power trade between Ethiopia and Kenya and increase in population access to electricity at affordable prices. In addition it will also support measures to strengthen the capacity of EEPCO and KETRACO/KENGEN/KPLC to ensure smooth and efficient operation of the power interconnection. The power interconnection project is intended to facilitate export of at least 2000 MW from Ethiopia to Kenya. The Project gives opportunity for Kenya to benefit from cheap hydro and also provides Ethiopia the opportunity to earn foreign exchange revenue.

The implementation of the Ethiopia - Kenya power interconnection will be the corner stone for establishing the regional market. Until the power pool is established, the power trade between the two countries will be based on bilateral contract (PPA). Subsequently, it should be possible to develop power interconnections such as Kenya-Uganda and further to tile region, towards setting up an integrated regional energy market at the regional level.

3. DESCRIPTION OF THE PROJECT

The Ethiopian - Kenya Power interconnection project involves establishing the power transmission facilities (power transmission line and substations) between Ethiopia and Kenya to export up to 2000 MW. The interconnecting transmission link between Ethiopia and Kenya is approximately 1100 km long. The power system analysis and the preliminary results at the economic/financial evaluation show preference for a solution which is based on a long-distance ±500 kV bipolar line HVDC link.

The HVDC line design shall include the economic optimization of the conductors while considering applicable international standards. The lines shall be protected against lightning discharges by two earth wires. One ground wire and one OPGW type

The recommended configurations in the Ethiopia - Kenya Interconnection Project features are:

- ±500 kV HVDC bipolar overhead line, from Wolayta/Sodo S/S on the Ethiopian side to the proposed Suswa 400 kV S/S on the Kenyan side;
- Ground electrode line at Wolayta/Sodo and Suswa.
- 5 new 400 kV 1½ breaker diameters at Wolayta/Sodo on tile Ethiopian side and 7 new 400 kV 1½ breaker diameters at Suswa on the Kenyan side, including shunt compensation, dynamic compensation and step-down transformers:
- One synchronous condenser rated 200 MVAr at Suswa Substation.

In normal operation, the rectifier station will be at Wolayta/Sodo in Ethiopia and Suswa in Kenya.

The proposed 500 kV HVDC transmission line is on conventional lattice self supported steel towers of approximate height 45 m.

3.1 DESCRIPTION OF PROPOSED WORKS

The main activities for implementation of the project shall include clearing of bushes and cutting of trees over 4.5 m high that fall within the 65 m RoW corridor. This work may at certain places be preceded by clearing of bushes scrub to create temporary vehicular passage to facilitate conveyance of construction materials and personnel from the nearest road position to the transmission line corridor. 45 m steel-lattice towers will be erected at regular intervals to support the overhead conductors. Each steel towers will be supported on 4 m deep reinforced concrete foundation measuring 17 X 17 m. The formwork for the foundation will be 30 X 30 m but will be removed after the foundation sets. In this respect an area measuring 17 X 17 m will permanently be occupied by the tower footings at regular intervals along the entire transmission line.

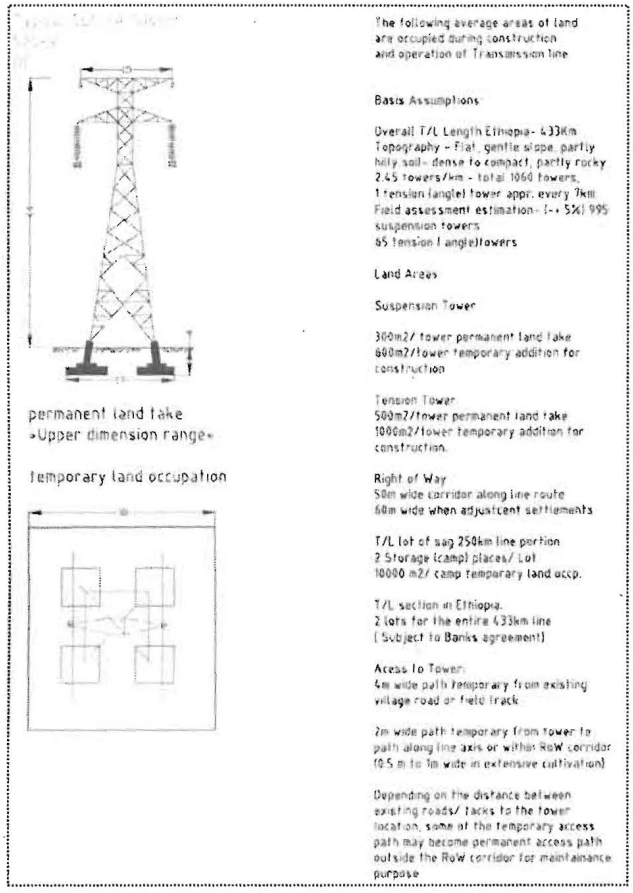


Figure 1: Typical TL Tower and Foundation

There will be a corridor 65 m wide, 32.5 m on both sides of the centre-line linking the entry point of the proposed transmission line at the Ethiopia – Kenya border and Suswa substation.

The total land area traversed by the RoW in Kenya is 39.39 km^2. This area covers privately-owned land, public land, community land and trust land.

3.1.1 Operations and Maintenance

Modern operation and maintenance procedures for transmission lines employ use of technology including electronic fault-finding techniques and overflying of the line by helicopter. Except where heavy engineering work such as replacement of tower members is necessary, most of the maintenance work on transmission lines is done using helicopter. For this reason, the temporary vehicle access passage constructed during installation and the bushes cleared during installation are allowed to re-grow. Trees and bushes are however cropped to a maximum height of 4.5 m for the entire lifetime of the transmission line.

3.2 Description of the Proposed Route

The proposed bipolar 500 kV HVDC line will originate from Wolayta Sodo in Ethiopia and terminate at Suswa in Kenya. The total length of the proposed transmission lines is 1,125 km, out of which approximately 434 km would be in Ethiopia and 606 km in Kenya. The routing in Ethiopia is in southerly direction along Lakes Abaya and Chamo, via Konso to the Ethiopia - Kenya border. It crosses the border approximately 90 km west of Moyale town. In Kenya, the transmission line route continues in a south-westerly direction through Marsabit, east of Wamba, and then on through Gilgil and Naivasha to Suswa.

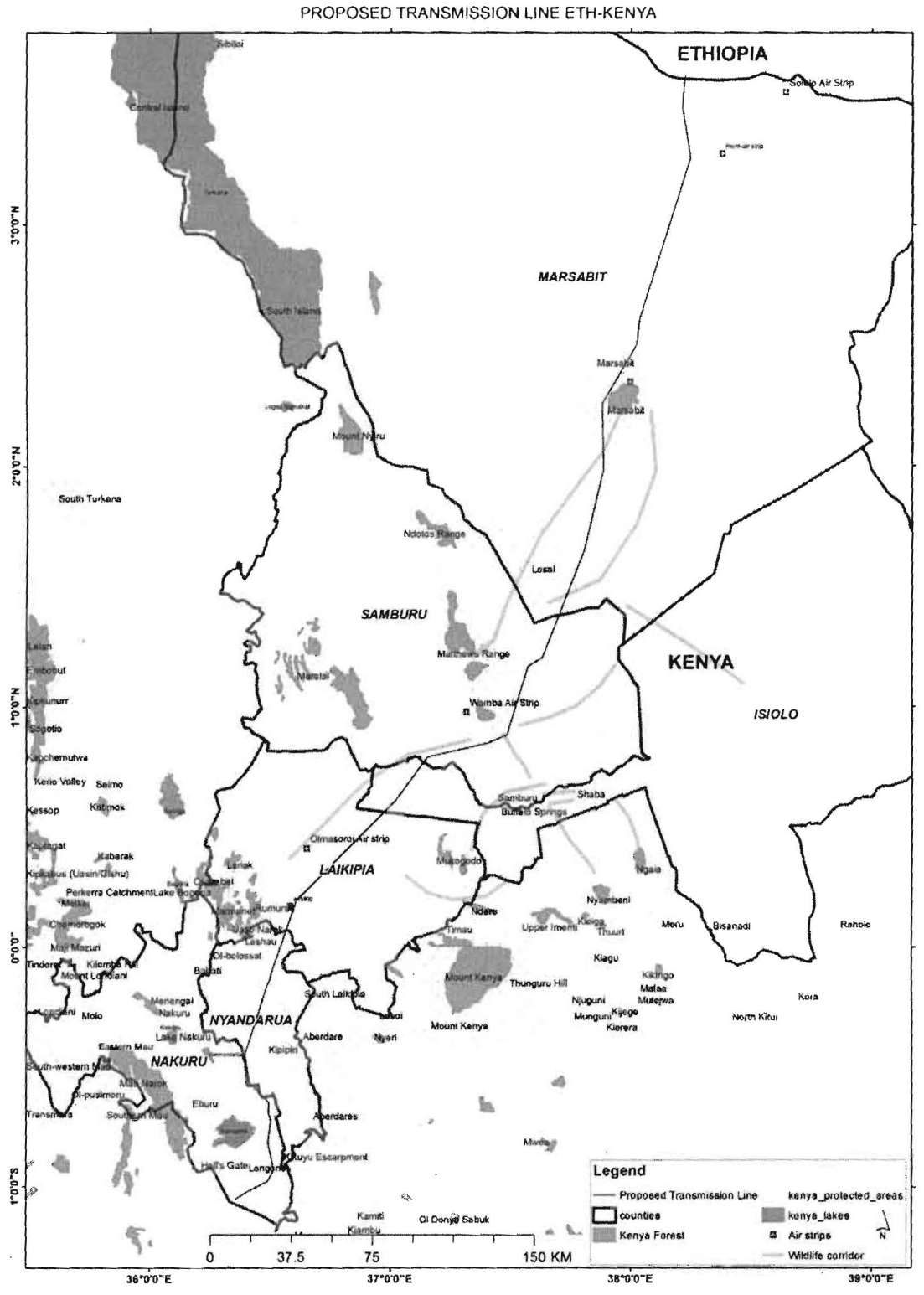


Figure 2: The proposed route after re-rerouting away from Mathews range

From the border 48 km west of Sololo town on geographical location Latitude 3.619^0 and Longitude 38.225^0, the line continues due south across Marsabit County. After turning angle point A2 for about 12.5 km section, the TL takes the first turn to the south/south east avoiding some volcanic domes at Hurri. At angle A3, the TL turns to the west of the main Moyale- Marsabit road. The RoW keeps off the road reserve by about 2.8 km running parallel through localities of Turbi and Bubisa. The TL turns west of Choba town centre keeping westerly while avoiding Marsabit municipality by about 6 km. The line continues parallel to the main Marsabit-Logologo road maintaining an offset of about 2.6 km west of the road.

After A6 the TL crosses the main road at latitude 2.204^0 and Longitude $37.881^0$to run east of the road for 7 km and crosses back to the west of the road running parallel to Marsabit- Laisamis road keeping an offset of 1.5 to 3.0 km.

At angle A8, the TL turns to the west maintaining similar direction with road alignment. At Laisamis town the TL runs close to the road as it enters Losai game reserve keeping a range of about 400m to 800m off the road reserve. The TL crosses the road to the east at Latitude 1.546^0 and Longitude 37.767^0, for about 13km southwards. Thereafter the TL crosses the road to the west at Latitude 1.431^0 and Longitude 37.721^0, while maintaining close parallel alignment with the road reserve. The line further runs through Lodosait and turns at angle A9 to A10 keeping similar road profile alignment. At the turning angle A10 the TL diverts completely away from the Main Marsabit- Isiolo road to the west meeting Angle point A11 which is about 7.8 km far east of Wamba town and 6 km west of the peak of Lololokwe Mountain.

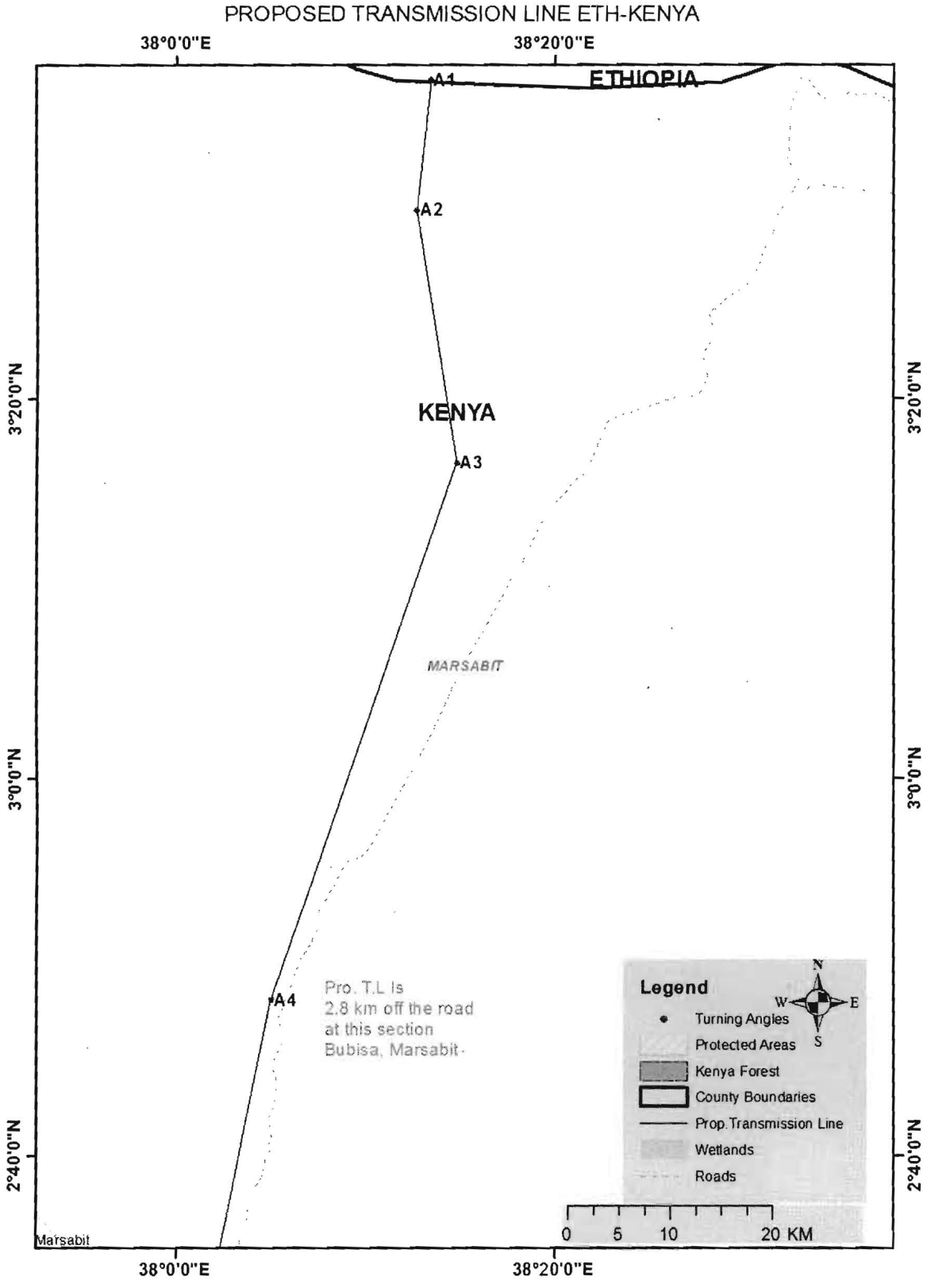


Figure 3: TL alignment from the border through Bubisa

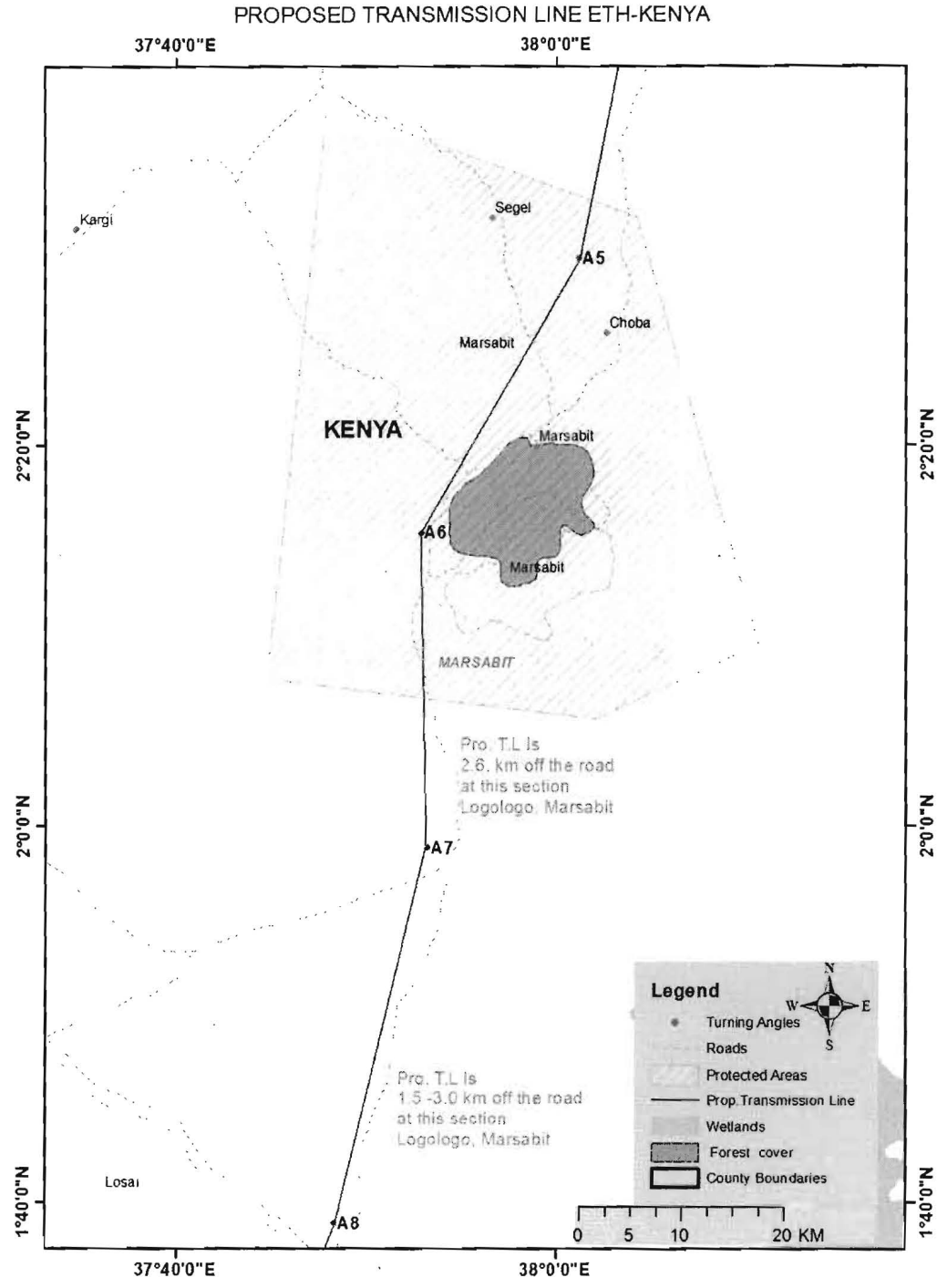


Figure 4: TL alignment through Bubisa – Marsabit - Logologo

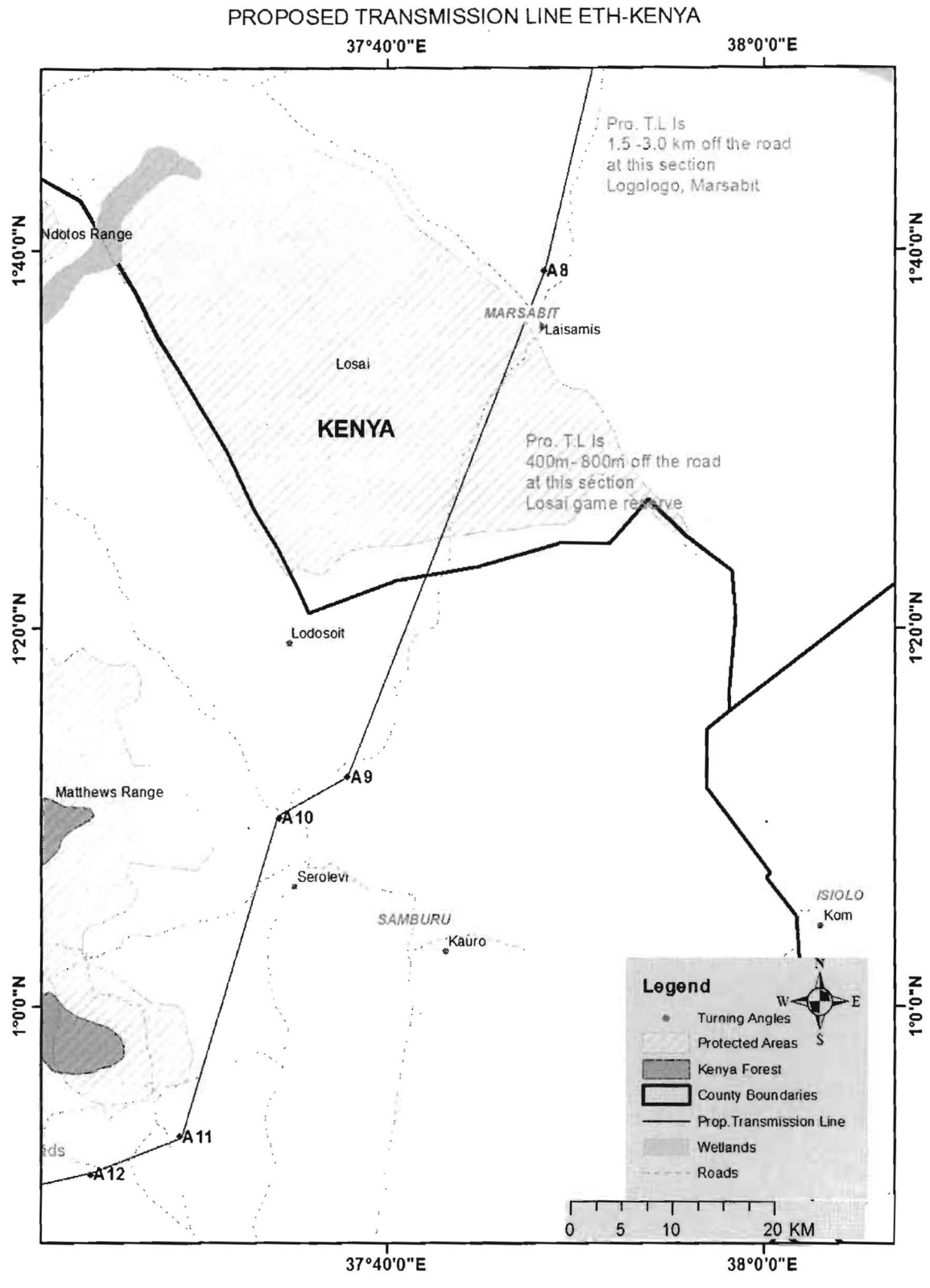


Figure 5: TL alignment through Logologo to Samburu

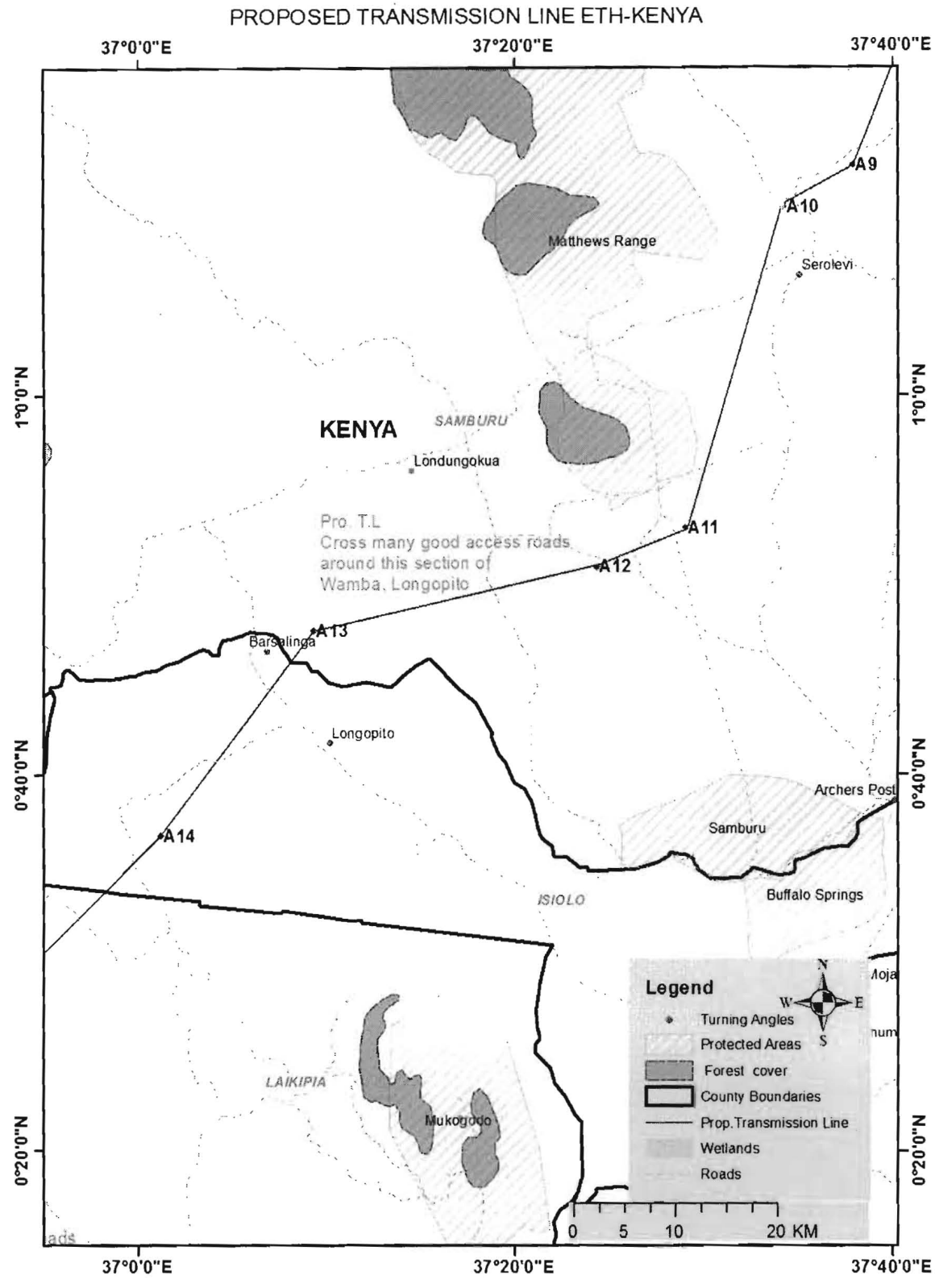


Figure 6: TL alignment through Samburu - Isiolo

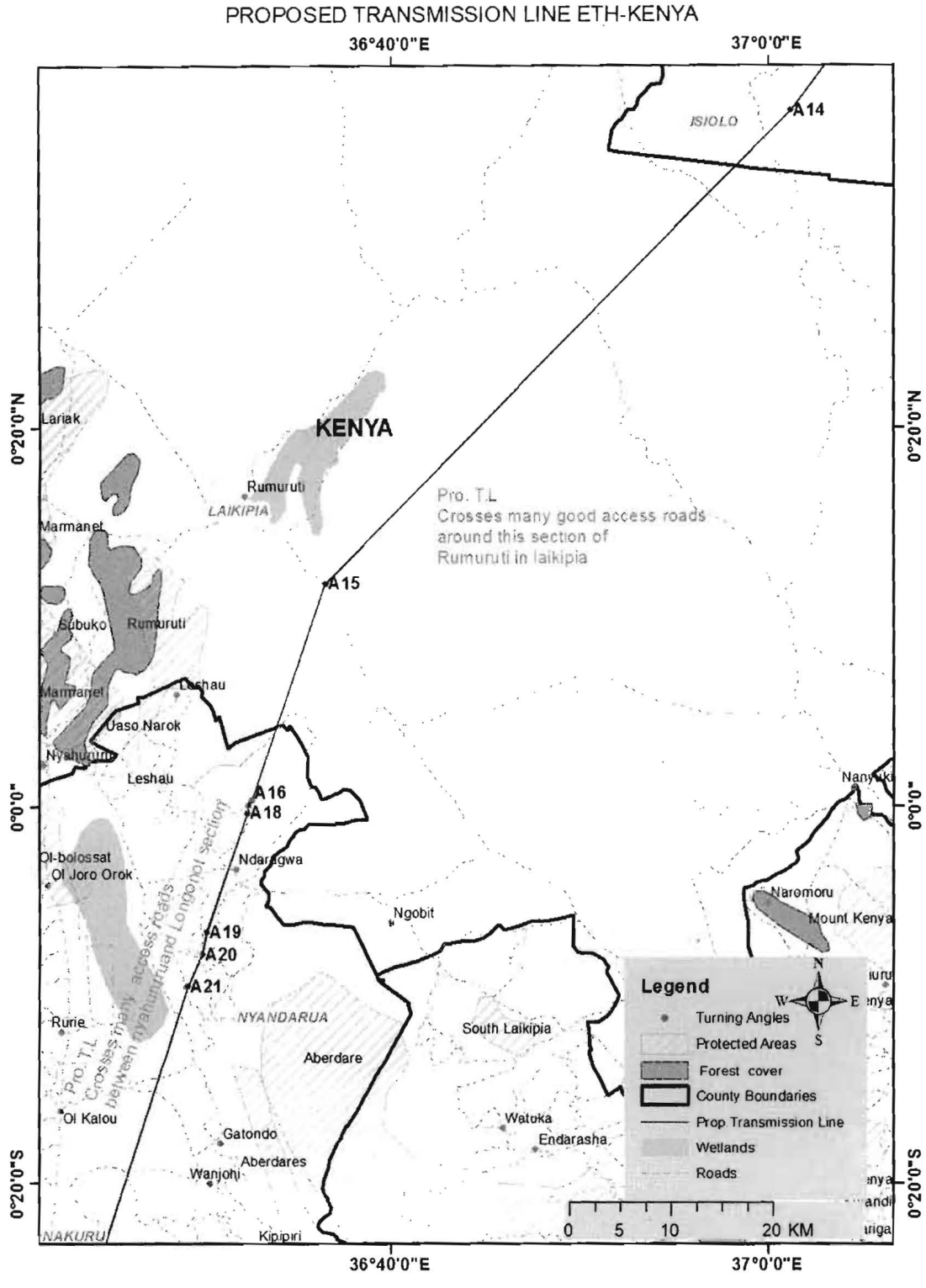


Figure 7: TL alignment through Laikipia - Nyandarua

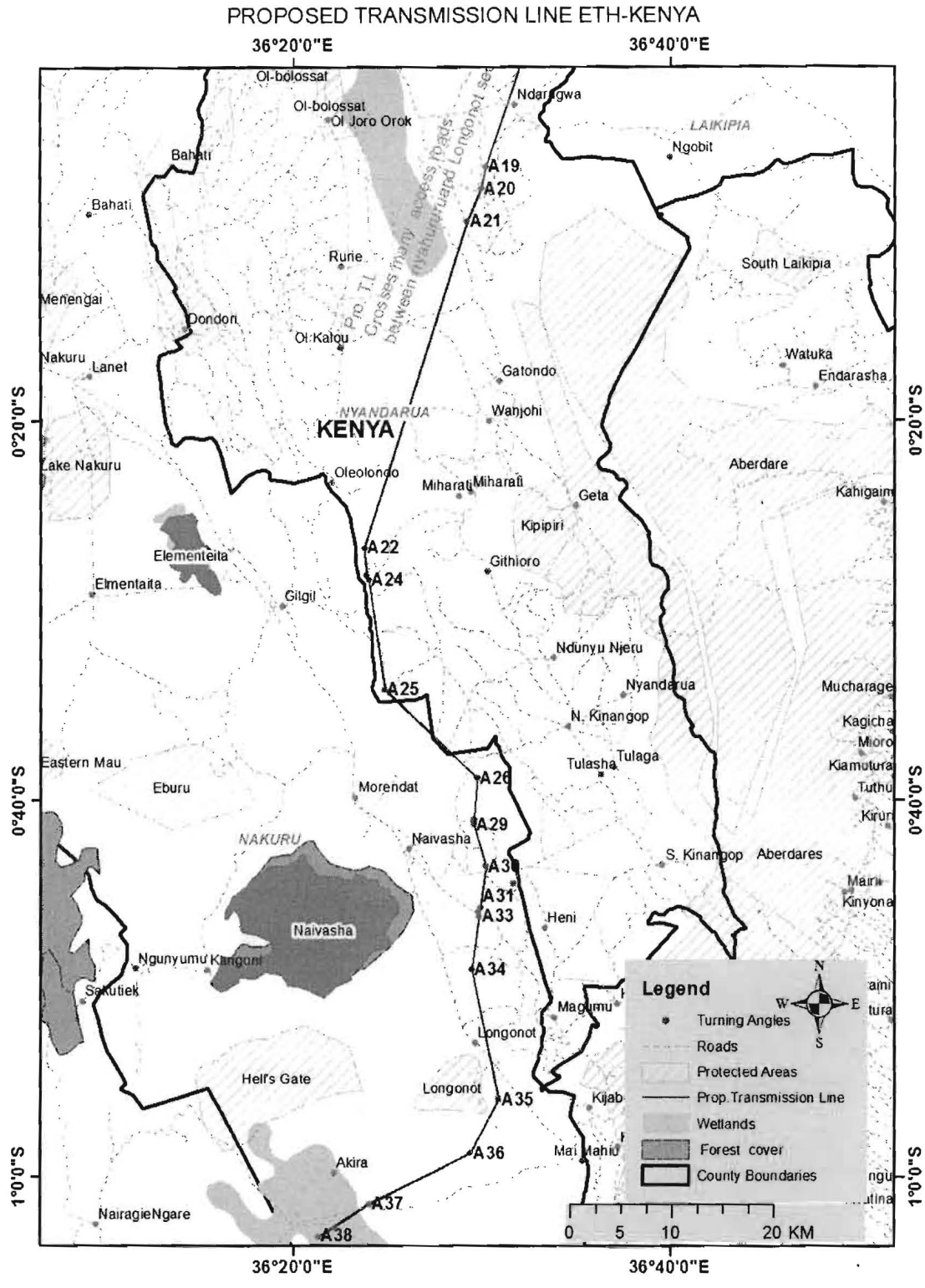


Figure 8: TL alignment through Nyandarua - Nakuru

From this section starting at turning Angle A11 southwards, accessibility to the TL by road is generally feasible through classified all-weather roads and private roads linking different parts of the vast conservancies in Isiolo and Laikipia. Such road accesses to the TL apply throughout the remaining sections of the TL up to turning angle A15 where the line turns south to Ndaragua in the western part of the Aberdare Range, then down over the cliff to Olkalou settlement in the eastern side of Lake Ol Bolossat. The TL proceeds further to the south west direction crossing Malewa River to the east. The line assumes a parallel alignment with Nyandarua county Boundary southerly to Naivasha avoiding densely populated zones. The TL keeps the alignment along the escarpment of Murungaru/ North Kinangop/ Karati up to NYS Training Institute; then drops down

the cliff south to Maraingishu settlement scheme. The TL keeps the upper part of Naivasha town and further down to the turning angle A35 in the south east slopes of Mount Longonot, the line keeps off the mountain peak by about 9km, The TL then turns to the south west crossing Maimahiu- Narok road near angle A37 and further south terminating at the proposed substation site at Suswa.

4. LEGAL FRAMEWORK OF KENYA

4.1 THE ENERGY ACT, NO. 12 OF 2006

The principal law that regulates the electricity sub-sector in Kenya is the Energy Act, 2006. The Act establishes the Energy Regulatory Commission (ERC) with powers to process and recommend applications for licenses for generation, distribution and transmission. The ERC is mandated to set, review and adjust transmission and distribution tariffs. It is charged with the responsibility of enforcing environmental and safety regulations, investigating complaints and ensuring fair competition in the sub-sector. It is also responsible for the preparation and approval the Power Purchase Agreements (PPAs) between generators and distributors.

Majority of regulatory issues are addressed through subsidiary legislations in order to maintain a fair degree of flexibility when dealing with ever-changing and fluid electricity sub-sector issues.

The Energy Act, 2006 provides for the way an electricity supply licensee is permitted to enter land for purposes of constructing electric lines. It highlights the process of establishing wayleaves and compensation for wayleaves, how complaints relating to compensation can be settled and the issue of compulsory acquisition of land for wayleaves purposes. Several other statutes complement the Energy Act in the regulation of the electricity sub-sector.

4.2 ENVIRONMENTAL MANAGEMENT AND COORDINATION ACT, 1999

The Environmental Management and Coordination Act No. 8 of 1999 (EMCA) is an Act of Parliament that provides the establishment of an appropriate legal, institutional and regulatory framework for environmental management.

The EMCA was developed as a framework law. It is the only legislation that contains the most comprehensive system of environmental management in Kenya.. The Act is based on the recognition that improved legal and administrative co-ordination of the diverse sectoral initiatives is necessary in order to improve national capacity for environmental management. It has the main purpose of coordination and supervision of a wide range of environmental issues, which are contained in the regulations and guidelines. Section 3 of the Act highlights the General Principles that guide its implementation. Every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance it.

The Act is implemented through an institutional set up that includes the National Environment Council (NEC), National Environmental Management Authority (NEMA), Public Complaints Committee, National Environment Tribunal and the Board of Trustees for the Environment Trust Fund among others. One of NEMA's main tasks is to ensure that industrialists and other developers comply with the laid down provisions of the Act. Developers under certain categories are required by law to carry out environmental impact assessments prior to proceeding with development. NEMA enforces the law through the lead agencies that it retains in its register.

4.2.1 EMCA (Environmental Impact Assessment and Audit) regulation of 2003

These regulations guides on the requirement of undertaking an environmental and social impact assessment in Kenya. It also guides on the requirements for undertaking annual Environmental Audit.

4.2.2 EMCA (Noise and Excessive Vibration Pollution) Regulations, 2010

These regulations should be followed together with the provisions of The Factories and Other Places of Work (Noise Prevention and Control) Rules, 2005.

Part III paragraph 14 applies to regulations regarding Noise, excessive vibrations from construction, demolition, mining or quarrying sites. The paragraph states that where defined work of construction, demolition, mining or quarrying is to be carried out in an area, NEMA may impose

requirements on how the work is to be carried out including but not limited to requirements regarding machinery that may be used, and the permitted levels of noise as stipulated in the Second and Third Schedules to these Regulations.

4.2.3 EMCA (Waste Management) Regulation, 2006

The Regulations guide on appropriate waste handling procedures and it require that, contractors engaged in waste management should be registered with NEMA and, should posses all recommended waste handling equipment's and documents.

The project shall generate large volumes of soil which should be used in backfilling during embankment development. It is anticipated that the amount of discarded material as waste shall be minimum but all waste generated including those generated by workers should be collected and disposed in designated dumping areas.

4.2.4 EMCA (Fossil Fuel Emission Control) Regulations, 2006

This Regulation aims to eliminate or reduce to minimum standards emissions generated by internal combustion engines. Sections 4(1) requires that, any internal combustion engine subjected to inspection under the Regulation should pass tests set for air pollution control and meet the standards prescribed under the First Schedule to the Regulations.

This regulation is triggered as the proponent will use vehicles and equipment's that depend on fossil fuel as their source of energy during project implementation. It is recommended the requirements of the regulation such as periodic vehicle inspection, use of clean fuels among others be implemented in order to eliminate or reduce negative air quality impacts.

4.3 The Occupation Safety and Health Act (OSHA), 2007

This Act applies to all workplaces and workers associated with it; whether temporary or permanent, with the aim of securing the safety, health and welfare of workers and non-workers. It is recommended that all sections of the Act related to this project be observed. OSHA Action Plan shall be developed and shall provide a clear statement of intent and a plan of action for the prevention of accidents and occupational illnesses and injuries.

4.4 Work Injury compensation Benefit Act 2007

This Act provides for the compensation of employees on work related injuries and diseases contracted in the course of employment and for connected purposes. The act includes compulsory insurance for employees. The project is likely to trigger this act as it shall employ both skilled and unskilled laborers' during construction and operation phases of the project, the contractor therefore must ensure this acts' requirement is observed.

4.5 Land Planning Act Cap 303

Section 9 of the subsidiary legislation (the development and use of land Regulation 1961) requires that before the Local Authority submits plans to the minister for approval, steps should be taken as may be necessary to acquire the consent of owners of the land affected by such plans. Comments and objections made by the landowners should be submitted and mitigated with the intent to reducing conflict of interest with other socio-economic activities. To ensure compliance with this Act, the proponent has developed a RAP that shall guide land acquisition before development.

4.6 Land Control Act Cap 302

This act of parliament controls transactions on agricultural land. The act is supported with the land control regulations and Land Control. This Act is triggered as the proposed power line will cross productive agricultural land south of Isiolo area.

4.7 LAND ACQUISITION ACT 295

This Act provides guidelines on land expropriation by the State or Government for the general benefit of the community. The Act considered that the owners of the acquired land should be compensated and their grievances addressed. The requirements of this Act are triggered and the proponent will require a RAP to facilitate planning for the compensation process; the RAP also details measures taken to mitigate asset loss, and where unavoidable, to provide compensation.

4.8 WAY LEAVE ACT 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 buildings or structures of an ongoing activity.

In accordance with the Act (section 4), notice will be given to community members before carrying out works and it shall provide a 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 the section.

4.9 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 the Registered Land.

4.10 PUBLIC ROADS AND ROADS OF ACCESS ACT (CAP. 399)

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 and land owners to create such access roads during the construction phase.

4.11 LOCAL GOVERNMENT ACT, CHAPTER 265 OF THE LAWS OF KENYA

The Energy Act, 2006 requires any applicant for a license to liaise with Local Authorities affected by its proposed activities and obtain their consents prior to submitting an application for a license to the Electricity Regulatory Board. The applicant should also adhere to the bylaws of the relevant Local Authority.

4.12 THE STANDARDS ACT, CHAPTER 496 OF THE LAWS OF KENYA

The Electricity Regulatory Board is empowered to enforce safety regulations and to ensure that electrical apparatus and building wiring works meet the standards set by the Kenya Bureau of Standards or where no such standards exist, compliance with the relevant international standards approved by the Kenya Bureau of Standards.

4.13 AGRICULTURE ACT (CAP 318)

The Agriculture Act contains provisions for promoting agricultural development. It is implemented by the Ministry of Agriculture. The longterm objective of the Act is to ensure the development of arable land in accordance with the sound practice of good land use. It therefore stresses the need for conservation of soil and its fertility and has provisions for soil erosion control. Through these provisions it has the means to control one of the most important pollutants: namely, sediments

eroded from agricultural lands. By regulating the utilization of different categories of land for various agricultural purposes, the Act strives towards sustainable utilization of land

resources.

4.14 Forests Act (Cap 385 and Act No. 7 of 2005)

The Forestry Act is regulated by the Ministry of Environment and Natural Resources. The Act contains the provisions for establishment, control and regulation of Government forests and other forests in Kenya. It regulates the conservation of vegetation of all types (both indigenous and exotic). The Act provides the regulations for the exploitation of these resources and their sustainable management.

4.15 Wildlife (Conservation and Management) Act (Cap 376)

This act of parliament is implemented by the Ministry of Environment and Natural Resources in conjunction with other relevant government agencies such as Kenya Wildlife Service. The act contains provisions for the preservation and control of wild fauna and flora. The spirit of the Act is to ensure that Kenya's fauna and flora continue to flourish in their natural habitats. Various national parks and game reserves apply the act in protecting flora and fauna in their areas of jurisdiction.

4.16 Land Planning Act (Cap 303)

The Land Planning Act is implemented through the Ministry of Lands and Settlement. The act contains provisions for planning, use and development of land. It regulates the extent of use and development of land in the urban and rural areas of Kenya.

4.17 Institutional Framework

4.17.1 KETRACO

Kenya Electricity Transmission Company Limited (KETRACO) came ito being as a result of energy sector reforms as enabled by the Energy Act of 2006 and further supported by Sessional paper No. 4 of 2004 on Energy. KETRACO was incorporated in 2008 and registered under the Companies Act, Cap 486. It is wholly owned by the Government and as such, it is regulated under the State Corporations Act, Cap 446. The Company was established to develop new high voltage electricity transmission infrastructure that will form the backbone of the National Transmission Grid, in line with Kenya Vision 2030. Its core business is to plan, design, build and maintain new electricity transmission lines and associated substations. These new lines will include 132kV, 220kV, 400kV and 500kV High Voltage Direct Current (HVDC).

4.17.2 National Environmental Management Authority (NEMA)

The Environmental Management and Coordination Act No. 8 of 1999 (EMCA) was enacted in January 2000. The Act established a number of institutions for purposes of management of the environment in the country, which are described in chapter 3.4.2. At the apex of these institutions is the Ministry of Environment and Natural Resources (MENR). Under MENR is the National Environment Council established under Section 4 of the Act. The Board of Management of the National Environmental Council is made up of fourteen members including the Permanent Secretary of the Ministry of Environment and Natural Resources who is the Chairman.

Within NEMA, EMCA has established several statutory committees namely Standards and Enforcement Review Committee, the National Environment Action Plan Committee and the Environmental Impact Assessment Technical Advisory Committee. In the administrative provinces and districts, the Act has established the Provincial and District Environment Committees.

EMCA has established two independent entities: the Public Complaints Committee and the National Environment Tribunal. The functions of the Public Complaints Committee include

receiving and investigating allegations or complaints relating to environmental degradation and forwards findings to NEMA for action. The primary functions of the National Environment Tribunal are to hear disputes on the administration of the Act and appeals against administrative decision of NEMA and other organs responsible for enforcement of the Act. Such appeals may be launched by aggrieved persons, communities or organizations.

4.17.3 The Role of NEMA during EIA and Auditing Processes

NEMA has the mandate to enforce Environmental Impact Assessment (EIA) and Environmental Audit (EA). EMCA provides guidelines for EIA and EA. These guidelines are applicable to both public and private sector development projects and programmes. Project types that should be subjected to EIA/EA are specified in the Second Schedule of EMCA. Besides the scheduled activities, the Act empowers the Minister to prescribe for EIA/EA appraisal upon any other activity which in his view is likely to have significant environmental impacts.

A scheduled activity will not receive the necessary authorization from NEMA to proceed or continue in operation until all the necessary EIA/EA requirements have been fulfilled and accepted by NEMA and its relevant lead agencies. EIA Licenses are granted when NEMA and the Minister are satisfied that an EIA has been satisfactorily conducted and a realistic and achievable Environmental Management Plan has been prepared and incorporated in the EIA report. All formal submissions under the EIA/EA guidelines are made to NEMA through the District Committees. NEMA maintains a register of all projects and programmes being appraised at any one time under the EIA/EA guidelines. The EIA/EA and subsequent reporting is the responsibility of the project proponent. NEMA on behalf of the Government provides the procedures and technical advice to project proponents on how to comply with the EIA/EA requirements. Under regulation 34, unless it is a self-auditing study, an EA shall, be conducted by a qualified and authorized environmental auditor or inspector who shall be an expert or a firm of experts registered in accordance with regulation 14.

For an ongoing project, NEMA would require the proponent to undertake an initial EIA study followed by subsequent environmental control audit studies as necessary at times agreed upon by NEMA and the proponent. The initial EIA study would provide baseline information upon which subsequent environmental control audits will be based. NEMA undertakes control audits to check compliance with the environmental management plan and to verify adequacy of the environmental management plan in mitigating the negative impacts of the project.

4.17.4 The Ministry of Energy (MoE)

The electricity sub-sector forms part of the energy sector in Kenya. The energy sector in Kenya is under the responsibility of the Ministry of Energy (MoE). The current set-up of the energy sector is as set out in the Energy Act No. 12 of 2006 which is a culmination of the restructuring that took place in the sector. The thrust of the restructuring of the power sub-sector which started in 1996 was to enhance arms-length commercial type-relationships between the sector entities and to create a legal and regulatory framework to facilitate the restructuring of the sub-sector. Under the restructuring the roles of electricity generation, distribution, transmission and rural electrification were separated. The Act set out the participation of the private sector in electricity production and distribution.

4.17.5 The Energy Regulatory Commission (ERC)

ERC was established under the Energy Act, 2006, which also stipulated the process of appointment of its commissioners. The Act provides for appointments to key executive posts including the Director General and Commission Secretary. It also outlines the ERC's main sources of funding.

In accordance with the Act, ERC is an industry-specific regulatory body and therefore has potential to provide industry-specific expertise and focus. Economic regulation involves making decisions on politically sensitive issues and decisions that have important implications on regulated utilities, their customers, suppliers and shareholders. Often the interests of different stakeholders in the

sub-sector would be conflicting. These conflicting interests have to be evaluated and resolved in an impartial and objective manner. This means that the regulator must be, and must be seen to be neutral and impartial. The Act provides for a fairly independent ERC whose commissioners are bestows with independence from political authorities, the regulated utilities and customers.

The ERC depends on the Ministry of Energy for policy guidance. As a safeguard against abuse of the trust invested in it, parties aggrieved by ERC's decisions may seek recourse from the Energy Tribunal. The ruling of the Tribunal can be appealed to the Minister for Energy. The ruling of the Minister can be appealed to the High Court of Kenya and further to the Court of Appeal. In addition, members of the Commission may be removed from office for reasons such as misconduct, bankruptcy, conviction of criminal offence involvement in dishonest gains, fraud or moral turpitude and incapacity.

5. INTERNATIONAL AGENCIES POLICIES

5.1 DESCRIPTION OF WORLD BANK ENVIRONMENTAL & SOCIAL SAFEGUARDS POLICIES AND TRIGGERS

In this section, the Environmental and Social Safeguard Policies of the World Bank and their applicability are discussed. The World Bank Safeguard Policies are;

1. Environmental Assessment (OP/ BP 4.01)
2. Natural Habitats (OP/ BP 4.04,)
3. Forestry (OP/ BP 4.36)
4. Pest Management (OP/BP 4.09)
5. Physical Cultural Resources (OP/BP 4.11)
6. Indigenous Peoples (OP/BP 4.10)
7. Involuntary Resettlement (OP/BP 4.12)
8. Safety of Dams (OP/BP 4.37)
9. Projects on International Waterways (OP/BP 7.50)
10. Projects in Disputed Areas (OP/BP 7.60)

The following Bank policies are triggered for the proposed Ethiopia-Kenya Power Interconnection Project:

1. Environmental Assessment (OP/BP 4.01,)
2. Involuntary Resettlement (OP/BP 4.12)
3. Natural Habitats (OP/ BP 4.04)
4. Indigenous Peoples (OP/BP 4.10)

A complete description of the World Bank safeguards and their triggers for applicability can be found on the World Bank's official web site www.worldbank.org and are summarized in this chapter.

5.2 ENVIRONMENTAL ASSESSMENT (OP4.01, BP 4.01

This policy requires an Environmental Assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making. The EA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed investment. The EA process takes into account the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and cultural property) and transboundary and global environmental aspects.

The EA should establish a mechanism to determine and assess future potential environmental and social impacts during project implementation, and then to set out mitigation, monitoring and institutional measures to be taken during operations of these activities, to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels.

Operational Policy 4.01 further requires that the EA must be disclosed as a separate and stand alone document by the Government of Kenya and the World Bank as a condition for World Bank appraisal. The disclosure should be both in Kenya where it can be accessed by the general public and local communities and at the InfoShop of the World Bank and the date for disclosure must precede the date for appraisal of the program.

The World Bank system assigns a project to one of three project categories, as defined below:

5.2.1 Category "A" Projects

An EIA is always required for projects that are in this category. Impacts are expected to be 'adverse, sensitive, irreversible and diverse with attributes such as pollutant discharges large

enough to cause degradation of air, water, or soil; large-scale physical disturbance of the site or surroundings; extraction, consumption or conversion of substantial amounts of forests and other natural resources; measurable modification of hydrological cycles; use of hazardous materials in more than incidental quantities; and involuntary displacement of people and other significant social disturbances.

5.2.2 Category "B" Projects

Although an EIA is not always required, some environmental analysis is necessary. Category B projects have impacts that are 'less significant, not as sensitive, numerous, major or diverse. Few, if any, impacts are irreversible, and remedial measures can be more easily designed.' Typical projects include rehabilitation, maintenance, or upgrades, rather than new construction.

5.2.3 Category "C" Projects

No EIA or other analysis is required. Category C projects result in negligible or minimal direct disturbance of the physical environment. Typical projects include education, family planning, health, and human resource development.

The Ethiopia –Kenya Power Interconnection Project has thus been screened and assigned an EA Category A.

5.3 OP 4.12 - INVOLUNTARY RESETTLEMENT

The objective of this policy to avoid where feasible, or minimize, exploring all viable alternative project designs, to avoid resettlement. This policy is triggered in situations involving involuntary taking of land and involuntary restrictions of access to legally designated parks and protected areas. The policy aims to avoid involuntary resettlement to the extent feasible, or to minimize and mitigate its adverse social and economic impacts.

This policy covers direct economic and social impacts that both result from Bank-assisted investment projects, and are caused by (a) the involuntary taking of land resulting in (i) relocation or loss of shelter; (ii) loss of assets or access to assets, or (iii) loss of income sources or means of livelihood, whether or not the affected persons must move to another location; or (b) the involuntary restriction of access to legally designated parks and protected areas resulting in adverse impacts on the livelihoods of the displaced persons.

The policy prescribes compensation and other resettlement measures to achieve its objectives and requires that borrowers prepare adequate resettlement planning instruments prior to project appraisal of proposed projects. The objective of this policy to avoid where feasible, or minimize, exploring all viable alternative project designs, to avoid resettlement.

The policy requires the displaced persons and their communities, and any host communities receiving them, are provided timely and relevant information, consulted on resettlement options, and offered opportunities to participate in planning, implementing, and monitoring resettlement. Appropriate and accessible grievance mechanisms are established for these groups. In new resettlement sites or host communities, infrastructure and public services are provided as necessary to improve, restore, or maintain accessibility and levels of service for the displaced persons and host communities.

This policy is triggered because the Project activities will lead to the involuntary taking of land and other assets resulting in:

- Relocation or loss of shelter,
- Loss of assets or access to assets,
- Loss of income sources or means of livelihood, whether or not the affected persons must move to another location,
- Loss of land.

5.4 OP/BP 4.04 NATURAL HABITATS

This policy supports the conservation of natural habitats and the maintenance of ecological functions as a basis for sustainable development. The objective of the policy is to promote environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions. The World Bank does not support projects that involve the significant conversion or degradation of critical natural habitats.

The policy calls for the avoidance of significant conversion or degradation of critical natural habitats, including those habitats that are (a) legally protected, (b) officially proposed for protection, (c) identified by authoritative sources for their high conservation value, or (d) recognized as protected by traditional local communities. Where projects adversely affect non-critical natural habitats, the project should proceed only if viable alternatives are not available, and if appropriate conservation and mitigation measures, including those required to maintain ecological services they provide, are in place.

The project should include mitigation measures that minimize habitat loss and establish and maintain an ecologically similar protected area. Whenever feasible, preference is given to siting projects on lands already converted. The policy requires that the Project consult key stakeholders, including local nongovernmental organizations and local communities, and involve such people in design, implementation, monitoring, and evaluation of projects, including mitigation planning.

5.5 OP 4.10 - INDIGENOUS PEOPLES

Indigenous peoples in particular geographical areas are identified by having: a close attachment to ancestral territories and to the natural resources in these areas; self-identification and identification by others as members of a distinct cultural group; an indigenous language, often different from the natural language; presence of customary social and political institutions; and primarily subsistence-oriented production.

The Bank's objective is to ensure that indigenous peoples do not suffer adverse effects from Bank financed projects and that they receive culturally compatible social and economic benefits. Effectively the World Bank requires a project to develop a program for addressing issues based on the informed participation of the indigenous people themselves. Any project that affects indigenous peoples is expected to include components or provisions that incorporate an "Indigenous Peoples Plan.

5.6 OP/ BP 4.11 PHYSICAL CULTURAL RESOURCES

The objective of this policy is to assist in preserving physical cultural resources (PCR) and avoiding their destruction or damage. PCR includes archaeological, paleontological, architecturally significant, and religious sites including graveyards, burial sites, and sites of unique natural value. Initial indications are that no observed physical or cultural resources will be affected by the project. Nevertheless, the Contractor is responsible for familiarizing themselves with the following "Chance Finds Procedures", in case culturally valuable materials are uncovered during excavation, including:

Stop work immediately following the discovery of any materials with possible archeological, historical, paleontological, or other cultural value, announce findings to project manager and notify relevant authorities;

Protect artifacts as well as possible using plastic covers, and implement measures to stabilize the area, if necessary, to properly protect artifacts

Prevent and penalize any unauthorized access to the artifacts

Restart construction works only upon the authorization of the relevant authorities

All contracts should include a Chance Finds Procedure clause

Table 1: World Bank Policies triggered by the project

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment (OP/BP 4.01)	X	
Natural Habitats (OP/BP 4.04)	X	
Pest Management (OP 4.09)		X
Physical Cultural Resources (OP/BP 4.11)		X
Involuntary Resettlement (OP/BP 4.12)	X	
Indigenous Peoples (OP/BP 4.10)	X	
Forests (OP/BP 4.36)		X
Safety of Dams (OP/BP 4.37)		X
Projects in Disputed Areas (OP/BP 7.60)		X
Projects on International Waterways (OP/BP 7.50)		X

5.7 Alignment of relevant WB and Government of Kenya Policies

Both the World Bank safeguards and GoK laws are generally aligned in principle and objective:

- Both require Environmental Assessment before project design and implementation (which also includes an assessment of social impacts).
- Both require public disclosure of EIA reports and stakeholder consultation during preparation.
- While OP 4.01 of World Bank allows different levels of environmental study for different category of projects, EMCA requires EIA for all sizes of projects, which require to be scoped as applicable.
- The Bank requires that stakeholder consultations be undertaken during planning, implementation and operation phases of the project which is equivalent to the EMCA requirements.
- Additionally, statutory annual environmental audits are required by EMCA.

In Kenya, it is a mandatory requirement under EMCA 1999 for all development projects (Schedule Two) to be preceded by an EIA study. Thus, under the Laws of Kenya, environmental assessment is fully mainstreamed in all development process consistent with World Bank policies.

5.8 Requirements for Public Disclosure

Upon finalization, the ESIA will be disclosed in both KETRACO website, and in the World Bank's InfoShop.

5.9 African Development Bank (AFDB) Policies

The AfDB policy on environmentally sustainable development in Africa is described in the 2004 Bank Group Policy on the Environment. The policy acknowledges the need to preserve and enhance ecological capital to sustain and enrich economic growth in Africa. The main goals of the policy are to:

- Promote a long-term view and perspective of economic and social development;
- Reverse, where possible, and halt the impoverishment process in Africa by enhancing the access of the poor to environmental resources;

- Help Regional Member Countries to build their human capacity and sensitize policymakers on environmental issues and bring about institutional changes to achieve sustainable development; and,
- Reinforce the existing partnerships with international institutions and network with regional and sub regional organizations to coordinate interventions in environmental sustainable development.

Two procedural guidelines central to the Policy on the Environment are the Strategic Impact Assessment Guidelines (SIA) and the Integrated Environmental and Social Assessment Guidelines (IESA). The SIA is a systematic process of evaluating the environmental consequences of any proposed policy or programme, as well as a tool for assessing social and environmental sustainability of policy-based lending, structural adjustment, and sector investment lending. The IESA Guidelines are designed to ensure the inclusion of environmental and social issues in Bank projects throughout the project cycle. These provide guidelines for sector-specific issues and impacts that should be taken into account during the preparation and assessment phases of a project.

5.9.1 Key Environmental Triggers

Two procedural guidelines central to the Policy on the Environment are the Strategic Impact Assessment Guidelines (SIA) and the Integrated Environmental and Social Assessment Guidelines (IESA). The SIA is a systematic process of evaluating the environmental consequences of any proposed policy or programme, as well as being a tool for assessing social and environmental sustainability for policy-based lending, structural adjustment and sector investment lending. The IESA Guidelines are designed to ensure the inclusion of environmental and social issues in Bank projects throughout the project cycle. These provide guidelines for sector-specific issues and impacts that should be taken into account during the preparation and assessment phases of a project.

The African Development Bank (AfDB) has sets of environmental and social assessment procedures that formalise the process to be followed when formulating, designing, constructing and operating programmes and projects. The environmental classification of proposed programmes and projects takes into consideration their nature, size and location. There are key environmental triggers that automatically put projects into the top class of environmental and social assessment. These are:

- Land acquisition that requires the involuntary resettlement of people.
- Projects in protected areas.
- Projects with impacts on the habitats of protected and threatened species.
- Projects where there are indigenous people. The key issue here is that no minority people are to be unfairly discriminated against, either due to loss of access to existing resources or to be unfairly excluded from project benefits.
- Projects that impact cultural heritage.
- Projects that have trans-boundary impacts, including work on trans-boundary waterways.

Amongst these triggers, the most relevant for the proposed TLare twofold, firstly is its potential indirect impacts on protected areas and secondly its potential impacts on habitats of protected and threatened species. Together with the magnitude of the Project, the AfDB has placed the Project in category 'A', implying it has potentials to impact on the environment in a significant way.

5.9.2 Environmental Classification according to AfDB

The African Development Bank (AfDB) is the proposed funding agency alongside the Government of Kenya for the Project. It is thus imperative that the environmental assessment process for the

Project is consistent with AfDB's Environmental and Social Assessment Procedures of 2001 and the Policy on Resettlement and Involuntary Displacement (2003). According to the AfDB Policy this is a Category 1 Project that requires a full Environmental and Social Impact Assessment (ESIA), including the preparation of an Environmental and Social Management Plan (ESMP). According to AfDB category 1 projects are likely to induce important adverse environmental and/or social impacts that are irreversible, or to significantly affect environmental or social components considered sensitive by the Bank or the borrowing country.

5.9.3 AfDB Environmental Social Impact Assessment Guidelines, 2004

5.9.3.1 Equator Principles

Equator Principles (EP) are a set of environmental and social benchmarks for managing environmental and social issues in development project finance globally. The principles require that for all medium or high risk projects (Category A and B projects), sponsors complete an Environmental Assessment, the preparation of which must meet certain requirements and satisfactorily address key environmental and social issues.

The principles require that the Environmental Assessment report addresses baseline environmental and social conditions, requirements under host country laws and regulations, applicable international treaties and agreements, sustainable development and use of renewable natural resources, protection of human health, cultural properties, and biodiversity, including endangered species and sensitive ecosystems, use of dangerous substances, major hazards, occupational health and safety, fire prevention and life safety, socio-economic impacts, land acquisition and land use, involuntary resettlement, impacts on indigenous peoples and communities, cumulative impacts of existing projects, the proposed project, and anticipated future projects, participation of affected parties in the design, review and implementation of the project, consideration of feasible environmentally and socially preferable alternatives, efficient production, delivery and use of energy, pollution prevention and waste minimization, pollution controls (liquid effluents and air emissions) and solid and chemical waste management. The principles require for risky projects, the borrower has to consult with stakeholders (NGOs and project affected groups) and provides them with information on the risks of the project.

5.10 International Agreements and Standards

Kenya is party to several international conventions that are relevant to natural resource/environmental management, from which some are listed in the following:

- Convention on Biological Diversity (CBD);
- African Convention on the Conservation of Nature and Natural Resources;
- Vienna Convention for the Protection of the Ozone Layer;
- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention);
- Convention on International Trade In Endangered Species of Wild Fauna and Flora (CITES);
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention or CMS);
- United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and /or Desertification, Particularly in Africa;
- Convention Concerning the Protection of the World Cultural and Natural Heritage.

6. METHODOLOGY

6.1 BIO-PHYSICAL ENVIRONMENT

The Impact Assessment was partly based on the materials presented in Fichtner ESIA/RAP studies of 2009, the comments of the stakeholders to 2009 studies, and data and Information collected during this study.

Document review: Existing secondary data including documents, maps, Satellite imagery, drawings, data and web site resources have been reviewed. The purpose of the review is to obtain an overview of the existing project route environmental conditions, identify gaps and come up with ways of filling-up the gaps. Subsequently, available documentation in hard and soft copies from various institutions and administration were reviewed and evaluated against the Fichtner, 2009 ESIA/RAP studies.

The main relevant documents found on the web sites are Statistical Abstracts and other studies by other sectoral agencies. Government policies and strategies as well as planning documents on particular areas are another source of information obtained from diverse sources. Critical information (such as cultural spots) relating to the study was supported by physical observation and positioning of important sites during field visits. The overall approach includes collection of baseline data prior to conducting specific in-depth analysis.

Semi-structured interviews with key informants: Interviews were held with a range of key informants including:

- National Environment Management Authority
- Kenya Wildlife Service
- Lake Ol Bollosat community conservation group
- Laikipia Wildlife Forum
- Northern Rangelands Trust
- A large number of ranchers and interested members of civil society (See annex 6)
- In addition, a household survey was undertaken to obtain information from affected persons.

Consultations: Consultation with various community groups were held via some 17 community meetings held along the proposed line route.

Two key stakeholders' meetings were held with the Laikipia Wildlife Forum in Nanyuki and the Northern community Conservancies and ranchers in Wamba to present the project and obtain their comments

Regular meetings were held with the client and the fanciers for early feedbacks and communications.

Analysis and Report Writing:

The study used an integrated approach whereby field study and documentations evaluated were analyzed targeting to address all relevant issues related to physical, biological and socioeconomic (income, livelihood, agriculture, livestock, gender, ethnicity, etc) in an integrated manner. In addition, in-depth studies were conducted to obtain specific information on potential impacts of the project.

6.2 SOCIO-ECONOMIC STUDIES

i) Household questionnaire

A questionnaire comprising of quantitative questions was administered to household heads whose properties were crossed by the RoW. The administration was face to face. This process was undertaken by a team of trained research assistants. In the process of the interviews they also took photographs of the principal structures affected.

ii) Observation

During the interviewing process observations were made in terms of the crops and other properties in the RoW.

iii) Community Consultations

A total of 11 community consultation meetings were held (See Annex 7). A diversity of community stakeholders including chiefs, village elders, village headmen, farmers, teachers, men and women were consulted in pre-arranged meetings held in public institutions including schools, market and/or identified homesteads within the proposed line route. The stakeholders were mobilized by chiefs, teachers and school management committee members of the affected schools. Teachers sent pupils to inform their parents of the planned meetings. Chiefs deployed their assistants and village headmen to make announcements and post notices at market centres informing the public about planned meetings.

The objectives of consultation meetings were:

1. To enlist the support and cooperation of government officials, politicians and other stakeholders
2. Create awareness about the intended project especially to those who may be directly affected and those living near the proposed transmission lines.
3. To obtain the stakeholders response, feedback and concerns about the project
4. To obtain social economic and environmental information about the community

First the agenda of the meeting was set and agreed upon between the project team and the community. During meetings, communities were informed about the proposed project through presentations with illustration when possible. They were also informed about the purpose of the meeting. The presentations highlighted the project background, objectives, expected upcoming activities, social economic information, environmental information and availability of skilled and unskilled labour including potential for business. After the presentations the community was given a chance to give their views, comments and ask questions. The questions were answered, others clarified and their recommendations were noted. At the end of the meeting the minutes of the discussions were read out to the participants for approval as a true representation of what was discussed. Thereafter a community leader (in most cases the chief or head teacher) signed the minutes as confirmation of a true reflection of what was discussed. A photograph of the meeting was taken with the consent of the members.

Consultations were also made with Conservancy and Group Ranch Managers, members and owners of eco-tourism hotels. Names of all participants including their telephone contacts were recorded.

Community consultations were conducted at the following locations along the proposed RoW:

1. Suswa
2. Longonot
3. Karati
4. Kamahia
5. Ndemi
6. Warukira
7. Wamba
8. Merille
9. Logologo

10. Bubisa
11. Turbi

The following NGOs were consulted:

1. The Catholic Church - Laisamis
2. Concern Worldwide – Marsabit
3. World Vision – Laisamis
4. National Tax Payers Association – Nyahururu Regional Office
5. Laikipia Wildlife Forum

Concerns of all the communities consulted were generally similar in terms of the extent of impacts on their livelihoods, forms of compensation (whether cash or in kind), which among them would receive compensation and whether communities traversed by the power line will benefit by being connected to the electricity grid. The Project Affected Persons were specifically concerned about the level of compensation, timing and procedure. They indicated that compensation should be at least at the market rates and that a transparent procedure of valuation and payment should be adopted. The PAPs were informed that they will still use the land within the right of way for agricultural crop production and grazing and that the only things exempted are structures and trees taller than 4.5 m. Further assurance was given to them that affected properties and resources will be compensated according to the market rates.

In Marsabit the NGOs proposed the use of wind power which is abundant in the area to connect small isolated villages, markets and schools. They were also concerned about how local people would benefit in terms of employment opportunities during construction. They were inflrmed that rural electrification was not in the perview of KETRACO and that the proposed project will import power into the country which should boost the power available for rural electrification. They were also informed that the line will be used to run an ICT cable that can benefit schools and other institutions in the area in the future. The Laikipia Wildlife Forum (LWF) which represents ranchers and conservancies in Laikipia expressed their concern regarding the impact of the project on tourism which is based on wilderness experience. The LWF indicated that the TL will have profound visual intrusion in an otherwise natural landscape and may reduce the visual value of the 'wilderness. The LWF was informed that the transmission line has carefully avoided scenic sites and proximity to tourist lodges to minimize this impact as far as possible.

The list of NGOs, Business Management Organizations (BMOs) and GoK groups consulted are presented in Annex 6 while comments from public consultations are contained in Annexes 4 and 7.

7. ANALYSIS OF ALTERNATIVES

An analysis of alternatives has been done involving several alternative routes and the 'no project alternative'.

7.1 No Project Option

Since Kenya produces its energy mainly from, hydropower-based electricity supplemented by Geothermal energy and thermal energy produced from burning fossil fuels. The energy demand in Kenya is poised to increase phenomenally if the Vision 2030 goals remain on track. On the other hand Ethiopia has a large hydropower potential which is in excess of its national requirement. If the huge power demand in Kenya is to be met, then the Country has to either increase its internal power generation or import from the neighbouring countries especially Ethiopia which has a huge energy pool with potential for more generation.

Kenya can increase its energy production internally through geothermal power, wind, solar and hydro-electric power, but these have limited capacities. The most immediate and plausible action would be to escalate thermal energy production and explore other sources including nuclear. Already the Kenya Government has established a task force to explore nuclear energy potential in the country. In the absence of this project, Kenya might be tempted to accelerate it push to go Nuclear with the attendant risks and environmental degradation.

The proposed project should reduce the overall Kenyan carbon footprint since it is from a sustainable energy source. On direct benefits the project will create opportunities for trade between the two countries. If the Project would not be realized, then both Ethiopia and Kenya would miss this chance to benefit from the opportunities. Beside this, the realization of this Project is important for the development of power exchange in Africa, as it will close a major gap by establishing a link for the power connection of North Africa to the South.

Further benefits will include accelerated access to ICT connectivity in the sparsely populated and less urbanized northern regions of Kenya. Such benefits would be even more remote without the project since laying ICT cables on their own across the region is an expensive undertaking that may not be a priority for the Kenyan Government.

Because of the above, the no project option is the least preferred alternative because it is unfavorable from a global environmental perspective, it will negate the potential benefits to the local communities through access to ICT cables and above the Government might consider the less than sustainable route of enhancing thermal energy and aggressively explore nuclear energy option.

7.2 Other alternatives to the project

Alternatives to the project have huge delays and this may prompt the country to use unsustainable sources of energy as described in the preceding section. These include hydro-electric power sources (sustainable but expensive with serious environmental consequences and social disruption), enhanced thermal power generation and nuclear power. Of note is that some of the alternatives will require huge financial resources to realize the same amount of power input. For example, the combined outputs of the planned Magwagwa hydro-electric scheme on Sondu River and Nandi Forest Multipurpose dam will require about KES 100 billion (approximately USD 1.2 billion) to realize about 300 MW of power.

For the same amount of energy production, the available alternatives are not financially and environmentally competitive for Kenya as this project.

7.3 ROUTE OPTIONS

Owing to certain environmental considerations and a need to shorten the length of the proposed transmission line, several route alternatives have been explored. Some of the environmental hot

spots that could be affected include protected areas of Marsabit National Reserve, Losai National Reserve, Matthews Range Forest Reserve and birds' migration routes. In view of possible infringement with the protected areas, the best route should avoid these environmentally sensitive areas while also being cost effective. Three routes have been discussed in details and compared with each other to arrive at a decision on the best environmentally friendly and most cost-effective alternative.

In this route study, several environmental factors including physical, biological, socio-cultural, technological conditions and constraints have been considered. The line has been rerouted to entirely bypass the Matthews Range Forest Reserve. The proposed line is routed west of Marsabit Town, completely avoiding the National Park and the Forest Reserve. While the proposed route would currently traverse Losai National Reserve, it is kept within a range of about 400m to800m off the road reserve. The idea of keeping the line close to the road is to minimize possible impacts on the reserve. Dida Galgalu and Lake Ol Bollosat are Important Bird Areas that are recognized as such by Birdlife International. This implies that the two areas host avian diversity of significant conservation value. As such, the necessary measures to protect avifauna will be implemented, and are detailed further in this document.

The Consultant reviewed Fichtner, 2009 ESIA/RAP reports and used desk study data and preliminary route inspection to identify alternative options and detailed four options in a Draft Route Selection Report which was submitted to the Client.

Fig. 9 below shows the four transmission route options A, B, A/C and D that were subjected to desk and field analysis that culminated in selection of at an optimized route for ESIA and RAP studies.

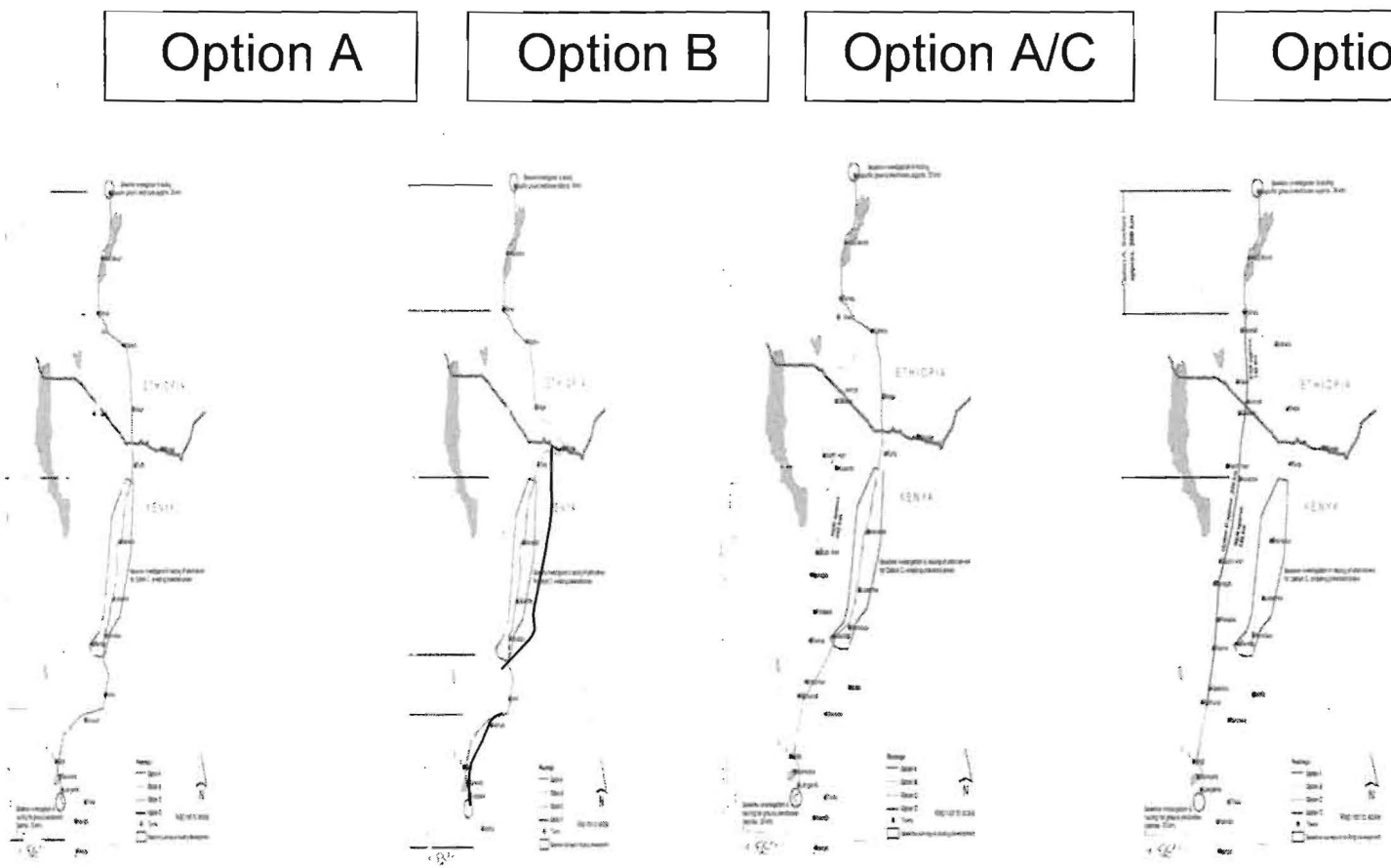


Figure 9: Transmission Line Route Options

Line optimization in Kenya involved comparison of environmental impacts in respect of four main preselected route options: A, B, C and D. These options were analyzed in details in respect of Marsabit National Park, Losai Game Reserve and Matthews Range Forest Reserve. These hotspots have been the subject of discussions among the main stakeholders including financers, Clients, PAPs and affected communities.

Route Option A in Kenya was the earliest selected route in 2008. It comprised a 649 km route entering Kenya at coordinates N389760, E498488. It runs along the Isiolo – Marsabit highway through Marsabit National Park and Losai Game Reserve and ran in a southerly direction up to Isiolo Town where it turned westwards through Nyandarua and Nakuru Counties to terminate at Suswa substation. This route was found to be unsuitable as it traversed military training areas in Archer's Post and passed close to a major air force base in Nanyuki. Military requirements restrict a transmission line to a minimum distance of 24 km from a military air base. Attempts to divert the line route 24 km north of the air base took it through the world renowned Lewa conservancy which would have elicited opposition. To overcome this situation, route Option C was mooted.

Route Option B in Kenya was suggested in 2011 as an effort to bypass Marsabit National Park, Losai Game Reserve and Matthews Range Forest Reserve. This route was 669 km long and crossed the Ethiopia - Kenya border near Moyale (at coordinates N351638, E390917). It then turned westwards south of Matthews Range to traverse Nyandarua and Nakuru Counties and terminate at Suswa substation. This route was found unacceptable by the Client because the area it traversed in Marsabit and Samburu Counties has no public roads that can be used for transportation during construction and for O&M. This meant that the Client would have to invest large sums of money to construct roads for use during line construction and for O&M. The option was therefore found to be technically unsuitable.

Route Option C in Kenya was mooted in 2008 after modification of Option A. Its length was 693 km and crossed the border at coordinates N399889, E419125. It ran along the Isiolo – Marsabit highway which traverses Marsabit National Park, Losai Game Reserve. It deviated into a mountain pass in the Matthews Range and then rejoins the common route through Nyandarua and Nakuru Counties to terminate at Suswa substation. This was found to be the most optimal route since it was well serviced by public roads which could be used for transportation during construction and for O&M. The section traversing Marsabit National Park and Losai Game reserve is already traversed by a major highway linking Kenya and Ethiopia. The environmental impact is imposed by the highway and the proposed transmission line is highlighted in the ESIA Report. This option was the most preferred and following field public consultations it was diverted south of the Matthews Range and thus bypassed the sensitive Matthews Range Forest Reserved. With this diversion it also avoiding numerous *manyattas* of the Samburu people and also avoided several public assets that were constructed after the 2009 Fichtner study.

Route Option D was mooted in 2011 as an effort to bypass Marsabit National Park, Losai Game Reserve and Matthews Range while attempting to shorten the length of the proposed transmission line by following a more direct route. It turned out to be 647 km, a mere 81 km shorter in total. The proposed option route crossed the Ethiopia - Kenya border at coordinate point N474141, E294831 and ran in a southerly direction through Marsabit, Samburu, Baringo and Nakuru Counties to terminate at the proposed Suswa substation. Although the Consultant highly recommended this option due to its high concentration of public roads which could be used for transportation during

construction and in O&M, the Client observed that due to lack of upkeep of the road network, because of the low population density in the area, the public roads could not be traversed by motorized vehicle. At the same time the Client argued that most of the areas traversed by the route in Marsabit were prone to prolonged flooding after rain seasons which would make transmission line construction and O&M expensive and difficult due to difficulty in accessing the construction site, and a dearth of locations for worker camps and storage of construction and maintenance equipment in the event of severe floods.. This option was therefore rejected.

The Consultants completed the transmission line route optimization by submitting the Final Route Selection Report followed by the Draft Inception Report. The Draft Inception Report was reviewed and resubmitted after incorporating comments received from the stakeholders. The Consultants have subsequently conducted field data collection which included household census and community consultations whose results are herein presented. During the household and community consultations the approved route option C in Kenya (overall A/C) was diverted southwards to avoid the Matthews Range as the negative effect of the line to tourism industry was strongly voiced by the financers. Subsequently, the RoW was re-routed south of the Matthews Range. Further consultations to support the decision were conducted among the group ranches and community conservancies in the area and the decision endorsed. After field data collection further minor route changes were effected along the entire route in order to avoid newly constructed schools and shopping centres with a view to complying with KETRACO's Resettlement Policy Framework and reduce compensation budget.

The Clients and stakeholders approved Option A/C as the optimum route upon which the Consultant carried out more detailed ESIA/RAP studies and submit Draft Final Reports as per the Contract. The preferred Option A/C is the original route studied under the Fichtner 2009 report with slight variations. The major points for preference of the A/C Option route above Options B and D were:

- The other alternative routes (Option B or D) did not achieve the 10 – 15% reduction in length as originally expected by the stakeholders;
- Option D which was shorter by 81 km was found to be traversing marshlands which often experience flooding which had the potential of making the project more expensive in construction and in operation and maintenance; and
- The Optical-Fibre Ground Wire (OPGW) to be installed on the proposed transmission line will provide telecommunication channels which have the potential of enhancing ICT in schools and village hubs being developed by the GoK under the Vision 2030 programme. The OPGW will also provide telecommunication for mobile telephony and digital television, an achievement already being enjoyed through other transmission lines in Kenya.

8. PREVAILING ENVIRONMENTAL CONDITIONS ALONG THE PREFERRED ROUTE

8.1 PHYSICAL ENVIRONMENT

8.1.1 Geography and Topography

In Kenya the route runs North to South and traverses the following counties: Marsabit, Samburu, Laikipia, Nyandarua and Nakuru. At the border of Ethiopia and Kenya lies Marsabit County. Most of the county is mainly low-lying at 400 and 700 masl. The main land use in the district is livestock rearing and nomadic pastoralism is the major way of life. The area is interspersed with several mountain ranges and hills including the Ndoto Mountains (2,660 m) to the west, and Marsabit Mountain (1,545 m) within Marsabit Town. The county is home to the Burji, Boran, Ariaal and Rendille communities who are mainly traders, pastoralists and also carry out some irrigation farming. The county borders Samburu County to the south.

Samburu County can be categorized into three agro-ecological zones with different climatic zones, landform and soils, and having a specific range of potentials and constraints for land use:

- Zone IV, covering 5% of the district area is suitable for small-scale crop production and receives rainfall of 400 - 650 mm/pa.
- Zone V covers 30% of the district, has annual rainfall ranging between 300 - 350 mm which can only support a variety of grasses and some shrubs. Livestock keeping is the main occupation.
- Zone VI covers Merti and Kericho divisions, approximately 65% of the district. It experiences an annual precipitation of 150 - 250 mm. This zone is mainly barren with scanty vegetation and mainly supports browsing animals.

Samburu County lies between 1,600 and 2,300 masl but less than 1% of its total land mass is arable. There are no gazetted forests in this county, but the hills cover an area of approximately 9,933 ha and covered by dense vegetation which provides potential for wildlife conservation. The county is vulnerable to natural hazards such as drought and floods along the Ewaso Ng'iro River and human confrontations for pasture and water. Recurring drought has resulted in loss of range biodiversity with a result of low vegetation cover. Constant migrations by the pastoral communities in search of water and pasture have enhanced environmental degradation as new tracts of land are cleared to provide temporary settlements. Another factor that has enhanced environmental degradation is exploitation of the scarce vegetation for fuel. The county borders Laikipia County to the south and extends in the semi-arid up to the high-altitude Laikipia Plateau to the north-west of Mount Kenya.

Nyandarua County has a total land area of 3,304 km^2. It lies between latitudes 0° 8' N and 0° 50' N and between longitudes 35° 13' E and 36° 42' E. The county borders Laikipia County to the north, Nyeri and Murang'a Counties to the east, Kiambu County to the south and Nakuru County to the west. Nyandarua County mainly lies in the Aberdares highland, comprising the Kinangop Plateau, Ol Kalou/Ol Joro Orok Plateau and Ol Kalou/Ol Joro Orok Salient.

Nakuru County lies at an average altitude of 1,890 masl, in the Rift Valley Province. Soil composition in the county is complex as it is influenced by intensive variation in relief rainfall climate, past volcanic activities and the underlying rocks.

8.1.2 Geology

The geology of Marsabit and Samburu Counties belongs to the Sub-Area I of the Mozambique Belt System, which covers most of north-central Kenya and constitutes a vast exposure of the Mozambique Belt south of Lake Turkana within the Samburu-Marsabit area of north-central Kenya. The lithostratigraphy of the Samburu-Marsabit area consists of the Basalt *Mukogodo Migmatites* which are unconformably overlain by metasediments such as banded gneisses, into which the *migmatites* have been thrust as subconcordant sheets.

Central sub-area II of the Eastern Mozambique Belt System in Kenya covers the Laisamis-Isiolo area. The geology of this sub-area is composed of mainly mica (*biotite, muscovite*) and/or *hornblende schists* and gneisses that occasionally show the presence of *staurolite*, almandine garnet, *kyanite* and *sillimanite*. Present also are amphibolites (± garnets), *migmatites*, *granitoid gneisses* and granites, intrusive and meta-intrusive *mafic* and *ultramafic* rocks that include diorites, gabbros, *anorthosites*, *peridotites* and *picrites*.

The geology of Laikipia and Nyandarua Counties is composed of mainly mica (*biotite, muscovite*) and/or *hornblende schists* and *gneisses* that occasionally show the presence of *staurolite*, *almandine garnet*, k*yanite* and *sillimanite*. The districts were created by vulcanicity and faulting which gave rise to two major landforms, the Great Rift Valley to the west and Aberdare Ranges to the east. Between the two physiographic features lies Kinangop and Ol Kalou Salient plateau. The Aberdares are an isolated volcanic range that forms the eastern wall of the Great Rift Valley. This escapement stretches for roughly 100 km in a north-southerly direction between Nairobi and Nyahururu. The Aberdare Ranges run across Nyandarua County. The proposed transmission line route is expected to cross the slopes of the Aberdare Ranges near Shamata settlement area. The soils in the area are red and of volcanic origin and rich in organic matter.

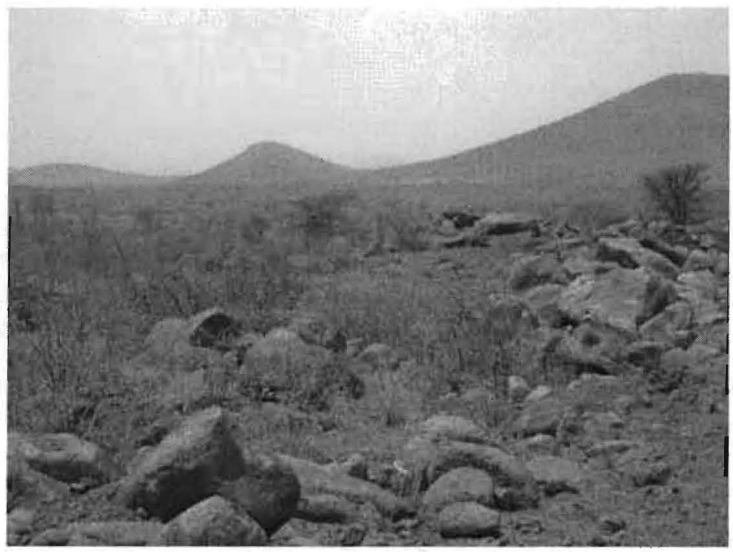


Figure 10: Exposed rock after years of erosion within Laisamis area.

8.1.3 Soil

The soil distribution in the project area is complex and is influenced by intensive variation in relief, climate, past volcanic activities and the underlying rocks. The main soil types in the Naivasha basin are *calcic gleysols*, *andohaplic pheozems*, *gleyic cambisols*, *ando-calcic regosols*, *lithosols*, and *calcic xerosols*, from the *lacustrine* plain through the volcanic plain to the volcanic hills respectively. Generally, the soils in the study area have high phosphorus, calcium, magnesium and potassium concentrations but are low in respect of nitrogen and carbon.

Pyroclastics-ashes, agglomerates and tuffs cover a considerable proportion of the area over the entire volcanic plain southerly of lake Nairashe. During the eruptions of the Longonot volcano, easterly winds caused the heaviest accumulations of the ejected ashes to occur in and around the study area. More recent *pyroclastics* are acidic in composition. The ashes are usually interbedded with other volcanic soils. The most recent eruptions are reported to be approximately 2000 years ago.

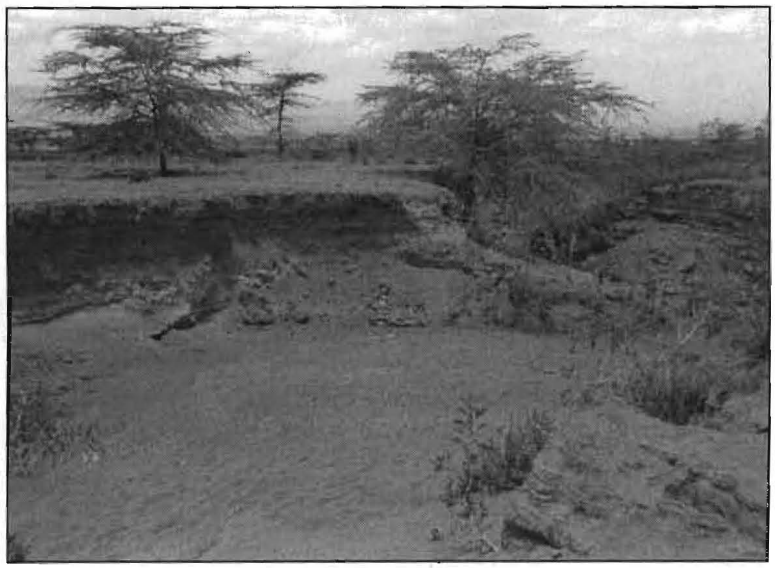


Figure 11: Gulley erosion in Suswa

The topography of Suswa is flat with the potential of waterlogging in the event of extreme rainfall. Soil on the slopes of Mt. Longonot in the direction that is facing Suswa is loose volcanic ash. Since the vegetation cover in this area comprises open Acacia grassland, the soil is easily eroded by wind and water along cattle and vehicles tracks. There are already small to medium-size gulleys formed along vehicle tracks.

8.1.4 Climate

Marsabit County is arid with low and unreliable rainfall ranging between 75 and 400 mm annually. The average temperatures range between 26 and 32°C. These temperatures are higher within the Chalbi Desert. The desert is rocky and devoid of any vegetation, except for few scattered Acacia species. The county is arid and largely inhabited. It has a mean annual rainfall of 200 mm in the lowlands and 800 mm in the highlands.

Samburu County is dry almost throughout the year and rainfall is generally scarce and unreliable. Rainfall is distributed within two seasons in a year with an average of approx. 580 mm. The county lies astride the equator which gives it two distinct seasons: wet and dry. The district is mainly semi-arid with rainfall varying significantly from one year to another. The rainfall in the region is influenced by three distinct rain periods in Kenya, the 'long' rains which are usually experienced from April to May, the 'short' rains in November and the 'continental' rains which fall sporadically from July to September. December, January and February are generally the driest months. Rainfall is associated with heavy thunderstorms in most cases. The rainfall varies as the north receives less rainfall than the south. The average annual rainfall distribution ranges from less than 500 mm in the dry areas to over 800 mm in the wet areas.

Laikipia and Nyandarua Counties experience two rainy seasons per year. The long rains are typical between March and May, and the short rains between September and November. The annual average rainfall is about 800 mm, which supports agriculture. Agriculture is important in the county, as it is the main occupation of the residents, and crops of this region are delivered to the nearby urban centres like Nairobi, Nakuru and Gilgil and over larger distances to cities like Mombasa and Kisumu.

The project-affected part of Nakuru County lies within the range of the Intertropical Convergence Zone. The rainfall distribution has a bi-modal character. The long rains are experienced from April to June and the short rains from October to November. Mount Kenya and the Aberdare Ranges capture moisture from the easterly monsoon winds, casting a significant rain shadow over the Lake Naivasha Basin. The spatial distribution of the rain varies from approx. 600 mm at Naivasha Town to approximately 1,700 mm at the slopes of the Aberdare Ranges.

During the rainy season rainfall usually occurs in the afternoon. The rain intensities can be very high, reaching 100 mm/hour. Long cycles of wet and dry conditions in the region result in large fluctuations of Lake Naivasha's water level. Days are generally warm but rarely hot and nights are cool. In Naivasha Town the maximum and minimum temperatures are 37°C and 5° C respectively with the mean lying around 16°C.

8.1.5 Water (Surface and Groundwater Resources)

The northern part of Marsabit County is mainly dominated by the Chalbi Desert. There are no perennial rivers in the county, except seasonal rivers which are water-bearing when rare and usually torrential rain falls in the desert. Marsabit County has also no permanent rivers although mountain run-offs provide temporary surface water in the lowlands mainly through Milgis and Merille Rivers. The highlands are interspersed with several permanent lakes, including Lake Paradise and several water-filled craters on Mount Marsabit. The only permanent water bodies in the entire Chalbi Desert region, besides Mount Marsabit, are Lake Turkana to the West and Uaso Ng'iro River in Samburu County to the South. Uaso Ng'iro River plays an important role in supporting pastoral livelihood and is currently utilized by the pastoralist Samburu, Ariaal, Rendille, Somali, and Boran tribes.

Figure 12: Partially wet lagga across the proposed TL

Samburu County has potential for both surface and sub-surface water sources. It has four perennial rivers: Ewaso Ng'iro, Isiolo, Kama and Bisanadi Rivers. Isiolo River is extensively used and is the main water source for Isiolo Town while the irrigation potential of the other rivers is yet to be determined. Preliminary assessments indicate that ground water and surface water potential in the region is limited. Boreholes sunk in some areas have shown low yields in parts of Oldonyiro and Kinna Divisions. Other areas such as Sericho Division have poor quality water due to high salinity, except for areas where volcanic rocks dominate. Such areas cover approximately 10% of the district. Water is scarce due to few reliable water sources (dams, springs and pans) and this often a source of conflict, which leads to persistent insecurity in the district. Only 43.5% of households in the region have access to tab water, and only 18% of

households have access to good quality water sources within a distance of 5 km. Water shortages are particularly common in Sericho and Merti Divisions.

The Laikipia Plateau is a zone of transition from the wetter to drier part of the eastern highlands. A large portion of the central region is utilized for large scale ranching, while wheat and barley are grown on the wet high altitudes. Small scale subsistence farming settlements continues to spread out. Pastoralists inhabit the northern region, which experiences a harsh and fragile environment. In those areas where overgrazing is widespread, it gives rise to soil erosion and general land degradation.

Lake Naivasha lies in the Eastern Rift Valley at an altitude of 1,890 masl and covers approximately 100 km^2. The lake is of recent geological origin, and is ringed by extinct or dormant volcanoes, including Mounts Longonot, Ol Karia and Eburu. Naivasha's water is supplied by the permanent Malewa and Gilgil rivers, which respectively drain the Aberdare mountains and the Rift Valley floor to the north, by the seasonal Karati River (also draining from the Aberdares) and from substantial ground-water seepage. The Malewa contributes 90% of the surface water entering the lake, which has no surface outlet. It is thought that a combination of underground outflow and sedimentation of salts keeps the lake fresh, unlike other endorheic lakes in the eastern Rift Valley. Naivasha includes three chemically distinct water bodies:

- the main lake (approx. 15,000 ha, max. depth approx. 8 m) incorporates a partially submerged crater,
- the Crescent Island lagoon (max. depth approx. 18 m) at its eastern end is largely isolated at low water levels, and
- the small (approx. 550 ha) somewhat alkaline Lake Oloidien to the south-east, separated by papyrus Cyperus papyrus swamp and an isthmus of Acacia woodland.

The lake's levels fluctuate enormously, and Naivasha has been dry within historic times.

8.1.6 Landscape

At the point where the proposed Option C transmission line route enters into Kenyan territory, the region is covered by shrubs/thickets on adulating terrain. This type vegetation and land formation continues to Turbi. Marsabit County is dominated by a desert landscape with few undulating hills especially in Turbi Division; the rest of the landscape fits the description of Marsabit landscapes. The county is characterized by diverse landscapes including dry valleys, hilltops and inter-hill depressions. The landscape is dominated by Mount Marsabit which is characterized by morning mist and fog. The uplands landscapes with altitude ranging from 1,300 to 1,358 masl are a generally cool environment with higher woody canopy cover. The soil is dominantly brown loam with moderate drainage, which is mostly used as dry season grazing, but currently much of it is used for crop cultivation and settlements. Low-lying landscape at altitudes ranging from 1079 to 1,296 masl are warm and mostly covered with low scrub vegetation, used mainly as grazing area especially for goats and camels. Hilly topography in the surrounding of farms and settlements is mostly reserved as pasture for calves and weak animals (Kalo).

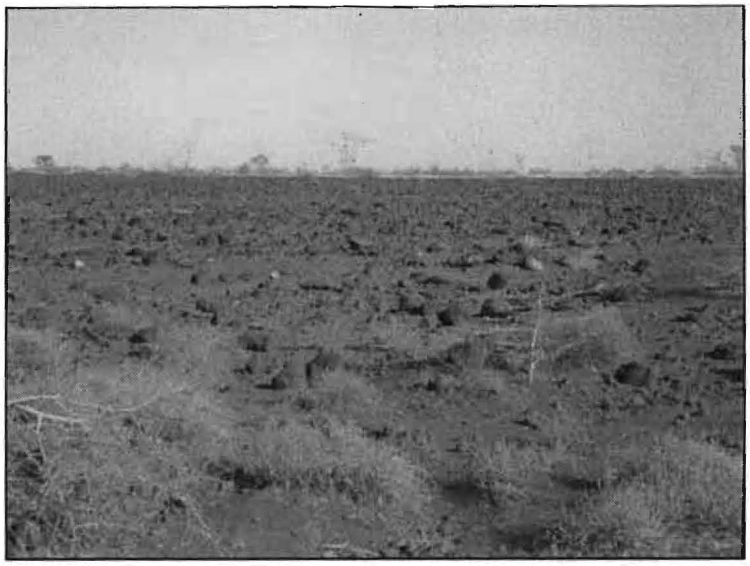


Figure 13: Typical landscape of areas north of Marsabit Town

The section from Bubisa to Marsabit is fairly flat with disintegrated rock boulders. From Marsabit southwards the proposed route runs close to the main road, the terrain is flat with several residual hills. The vegetation is bushy and covers the rest of the route to Logologo and on to Laisamis. It continues southwards adjacent to the main road at a distance of up to 8 km from the road to Merille where it slightly westwards running east of the Wamba Mountains. It then continues through a stretch of fairly flat land covered by thorny shrubs and bushes. The route then turns southwards into the Ngorbit plateaus, over the ridges, descends into Laikipia West the cuts through the extreme western section of Impala Ranch, an area mainly covered by fairly scattered thickets and bushes. It then crosses Mutara River and east of the diminished Pesi Swamps into Ndaragwa on the western edge of the Aberdare Forest. In this region the terrain is fairly undulating and well serviced by access roads.

The proposed transmission line route traverses the slopes of the Aberdare Ranges near Shamata Settlement. The region has red soils of volcanic origin but rich in organic matter. The ranges have two main peaks: Ol Donyo Lesatima (3,999 masl) and Kinangop (3,906 masl) which are separated by a long saddle of alpine moorland which rises to an altitude of over 3,000 masl. The topography is diverse with deep ravines cutting through the forested eastern and western slopes through which many clear streams flow forming cascading waterfalls on their way to the low-lying plains. The section to Maragishu has the highest population density of the entire Kenyan section of the project. The route continues to the top ridge of Shamata and then sharply descends to the flat plains of Ol Bolossat approximately 2 km south-east of Lake Ol Bolossat. It then traverses the adulating ridges of the Olkalou Settlement Scheme, cuts across Malewa River, turns a slight angle and runs along the Malewa River.

The terrain at this section is undulating and covered with tree plantations. At Malewa farm the proposed routing turns south-eastwards, ascends a steep hill and runs along the provincial boundary of Rift Valley and Central Provinces. The top of the ridge is made up of a flat land with sparse settlements which continues to the edge of the National Youth Service Training Centre's plot boundary. The routing then descends to the flat land of Marangishu (Karati) and onwards to Kijabe after crossing both Nakuru – Nairobi highways near Naivasha and Mai-Mahiu respectively. The route then continues 6 km east of Mount Longonot into the proposed Suswa Substation site. This section is fairly flat and is characterized by volcanic soil, shrubs and sparse settlements.

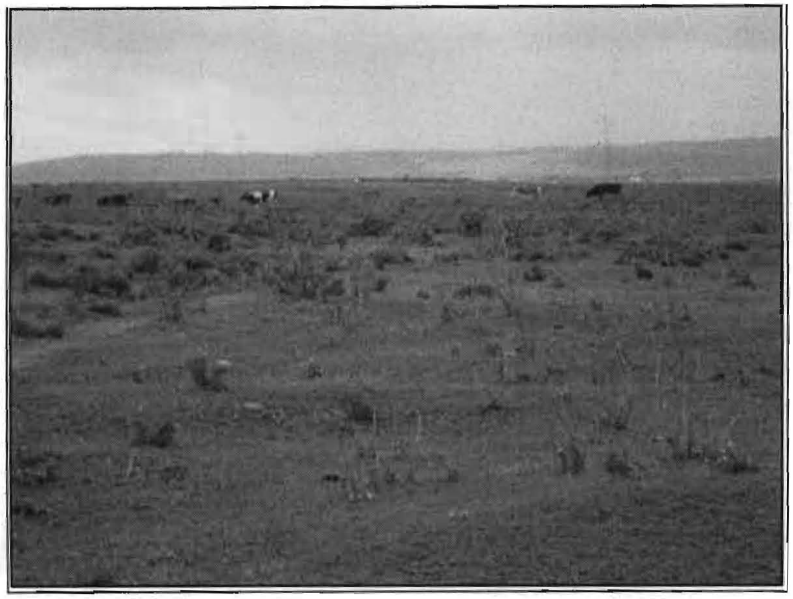


Figure 14: The grassland plains with thorny shrubs within Naivasha area

The lake is of recent geological origin, and is ringed by extinct or dormant volcanoes, including Mounts Longonot, Ol Karia and Eburu. Naivasha's water is supplied by the Malewa and Gilgil rivers, which respectively drain the Aberdare Mountains and the Rift Valley floor to the north. The Malewa contributes 90% of the surface water entering the lake, which has no surface outlet. It is thought that a combination of underground outflow and sedimentation of salts keeps the lake fresh, unlike other endorheic lakes in the eastern Rift Valley.

8.2 BIOLOGICAL ENVIRONMENT

8.2.1 Vegetation

The vegetation in Marsabit and Samburu Counties can be described in four categories: woodland, dwarf shrub bushland, shrubland and thickets. Woodland can only develop with subsidiary water supply along channels and permanent rivers.

The differentiation of bushland and shrubland is correlated with soil properties. While bushland covers loamy and sandy sites, shrubland is confined to clay soils which are characterized by low infiltration rates. Thicket formation especially occurs on eroded valley sediments.

The bushland is characterized by *Acacia tortilisis*, *Commiphora africana*, *Grewia* species and dwarf shrubs such as *Lippia carviodora* and *Vernonia cinerascens*. There are indications that the present high coverage of *Acacia tortilisis* is as a result of an increase in herbivore pressure during recent years. Similar conclusions are drawn in the case of thickets which are mainly composed of *Acacia horrida* and *Acacia reficiens*.

In contrast, there is no evidence of an impact of livestock on the structure of the shrubland which is characterized by *Acacia mellifera*, *A. Paolii* and several species of the *Capparaceae* family. Exotic trees or shrubs have not invaded the area due to low rainfall. Compared to the ground layer, the effects of livestock on the bush and tree layer are low. The vegetation within the Marsabit and Samburu Counties traversed by the proposed transmission line can further be classified as follows:

> **Bushland** consists of woody vegetation which often has multiple stems; most of them do not exceed 10 m in height. Vegetation crowns often interlock and canopy cover is above 20%. Trees are scattered but conspicuous. The herbaceous understorey is usually sparse.

Shrubland consists of woody plants of about 6 m high without a significant presence of trees. Canopy cover is more than 20%. The herbaceous understorey is usually sparse. Scarpline shrubs consist of vegetation growing mainly in minor scarps. It is characterized by scattered shrubs less than 6 m height with sparse or no herbaceous vegetation and rocky ground cover. Shrub or Bush Grassland consists of grassland with scattered trees and shrubs having a combined canopy cover of less than 20%. Grassland is dominated by grasses or sedges. Woody plants are either lacking or are dwarfed and inconspicuous. Woody plants contribute to less than 2% of the canopy cover.

Forests contain mostly trees of 7 - 40 m height or more, with often interlocking crowns. Evergreen forests are characterized by individual trees that may shed leaves, but the canopy as a whole remains green throughout the year (e.g. composed of trees such as *Olea eurpaea* subsp. *cuspidata*). Deciduous forests are characterized by trees that lose their leaves during the dry season (e.g. Acacia and *Combretum* spp.). These are found between Shamata and Ndaragwa areas of Nyandarua County.

The dominant tree species is Acacia. Fire-adapted grassland is common in the semi-arid central parts of Samburu County, which is partly the result of human activities including frequent fires, charcoal burning and over-grazing. The area of Laikipia Ranch has three main vegetation types: mixed Acacia bushland, open grassland and Acacia woodland.

Figure 15: Typical landscape of Samburu County showing short Acacia trees

Land use and natural vegetation types in the Upper Ewaso Ng'iro basin depend on the altitude, climate and soils. On mountain slopes, moist *montane* forests dominate. There are also riverine forests especially in higher altitude, and dry forests in the drier highlands such as Matthews Range. Shrub grasslands and bush grasslands occupy much of the Laikipia Plateau area, while in the plains of Isiolo and Samburu, shrubland is dominant.

Within Naivasha in Nakuru County, only little natural vegetation is left in the catchment area. The headwaters of River Malewa are situated in the Aberdare National Park and the adjoining gazetted forest. Vegetation in this region is humid *Afromontane* forest and bamboo.

In order to provide a reasonable assumption of vegetation and land use coverage, the following information will be used:

Table 2: Estimated vegetation coverage in the project area

Land use	Percentage (%)
Agriculture (dense)	4
Agriculture (sparse)	11
Barren land	29
Bushland (dense)	34
Bushland (sparse)	7
Forest	0
Grassland	4
Plantation	8
Swamp	1
Woodland	2
Total	100

Source: ILRI GIS data, land use classification derived from 1980 Landsat data

8.2.2 Fauna

Marsabit County has protected areas accommodating a wide range of animals including some rare species, such as Reticulate Giraffe, Beisa Oryx, and Somali Ostrich. Further wildlife in the arid- and semi-arid regions include elephants, elands, buffaloes, zebras, giraffes, lions, baboons, gravy zebras, greater kudu and a few rhinoceros. The Somali Ostrich is also common in the Chalbi Desert.

Except in Laikipia – Samburu ecosystem, accurate estimates of wildlife populations are unavailable in the wider project area. However, regular ground counts and aerial surveys indicate long-term population changes. Most authorities agree that the number of small stock in various districts is increasing. Wild herbivores have been surveyed frequently and their populations appear to be more stable than those of domestic herbivores. Wild herbivores are however unevenly distributed over the project area.

Laikipia – Samburu ecosystem, although a semi arid district, is very rich in biodiversity. The tourism industry is based not only on the wildlife but also on the adverse avifauna and an abundance of dry-land plant species.

Figure 16: Landscape dominated by Combretum spp, note a herd of zebras in the woods

Outside the gazetted parks of all districts in Kenya, Laikipia-Samburu has the largest diversity and population of wildlife which are mainly found in private ranches and the communal lands. Below is a summary of the 2008 population estimates for some of the species that are counted regularly using sample survey techniques by the Department of Resource Surveys and Remote Sensing (DRSRS) in partnership with Mpala Research Centre (Kinnaird and Ojwang 2008).

Table 3: List of major animal species in the ecosystem

Species	2008 Population Est.	Standard error (S.E.)
Wildlife		
Buffalo	3,026	1,612
Elephant	3,792	1,198
Impala	7,441	2,383
Rhino		
Grevy's Zebra	2,554	2,290
Plain's Zebra	29,852	6,690
Gerenuk	151	109
Giraffe	1,931	628
Grant's Gazelle	4,949	1,262
Kudu		
Oryx	1,486	868
Warthog	1,077	562
Eland	1,709	643
Thomson's Gazelle	4,735	2,191
Hartebeest	641	402
Ostrich	587	380
Waterbuck	294	215

(Source; Max Graham Laikipia wildlife forum)

It is important to note that these are population estimates based on sample counts which can lead to errors, particularly for species that occur in clumped distributions unevenly across the landscape, such as buffalos and elephants.

The biodiversity value and ecosystem integrity within the Laikipia-Samburu ecosystem can be summarized as follows:

- Second largest functional ecosystem after Tsavo.
- Second highest wildlife densities after the Mara.
- Highest wildlife diversity in the country.
- More threatened and endangered mammals than anywhere else in Kenya.
- 50% of Kenya's black rhino population.
- Largest elephant population outside Tsavo (5,400 in the ecosystem in 2002)
- Increasing overall wildlife populations, in contrast to most of the country has been witnessed in this region.

Some species of wildlife that occur in Laikipia-Samburu ecosystem are of conservation concern both nationally and internationally. Selected species based on species to consider in light of the proposed project are summarised here:

African Elephant

Laikipia and Samburu District hold Kenya's second largest population of elephants after Tsavo National Park, numbering over 3,700 animals. In the past there has been significant movement of African elephants recorded between Laikipia and Samburu. More recent GPS tracking of elephants suggests this occurs in three places:

- In the east between the private ranches and conservancies of eastern Laikipia (Borana, Lewa), through the group ranches adjacent to the Mukogodo Forest and up into Samburu District

- In the west between the block of ranches in West Laikipia (Loisaba, Mpala, Suyian, Ol Doinyo Lemboro etc) and up to the Ewaso N'giro River
- From Mugie Ranch to the Karissia Hills near Marallal

Elephant Migration

Elephant populations of Samburu and Laikipia on average move a distance of up to 140 km north from the cattle ranches of Laikipia to the drier pastoralist areas of Samburu twice a year, that is during the two rainy seasons. Their movements give the appearance of a regular migration between small dry season ranges and larger wet season ranges. Northward movements are associated with rainfall in the Samburu range land, and the return to the south relates to the drying up of temporary water sources. Until the 1970s the majority of elephants in the area were resident in Samburu.

It is suggested that the main reasons for the development of long distance movements were the change in the dominant vegetation in the ecosystem from grassland to bush land and an increase in the number of man-made permanent water sources. The reason for the continuation of these movements, despite the recent decrease in poaching, may be competition for water with the increased human population in Samburu. In contrast to Samburu, the Laikipia ranch lands have more reliable permanent water, and little human disturbance.

Connecting corridors typically cross through unprotected habitat and elephants move faster along corridors than elsewhere in their range, which suggests they might be aware of danger in unprotected range. The Laikipia plains of old were a key crossroad for migration of elephants and other game from Mt. Kenya to the Aberdares Mountains, but also for game migrating to and from the north, with evidence that elephants did come and go all the way to Marsabit and back.

Figure 17: Distribution of wildlife in the greater Ewaso Ecosystem (Laikipia, Isiolo and Samburu Counties shown, Laikipia in black outline in the South west), proposed power line in dark red. Courtesy of Laikipia Wildlife Forum)

Source: Department of Resource Surveys & Remote Sensing and Mpala Research Centre.

Migration corridors of the African Elephant

- Isiolo Elephants: Kipsing Valley – Mukogodo Forest – Doinyo Sangei – Mukogodo Forest
- Samburu Elephants: Ol Doinyo – Laikipia Central – Rumuruti Forest – Marmanet Forest
- Elephants are particularly affected by human activity, especially if their migration corridor is blocked and they become aggressive.

Fauna in Naivasha - Nakuru County

Within Naivasha District, the Lake Naivasha is known as Important Bird Area (IBA) and holds over two hundred bird species, including the endangered and rare species such as Great Crested Grebe (critical), Maccoa Duck (endangered), African Darter, Great Egret, Saddle-billed Stork, White-backed Duck, Baillon's Crake and African Skimmer (all vulnerable). Coot and Yellow-billed Duck, which formerly could be enumerated in ten thousands, reappear in single thousands in the years when submerged aquatic plants are found. Jacana or Lily Trotter, formerly present in thousands can now only be counted in few hundred at most, concentrated on tightly-packed Hyacinth fringes in northern areas.

Lake Naivasha is also important for riparian mammals, primarily the population of approximately 600 - 700 *Hippopotamus amphibious*, which represents the largest meta-population of this specie in the Kenya Rift. Its numbers have remained stable for the past two decades. Marsh mongoose and otter are rarely-seen but important

predators of Crayfish. Plains mammals, notably zebras and Thomson's gazelles inhabit the riparian zone of larger properties, such as the Marula - Morendat - Manera ranches at the river entries and can move relatively freely around the north-west. Crescent Island is a private game reserve.

8.2.3 Protected Areas

The wider project area has some protected areas, mainly national parks and game reserves, both protected under Wildlife Conservation and Management Act, Cap 376, and forest reserves which are protected under Forest Act No. 7 of 2005 and Forest Act, Cap 387. Table 4 below gives the list of protected areas in relation to the line.

Table 4: Protected areas in relation to the line

Protected area	Status	Relation to line
IBA Dida Galgalu Desert	Not officially recognized as protected area, but has abundant avifauna	Crossed
Marsabit National Reserve	Protected area	Not crossed
Losai National Reserve	IUCN Category 6, community managed with technical support of KWS	Crossed but line runs parallel to the main Isiolo – Marsabit road
Aberdare national Park	Recognized protected area	Not crossed
Lake Ol Bolossat	Not officially recognized as protected area, but rich in avifauna	Line does not cross the lake riparian zone, but crosses the lake catchment
Lake Naivasha	This is a Ramsar site	Not crossed
Buffalo Springs and Samburu National Parks	Officially recognized protected areas	Not crossed

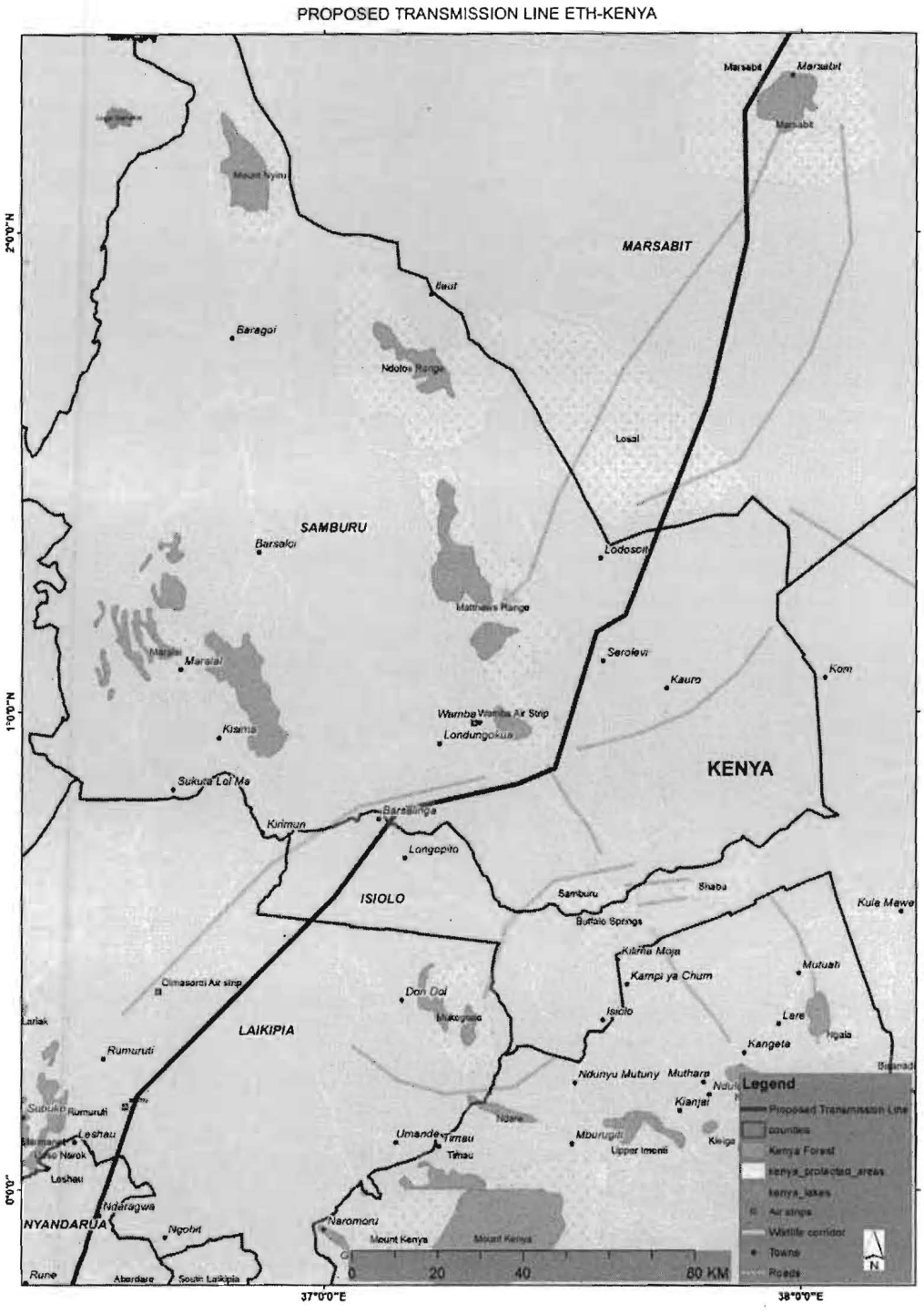


Figure 18: Protected areas against the TL

8.2.3.1 National Parks

Three areas of the IUCN Category II (National Park) were identified in the region of the Kenyan project area, namely Marsabit National Park, Aberdare National Park and Longonot National Park.

Category II protected areas are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational

and visitor opportunities. Although the line avoids crossing these parks, they are all described as critical natural habitats as defined in WB OP 4.04.

8.2.3.1.1 Marsabit National Reserve

The Marsabit National Park is located in the Marsabit County and managed by the Kenya Wildlife Service. There is also the Marsabit Forest Reserve, which is contiguous with the park but this is managed separately by the Kenya Forest Service. The reserve covers an area of 1,600 km² in the middle of the desert wilderness, and includes a Forest Reserve on the forested Mount Marsabit, from which the protection area derives its name. The mountain was born out of volcanic activity and characterized by morning mist, creating its own ambient climate. Although the lower slopes are scorched and dry, above them are richly wooded zones of crater lakes and swamps, towering cliffs and giant trees, providing habitats for a large range of wildlife.

The region surrounding the reserve is of dry and barren semi-desert character. Due to the presence of the mountain, a rainfall rate is induced, feeding streams and lakes such as Lake Paradise and sustaining the vegetation necessary for the ruminant animal. The reserve is protective area for large mammals such as buffalo, zebra, giraffe, cheetah, antelope, oryx, greater kudu, elephants, rhinoceroses, lions, leopard and numerous species of birds.

The Ministry of Tourism and the Kenya Wildlife Service are promoting wildlife viewing (mammals, birds) and the scenic landscape as tourist activities. Lodges and campsites are providing accommodations within the park.

The proposed line is routed West of Marsabit Town, completely avoiding the National Park and the Forest Reserve.

8.2.3.1.2 Aberdare National Park

The Aberdare National Park was established in 1950 and is located in Nyandarua County and Nyeri. The park is managed by the Kenya Wildlife Service. The park consists of the Aberdare Range, a mountain chain of volcanic origin, stretching from north to south and of the tight forested foreland located in the east.

The park contains a wide range of landscapes, including mountain peaks that rise to 4,300 masl, their deep, v-shaped valleys intersected by streams, rivers, and waterfalls to the east and west, feeding the Tana and Athi River. Between the elevation of Ol Donyo Lesatima (3,999 m) and of Kinangop (3,906 m), an anticline of alpine heath lands stretches in a height of 3,000 m. Aberdare National Park and the ambient surrounding is characterized through forests zones dominated by indigenous vegetation types such as moorland, bamboo forests and rainforests, found at lower altitudes.

The sanctuary and its variety of habitats is home for lion, leopard, serval, golden cat, baboon, black and white colobus monkey, Sykes monkey, bongo and for black rhino. Beside the mammals also the avifauna is presented with up to 250 species, including the endangered *Aberdare Cisticola*, Jackson's Francolin, sparry hawk, goshawks, eagles, sunbirds and plovers. The route will not pass the Aberdare National Park.

8.2.3.1.3 Longonot National Park

Longonot National Park is located around the Mount Longonot with an altitude of 2,776 masl. The Park is managed by the Kenya Wildlife Service. The mountain was created during the volcanic eruptions that formed the Great Rift Valley. The zones around of the mountain are characterized by valleys and ridges, providing habitats for evergreen and semi evergreen plant species. Occurring vegetation at the lower zones of the volcano's foot is scrubland dominated by species such as Acacia. At higher zones occur thickets and giant heath. The crater bottom itself is timbered with thick scrubland, mostly dominated by species such as *Digitaria* and *Tarchonanthus*.

The fauna around at Longonot National Park is characterized by ruminant animals such as Buffalo, Grant's Gazelle, Thomson's Gazelle, Giraffe, Coke's Hartebeest, Klipspringer, Reedbuck, Zebra and predators such as Lion, Leopard and Cheetah.

Mount Longonot offers a wide range of attractions for visitors keen on activity holidays, like the neighboring Hell's Gate National Park. Promoted activities include hiking, rock climbing, biking as well as bird and wildlife viewing. Kenya Wildlife Service rangers are available as guides. The Longonot National Park has no tourist accommodation areas within the park itself. However the area around Lake Naivasha provides ample accommodation for all budgets.

The Longonot National Park is located westerly of the proposed route. Based on the current information, the distance between the nearest park border and the routing is at least 3 – 4 km.

8.2.3.2 Game Reserve

8.2.3.2.1 Losai Game Reserve

The Losai Game Reserve is classified as IUCN category VI and considered as critical natural habitat as described in WB OP 4.04. Protected areas with this status conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level nonindustrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area. The primary objective of such areas is to protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial.

The Losai National Reserve is located to the south-west of the Marsabit County, across the Kaisut Desert. It is accessed via the Isiolo – Marsabit road which passes through the sanctuary. The Losai National Reserve is flanked on the west by the Ol Doinyo Lenkiyo and Ndoto Mountains. The Ndoto Forest is one of Kenya's largest virgin forests and borders the park on the west. The reserve is characterized by a semi-desert landscape with rugged terrains, seasonal rivers, a lava plateau with scattered volcanic plugs covered with thorn bushes, and a zone of impenetrable mountain forest on the north-eastern edge of the central highlands.

Losai National Reserve opened in January, 1976 as a single reserve and managed by the community with technical support from the KWS but the management by the county council and communities has been rather lax, thus it is heavily degraded by livestock grazing. KWS is supposed to provide technical support to the management but this is yet to materialize. Nonetheless the reserve is known for having formerly been a habitat for black rhino and elephants. The reserve is planned for the protection of large mammals such as elephant, greater and lesser kudu, gerenuk and Grants gazelle.

The proposed route would currently traverse Losai National Reserve keeping a range of about 400m to800m off the road reserve. The idea of keeping the line close to the road is to minimize possible impacts on the reserve.

8.3 Environmentally Sensitive sites Other than Protected Areas

Environmentally sensitive areas were identified based on their conservation values and / or the vulnerability of the areas to environmental degradation. The sites must either be close enough that the project alignment can have at least some indirect impacts or the alignment actually crosses the area. Using these criteria, the following areas were identified:

1. Dida Galgalu Important Bird Area

2. Laikipia – Samburu Ecosystem
3. Lake Ol Bolossat

Dida Galgalu and Lake Ol Bollosat are important bird areas that are recognized as such by Birdlife International. This implies that the two areas host avian diversity of significant conservation values. On the other hand, Marsabit National Park and Losai National Reserve are gazette protected areas of importance to conservation.

The Laikipia – Samburu ecosystem as a whole cannot be considered a 'biodiversity hot-spot' in the sense of having a wide diversity of endemic and/or endangered species. The main conservation significance of the ecosystem is that it is large area of relatively natural habitat, which is still large enough to contain large wide-ranging species, and thus can sustain a full range of ecosystem processes. Further, the ecosystem hosts some globally endangered species whose populations have declined over recent years. Laikipia-Samburu is of particular significance for lions, wild dogs, Grevy's zebra, eland, elephants, reticulated giraffes and patas monkeys. The Longonot-Suswa area is prone to soil erosion and is currently under pressure from human activities.

8.3.1 The Laikipia – Samburu Ecosystem

The Laikipia-Samburu ecosystem spans approximately 25,000 square kilometers and is defined by the Ewaso N'giro river watershed. The proposed transmission line crosses this ecosystem from around Rumuruti to around Logologo.

Figure 19: The Laikipia Samburu Ecosystem (shaded area)

Private and communal ranches account for about 70% of land use in the ecosystem. The other 30% is home to the Mukogodo Masai and, in the north, the Samburu pastoralists. Protected areas are few--only Aberdare National Park and the Samburu and Shaba Game Reserves.

8.3.1.1 Vegetation

The main type of vegetation in the ecosystem is considered a rangeland type (Taiti, 1992) with the higher grounds being characterized by upland dry forests while some of the lowland areas are wetlands. Close to 40 families and 170 species of plants can be found in the ecosystem. About 52,300 ha of the area is under timber plantation. A total of 6 vegetation communities have been identified and mapped in Laikipia-Samburu ecosystem (Pratt, 1996). Based on location and/or type, they were categorized as:

- Urban and Built up areas (Nanyuki/Nyahururu/Rumuruti)
- Crop Land Complex (western parts, to the north of Nyahururu)
- Upland/Riverine and Degenerated Dry Upland Forests (Rumuruti,, Ngare Ndare)
- Bushland Vegetation Communities which is the dominant community in the ecosystem
- Grassland Vegetation Communities (northern parts of Sosian, Il Digi, Mumonyot, Dol Dol; central regions of Segera/Sirima and the southern parts of Lamuria and Naro Moru)
- Barerock, Escarpment and Kopje Communities (Ol Moran)
- Plantation Forests

The vegetation of the area is largely Acacia bushland, dominated by *Acacia reficiens, A.mellifera*, *A.drepanolobium (which* accounts for close to 80% of tree cover*), A.seyal,* and *A.brevispica* and *Aristida* annual grass species.

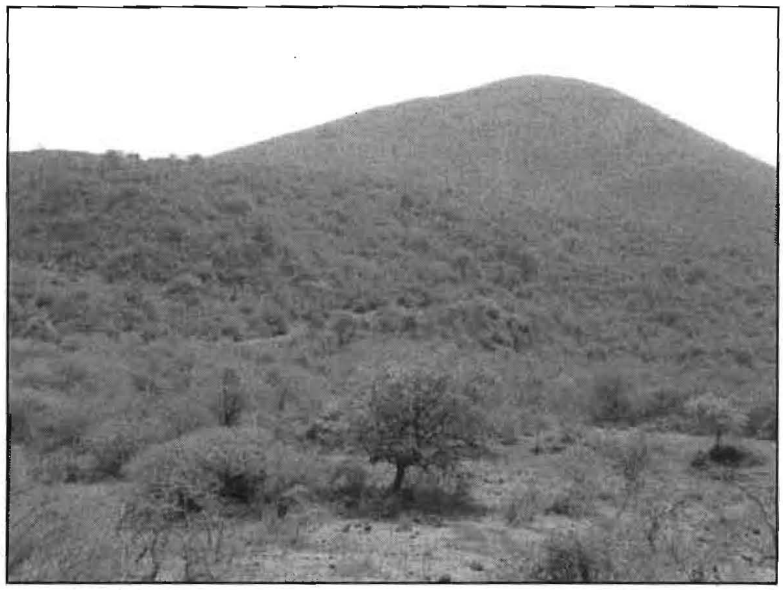


Figure 20: Typical vegetation cover of the Laikipia – Samburu wilderness

The bushland vegetation communities form a transition between upland forest and the Acacia dominated associations in the lowlands. Chikamai et al, (1999) list two of such associations as *Combretum-Tarchonathus-Hyparrhenia* and *Euphorbia-Croton-Aristida.*

Acacia drepanolobium is the most widespread species found on poorly drained and seasonally waterlogged soils at altitudes (1000-1800 m.a.s.l), mostly in the central areas of the complex. It is also the major species being cleared for charcoal. *Acacia mellifera* association is confined to the drier northern parts of Mukogodo and the lower valleys of Ewaso Narok and Ewaso Ng'iro Rivers.

Degraded or unstable ecosystem in the area is indicated by the presence of *Acacia bravispica*, and is confined to the drier steep, well drained sites with rocky or shallow soils (Chikamai et al, 1999). *Euphorbia candelabrum, A.bravispica, Croton*

dichogamus, Aloe londetia and *Hyparrhenia* spp are the dominant species on the bare rock, escarpment where they help in the rehabilitation of the degraded lands.

The main crops grown include maize (*Zea mays*) estimated at 51% of the plated area, bean (*Phaseolus vulgaris*), potato (*Solanum tuberosum*) and horticultural crops like kale, cabbage, tomato, onion and spinach. Wheat and barley are the main cash crops. The opportunity to grow them has been successfully seized by large scale farmers. Coffee, pyrethrum, pineapples, and castor oil are produced in small scale in Ngarua, Nyahururu and Rumuruti. Millet (*Pennisetum typhoides*), sorghum (guinea corn) and sunflower are on trial in the county.

8.3.2 Lake Ol Bolossat

The Lake Ol Bolossat is located to the east of Aberdare ranges in Nyandarua County. The lake and its surroundings is rich in flora and fauna, with over 200 plant species, over 180 bird species and over 15 species of mammals recorded. Due to this rich biodiversity, the lake has been listed as an Important Bird Area by Birdlife International. This implies that the lake has a rich avian diversity and population. There also species of fish, reptiles and amphibians. The lake is currently under heavy human pressure with most of its catchment heavily degraded by settlements, agriculture and reduction of forest cover on the Aberdare escarpment.

8.3.2.1 Flora

Lake basin and its catchment has six general categories of natural vegetation comprising of montane open grassland, montane acacia forest, cedar forest with thick under growth, reed and swamp grass, *Themeda pennisetum* grassland mixture and aquatic floating macrophytes. There are human induced changes in the structure and composition in the natural vegetation.

The Aberdare escarpment is currently dominated by grassed and shrubs such *Grewia* spp., *Rhus nalatensis* and *Buddleia polystachya* which has replaced the natural vegetation. Frequent burning of the escarpment has reduced the density of shrubs and grasses are dominant in certain parts, especially in the north and south.

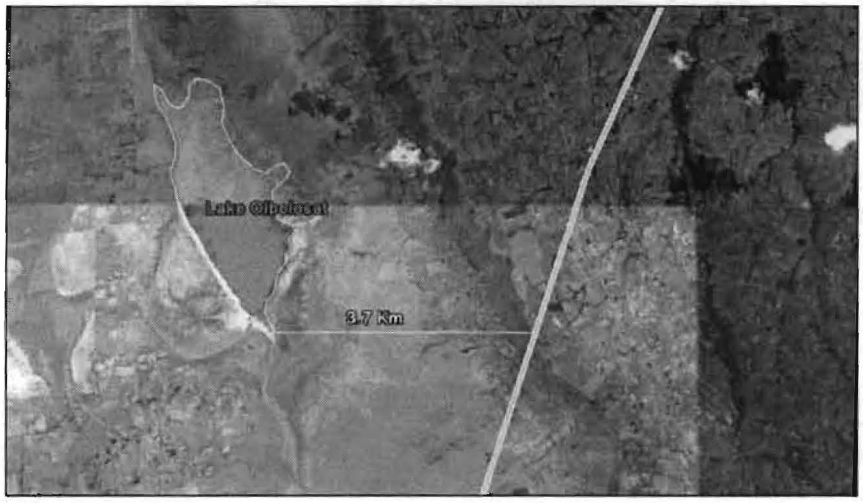


Figure 21: Lake Ol Bolossat showing distance to the power line from the lake edge

Tall trees of indigenous species are sparse. The main tree species still standing are *Juniperus procera, Cussonia spicata, Dombeya goezenii, Euphorbia candelabrum, Albizia gummifera, Acacia tortilis* and *Croton megalocarpus* which are often cut for fuel wood (charcoal) and other domestic uses by the local farmers. Except for the gallery forests much of the escarpment is devoid of trees. A few exotic tree species such as Eucalyptus, Cupressus and *Grevillea robusta* have been planted on farmlands at the bottom of the escarpment.

Montane and Themeda-pennisetum grassland are well differentiated into short and tall grassland sections. The dominant tall grasses consist of *Pennisetum sphacelata, Themeda triandra, Sporobolus spp* and *Pannicum* spp. The short grass zone, next to the marshes, is dominated by *Pennisetum clandestinum. Eragrostis cilianensis, Chloria virgata* and *Setaria* Spp.

Figure 22: Farmlands and homesteads occupying the 3.7 km buffer zone between Lake Ol Bolossat and the TL

Swamp vegetation include, *Phalaria arudinacca, Cyperus rigidifolia, C. immensus* and *C. Papyrus, Cirsium vulgare, Cyperus latifolia* and *Cyperus papyrus.* These form important grazing land in the marshes. The open water has a wide range of floating and submergent macrophytes. Water lilies *Nymphaea caeruleae, Ludwiga stolonifera,* and *Najas pectitus.* Nitiritus aquatic weeds such as Salvinia molesta and pistia stratiotes, have invaded the lake. Submergent macrophytes such as *Najas pectincta* and *Ceratophylum demersum* occur in areas of the lake with clear water.

8.3.2.2 FAUNA

The Lake and entire surrounding areas including Satima Escarpment, Aberdare Forests and National Park, Marmanet Forest Reserve, agricultural lands and urban centres has over 350 species of birds.

Water birds are the most conspicuous wildlife on the lake where over 87 species of water birds have been recorded. Among the waterfowls, the most abundant groups are Afro tropical ducks and geese, Rails, Gallinules and Coats and Ibises and spoonbills, while the most abundant species are Red-Knobbed Coat, Egyptian Goose, Sacred Ibis and Yellow-billed Duck. Several Palaearctic and Afro tropical migrant species have also been recorded. A majority of the water birds recorded are listed by the Africa-Eurasian Water bird Agreement (AEWA) under the Bonn Convention on Migratory Species.

The Lake is a breeding site for Red-knobbed Coot, *Felica cristata*, African Jacana, *Actophilornis africanus,* Blacksmith plover, *Venellus armatus*, Black-winged Plover, *V. Melanopterus*, African Snipe, *Gallinago nigripennis*, Yellow-billed Duck, *Anas undulate*, Red-billed Duck, *A. erythrohychna*, Purple Swamphen, *Porphyrio Porhyrio* and Gray Crowned Crane, *Balearica regulorum.*

A bird survey carried out in seven sites (Kianjata North, Kianjata South, Manguo/Kibathi, Kanguo, Gatumbiro, Kasuku and Rurii), on the western riparian grasslands on terrestrial species confirmed the presence of Kenyan endemic and endangered Sharpe's Longclaw Macronyx Sharpei and the east African endemic and near threatened Jackson's Widowbird *Euplectes Jacksoni* (Birdlife International).

Key avian species recorded from sites around Lake Ol Bolossat and their status

- Sharpe's Longclaw Macronyx sharpei EN
- Jackson's Widowbird *Euplectes jacksoni* NT
- Great (White) Egret *Casmerodius alba* VU
- Maccoa Duck *Oxyura maccoa* EN
- Saddle-billed Stork Ephippiorhynchus senegalensis VU
- Great Crested Grebe *Podiceps pristatus* CR
- Long-tailed Widowbird *Euplectes progne* VU
- White-backed Duck Thalassornis leuconotus VU
- Hunter's Cist Cola *Cisticola hunteri*
- Africa Marsh Harrier *Circus ranivorus*

Key to threat categories used: EN Endangered, NT= Near-threatened, CR= Critical and VU = Vulnerable

Lake Ol Bolossat was listed as Kenya's 61st IBA by the National Liaison Committee on IBAs, led by Nature Kenya, on 26th March 2008 followed the confirmation of Sharpe's Longclaw and Jackson's Widowbird at the site. Other species of conservation concern were recorded during the survey as well as in the previously studies (Oyugi and Owino 1998, 1999).

The number of hippos recorded at Lake Ol Bolossat range from a mean minimum of 89 and a mean maximum of 176. The maximum number coincided with wet seasons while the minimum number coincides with dry seasons. The distribution of hippos on the lake is dependent on biomass distribution of green herbage on the riparian area

The marshes and swamps around the lake support catfish. Several dams in the plan area are also stocked with various fish species. Although the fish found in most swamps and marshes is catfish, the community around the lake rear tilapia and common carp in their ponds and dams.

8.3.3 Dida Galgalu

This area comprises a vast expanse of arid, inhospitable black lava desert, stretching from 20 km north of Marsabit town for at least 60 km on either side of the main Marsabit–Moyale road. The distributional limits of the special birds, and therefore the limits of the IBA, are unknown. Rainfall is erratic and unpredictable, averaging less than 200 mm/year. The nomadic Gabbra people inhabit the area, but there are no permanent settlements in this harsh, waterless terrain. The desert's southern fringe is just within the Marsabit National Reserve, but it is otherwise unprotected.

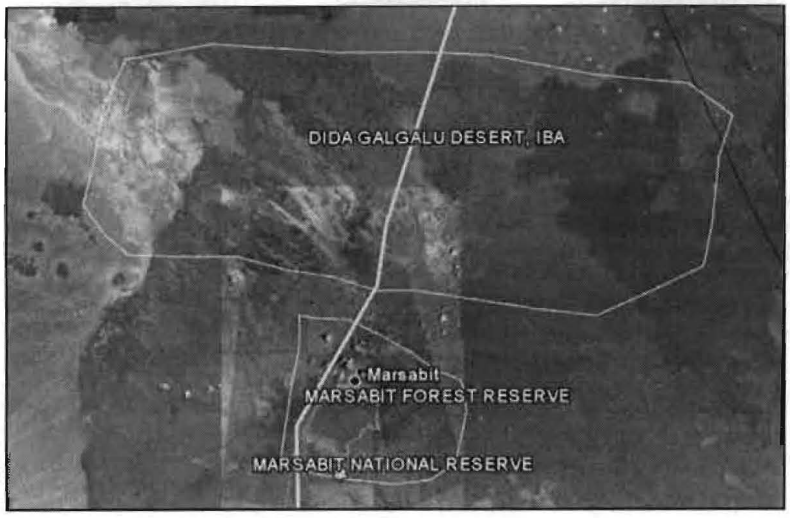


Figure 23: The vast Dida Galgalu Desert

This appears to be the stronghold of the near threatened, restricted-range *Mirafra williamsi*, and most recent records have been from this area. The species is locally common but inconspicuous in rocky lava desert with sparse grass and low *Barleria* shrubs. Other notable species include *Neotis heuglinii*, *Merops revoilii*, *Spizocorys personata* (probably the largest population in Kenya), *Galerida theklae*, *Eremopterix signata* and (on the northern fringes) *Spreo albicapillus*. Many Somali–Masai biome species occur in the general area of Marsabit, but it is not known how many are present in the desert itself.

Table 5: Population of IBA trigger species

Species	Season	IUCN Category
Vulturine Guinea fowl *Acryllium vulturinum*	resident	Least Concern
Yellow-necked Spurfowl *Francolinus leucoscepus*	resident	Least Concern
Eastern Chanting-goshawk *Melierax poliopterus*	resident	Least Concern
Heuglin's Bustard *Neotis heuglinii*	resident	Least Concern
Black-faced Sandgrouse *Pterocles decoratus*	resident	Least Concern
Sombre Nightjar *Caprimulgus fraenatus*	resident	Least Concern
Donaldson-Smith's Nightjar *Caprimulgus donaldsoni*	resident	Least Concern
Star-spotted Nightjar *Caprimulgus stellatus*	resident	Least Concern
Somali Bee-eater *Merops revoilii*	resident	Least Concern
Eastern Yellow-billed Hornbill *Tockus flavirostris*	resident	Least Concern
Von der Decken's Hornbill *Tockus deckeni*	resident	Least Concern
Black-throated Barbet *Tricholaema melanocephala*	resident	Least Concern
Red-and-yellow Barbet *Trachyphonus erythrocephalus*	resident	Least Concern
D'Arnaud's Barbet *Trachyphonus darnaudii*	resident	Least Concern

Species	Season	IUCN Category
Rosy-patched Bush-shrike *Rhodophoneus cruentus*	resident	Least Concern
Three-streaked Tchagra *Tchagra jamesi*	resident	Least Concern
Taita Fiscal *Lanius dorsalis*	resident	Least Concern
Somali Fiscal *Lanius somalicus*	resident	Least Concern
Somali Tit *Parus thruppi*	resident	Least Concern
Mouse-coloured Penduline-tit *Anthoscopus musculus*	resident	Least Concern
Williams's Lark *Mirafra williamsi*	resident	Data Deficient
Red-winged Lark *Mirafra hypermetra*	resident	Least Concern
Pink-breasted Lark *Mirafra poecilosterna*	resident	Least Concern
Masked Lark *Spizocorys personata*	resident	Least Concern
Short-tailed Lark *Pseudalaemon fremantlii*	resident	Least Concern
Chestnut-headed Sparrow-lark *Eremopterix signatus*	resident	Least Concern
Ashy Cisticola *Cisticola cinereolus*	resident	Least Concern
Grey Wren-warbler *Camaroptera simplex*	resident	Least Concern
Yellow-vented Eremomela *Eremomela flavicrissalis*	resident	Least Concern
Rufous Chatterer *Turdoides rubiginosa*	resident	Least Concern
Golden-breasted Starling *Cosmopsarus regius*	resident	Least Concern
White-crowned Starling *Spreo albicapillus*	resident	Least Concern
Bristle-crowned Starling *Onychognathus salvadorii*	resident	Least Concern
African Grey Flycatcher *Bradornis microrhynchus*	resident	Least Concern
Kenya Violet-backed Sunbird *Anthreptes orientalis*	resident	Least Concern
Hunter's Sunbird *Nectarinia hunteri*	resident	Least Concern
Donaldson-Smith's Sparrow-weaver *Plocepasser donaldsoni*	resident	Least Concern
White-headed Buffalo-weaver *Dinemellia dinemelli*	resident	Least Concern
Blue-capped Cordonbleu *Uraeginthus cyanocephalus*	resident	Least Concern
Purple Grenadier *Uraeginthus ianthinogaster*	resident	Least Concern
Steel-blue Whydah *Vidua hypocherina*	resident	Least Concern
Straw-tailed Whydah *Vidua fischeri*	resident	Least Concern
Ethiopian Grosbeak-canary *Serinus*	resident	Least Concern

Species	Season	IUCN Category
donaldsoni		
Somali Golden-breasted Bunting *Emberiza poliopleura*	resident	Least Concern

Source: Birdlife International 2008

The area being a desert with little foreseable human activities, this habitat could be described to be unlikely to be under threat in the near future.

8.4 THREATENED SPECIES WITHIN THE PROJECT AREA

8.4.1 Grevy's Zebra

This species is listed as endangered under the IUCN red list with numbers worldwide having declined by over 50% in the last 50 years. While in the 1970s there were thought to be 15,000 Grevy's Zebra in the world, today there are fewer than 3,000 with 2,407 counted in the Laikipia/Samburu ecosystem during a national census conducted by the KWS in 2008, translating to over 80% of the world's population. Of these, 38% were counted in Laikipia with much of the remainder counted on community owned conservancies around Wamba in Samburu. Researchers working in Laikipia and Samburu believe there is still significant movement of Grevy's Zebra between Laikipia and Samburu.

8.4.2 Lion

Lions are categorized as vulnerable under the IUCN Red List with around a 30% decline in Africa over the last 20 years, largely as a result of being killed in defence of livestock. There are between 220-250 lions in Laikipia and possibly a further 100 in Samburu, accounting to around 12-15 % of Kenya's estimated national population (figures based on estimates provided by researchers of the Laikipia Predator Project that has operated in the area for over 10 years). It is important to note that Laikipia/Samburu was recently identified by the KWS as one of the 3 most important remaining areas for large carnivores in Kenya.

8.4.3 African Wild Dog

The African wild dog is classified as Endangered in the IUCN Red List. There are approximately between 3,000 and 5,500 free ranging wild dogs remaining in Africa with populations declining as a result of conflict over human activities, disease and habitat fragmentation. In Africa, 25 out of 39 former range states no longer support populations of African Wild Dog. In Kenya, Laikipia/Samburu is an important stronghold for this endangered carnivore with a local population of around 300, the sixth largest in the world and numbers continuing to increase in recent years. There is some movement of wild dog packs between Laikipia and Samburu District. In this regard it is important to note that Wild Dog successfully recolonised Samburu District in recent years after an absence of almost 20 years.

8.4.4 Cheetah

Cheetahs are listed as Vulnerable under the IUCN Red List with just 7,500 animals occurring in the world. They occur in Laikipia at low densities, though the exact population has not been determined.

8.4.5 Black Rhino (*Diceros bicornis*)

Laikipia – samburu ecosystem was historically home to numerous black rhinos, but the rhino population was severely depleted during the 1970s poaching epidemic. This species is now largely protected in private conservancies across the ecosystem.

8.4.6 Other Species

Other species of conservation concern in Laikipia include: Black Rhino which is critically endangered with Laikipia holding most of the country's population across a network of privately owned conservancies; reticulated giraffe (which may possibly be its own species).

Threatened Species:

The following list includes animals that are rated as Critically Endangered (CR), endangered (EN) or Vulnerable (VU) in the 2004 IUCN Red List of Threatened Animals. These species are found within the various districts traversed by the proposed transmission line.

Critically Endangered:

- Black Rhinoceros (*Diceros bicornis*)
- Hirola (Hunter's Antelope or Hartebeest) (*Damaliscus hunteri*)
- Macow's Shrew (*Crocidura macowi*) (Endemic to Kenya)
- Peters' Musk Shrew (*Crocidura gracilipes*).
- Rainey Shrew (*Crocidura raineyi*) (Endemic to Kenya)
- Tana River Red Colobus (*Procolobus rufomitratus*)
- Ultimate Shrew (*Crocidura ultima*) (Endemic to Kenya)

Endangered:

- Aders' Duiker (*Cephalophus adersi*)
- Black-and-rufous Elephant Shrew (*Rhynchocyon petersi*)
- Giant African Water Shrew (*Potamogale velox*)
- Grevy's Zebra (*Equus grevyi*)
- King Mole Rat (*Tachyoryctes rex*). (Endemic to Kenya)
- Naivasha Mole Rat (*Tachyoryctes naivashae*) (Endemic to Kenya)
- Wild Dog (*Lycaon pictus*)

Vulnerable:

- Aberdare Shrew (*Surdisorex norae*) (Endemic to Kenya)
- African Elephant (*Loxodonta africana*)
- African Golden Cat (*Profelis aurata*)
- Audacious Mole Rat (*Tachyoryctes audax*) (Endemic to Kenya)
- Cheetah
- Dwarf Multimammate Mouse (*Mastomys pernanus*)
- East African Collared Fruit Bat (*Myonycteris relicta*)
- Eastern Tree Hyrax (*Dendrohyrax validus*)
- Fischer's Shrew (*Crocidura fischeri*)
- Hamilton's Tomb Bat (*Taphozous hamiltoni*)
- Highland Shrew (*Crocidura allex*)
- Hildegarde's Tomb Bat (*Taphozous hildergardeae*)
- Hopkins's Groove-toothed Swamp Rat (*Pelomys hopkinsi*)
- Jackson's Mongoose (*Bdeogale jacksoni*)
- Kenyan Big-eared Free-tailed Bat (*Tadarida lobata*)
- Large-eared Free-tailed Bat (*Otomops martiensseni*)
- Lion (Panthera leo)
- Red Bush Squirrel (*Paraxerus palliatus*)

8.5 ELECTROMAGNETIC ENVIRONMENT

A direct current (DC) transmission line has two conductors with voltages of opposite polarity, one positive and one negative. The environment surrounding the DC transmission line can be primarily characterized by three electrical parameters: the electric field, the air ion concentration, and the magnetic field. The electric field arises from both the electric charge on the conductors and air ions surrounding the conductor. Air ions are charged air molecules produced by the electric field on the surface of conductors. A static magnetic field is produced by current flowing through the conductors but it quickly decays to harmless level and outside the RoW negligible levels are unlikely to come into contact with humans, animals and plants.

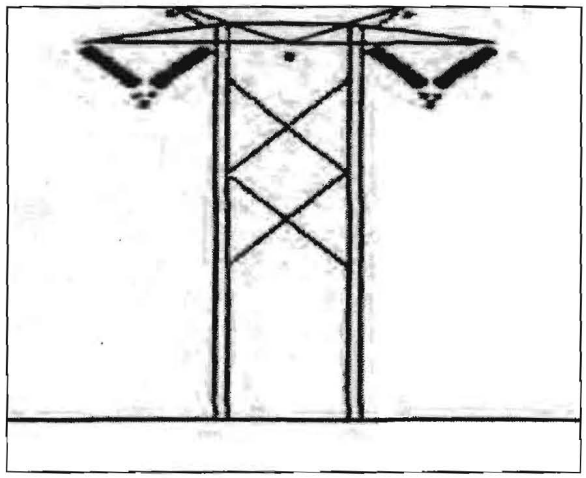


Figure 24: A typical design of a high voltage transmission DC line

8.5.1 Corona and the production of air ions

Corona is a partial electrical breakdown of the air surrounding DC conductors. It occurs when the electric field at the surface of a conductor becomes large enough to dislodge one or more electrons from the air molecules in the immediate vicinity, usually within two to three centimeters of the conductor. This produces air ions, which are primarily derived from nitrogen and oxygen gas molecules. Positive air ions result from air molecules that have lost electrons; while negative air ions are air molecules that have picked up the excess electrons. Corona normally does not occur to a great extent when transmission line conductors are clean and smooth. However, suspended particles, dusts, liquid droplets, and sometimes insects that deposit on a conductor may enhance the electric field, thereby forming sources of corona, and thus, sources of air ions. Corona production from DC conductors is therefore strongly affected by weather conditions (humidity, temperature, and precipitation) and the season of the year. In fair weather with little debris on the conductors, corona is minimal. The corona produced by a DC transmission line is much lower than that produced by an AC line.

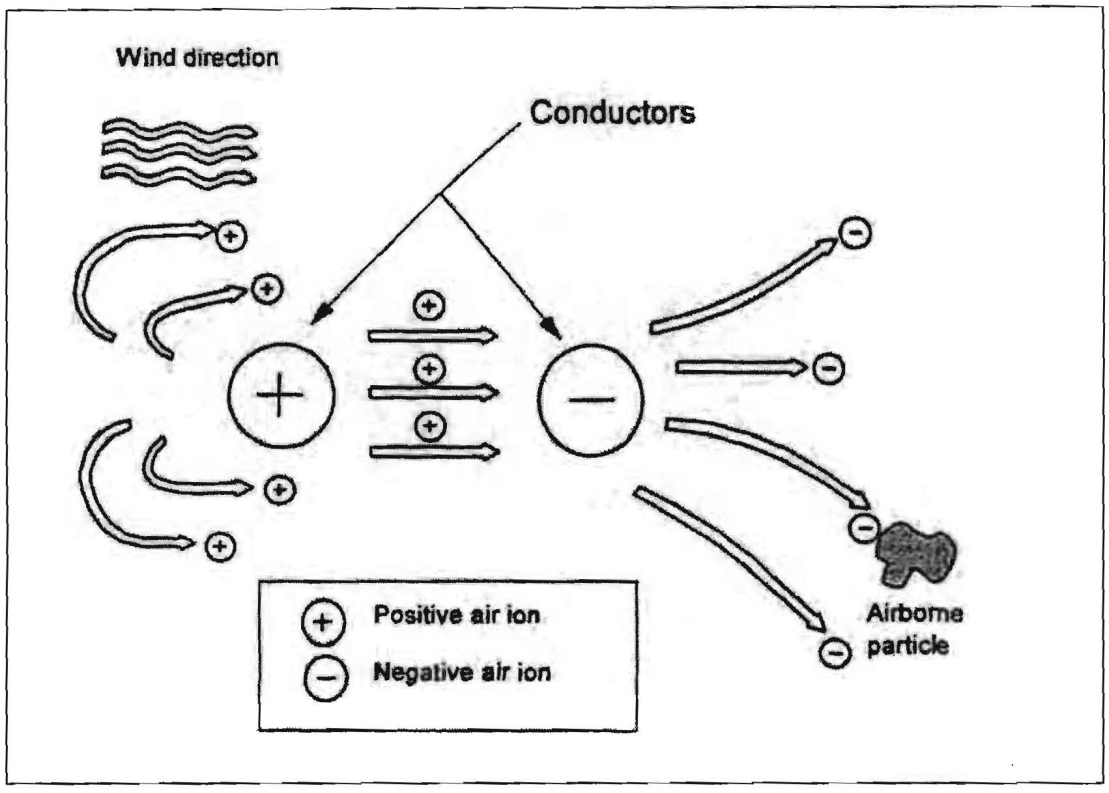


Figure 25: Ions drift with the wind

8.5.2 Air quality

In addition to the production of air ions, corona on DC transmission lines also leads to the production of small quantities of ozone *(O_3)* and nitrogen oxides (NO_x). The question is whether air ions generated by DC transmission lines are substantially different from ambient air ions generated by other sources. These pollutants are normally present in the atmosphere at levels of about 20-25 ppb *(O_3)* and 2-5 ppb (NO_x) in rural areas. Substantially higher levels of these pollutants are found in urban areas. The primary ambient air quality standards for these pollutants are 53 ppb for NO_2 (on annual basis) and 120 ppb for O_3 (per hour/day/year). While levels exceeding these standards could be expected to have impacts both on human and animal health as well as the environment, there is no empirical data to suggest that a DC transmission line significantly impacts ambient air quality. Moreover, air ions generated by a DC transmission line persist for only 2-3 seconds while most naturally-occurring air ions have lifetimes as much as 100 times longer (Bailey et al, 1997).

8.6 Socio-Economic And Cultural Environment

8.6.1 Population and Demographic Features

The proposed transmission line route traverses six counties, mainly rural areas. Most of the counties traversed are sparsely populated except the settlement areas of Nakuru and Nyandarua counties. The line avoids towns such as Marsabit and Naivasha and urban settlements.

The population profile given in the Table below is based on the 2009 National Population census.

Table 6: Population profile of the project area by counties

County	Male	Female	Total
Marsabit	151,112	140,054	291,166
Samburu	112,007	111,940	223,947
Laikipia	198,625	200,602	399,227

County	Male	Female	Total
Isiolo	73,694	69,600	143,294
Nyandarua	292,155	304,113	596,268
Nakuru	804,582	798,743	1,603,325
Total	1,632,175	1,625,052	3,257,227

Source: Kenya National Bureau of Statistics, National Population Census Report, 2009

Table 7: Ethnic composition of project affected persons

	COUNTY				Percentage of Respondents
ETHNIC_GROUP	Nyandarua	Marsabit	Nakuru	Grand Total	
Gikuyu	213	1	126	340	96.31
Masai			3	3	0.85
Meru	1			1	0.28
Rendille		6		6	1.70
Sakuye	2			2	0.57
Luo	1			1	0.28
Others					0.01
Grand Total	217	7	129	353	100.00

According to the consulted communities vulnerability in Marsabit and Samburu Counties included persons affected by drought and in Nakuru and Nyandarua Counties it included households without land and livestock, squatters and internally displaced persons (IDPs). The drought victims comprised the large portions of marginalized groups. The perception of vulnerability differed between the primarily agricultural counties of Nyandarua and Nakuru and in the primarily pastoral counties of Marsabit and Samburu.

Table 8: Population of marginalized persons according to community

Counties	Drought Victims	Squatters/IDPs	Without Livestock	Total Population of Marginalized
Marsabit	10,300	0	4,000	14,300
Samburu	300	0		300
Nyandarua	0	11,200		11,200
Nakuru	0	2,000		2,000
Total	10,600	13,200	4,000	27,800

Source: Field interviews

Marginalized groups according to the community are persons affected by drought, households with no land and livestock. Squatters and Internally Displaced Persons (IDPs) in Nakuru and Nyandarua and drought victims in Marsabit and Samburu comprised the large portions of marginalized groups. Perception of marginalization differs in the primarily agricultural counties of Nyandarua and Nakuru and in the primarily pastoral counties of Marsabit and Samburu. Marsabit, According to the community estimates, 27,800 persons are marginalized in diverse ways.

8.6.2 Character of Households

The average age of household heads within the RoW is 54 years. The youngest household head was 20 years old while the oldest was 90 years (RAP Report) shows the marital status of household heads (HH). Most of the household heads (74%) were married while 20% were widow/er. Among the households surveyed, 65% were male headed while 35% were female headed.

The average household size in the area is 5 members of whom the majority of household members are less than 24 years old and 2.7 above 55 years old. This leaves only 2.3 members (18.3%) in the productive bracket of 25-54 years old. Table 9 describes the composition of the household in the project-affected area.

Table 9: Composition of households according to gender

Age Group	N	Male	Female	Total (M+F)	Males per HH	Females per HH	Average HH size
0 - 4 years	135	145	180	325	1.1	1.3	2.4
5 - 14 years	197	279	258	537	1.4	1.3	2.7
15 - 24 years	180	239	199	438	1.3	1.1	2.4
25 - 54 years	241	279	280	559	1.2	1.2	2.3
55 - 64 years	74	41	71	112	0.6	1.0	1.5
65 years and over	82	50	51	101	0.6	0.6	1.2
Total		1,033	1,039	2,072			

8.6.3 Settlement

The settlement pattern in the traversed districts are characterized by the potentiality of land, land use system and water availability, or summarized basically on climate and soil conditions.

Figure 26: Modern housing in Nyandarua

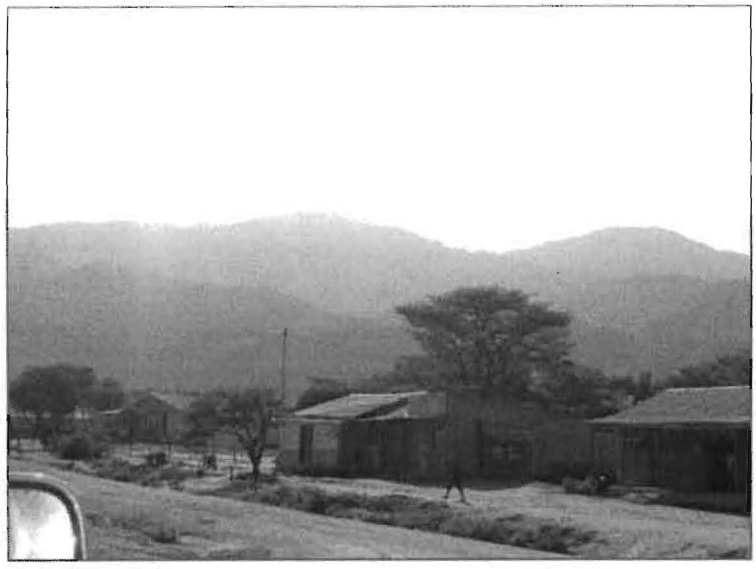


Figure 27: part of Wamba trading centre in Samburu

In the northern arid and semi-arid counties, nomadic pastoralism is predominant, and majority of inhabitants are highly mobile and dispersed. The average population density in these regions is low e.g. in Marsabit County is 2 persons per km². In some divisions of the Marsabit County, which occupy the arid and very arid areas, settlement is limited only to around the mountains and isolated pockets where water is available, resulting in the lowest density of 1 person per km².

8.6.4 Land use

Approximately 18% of the land in Kenya has high to medium agricultural potential and supports approximately 80% of the country's population. Agriculture is dominant in the central counties, while in the other traversed areas are characterized by nomadic pastoralism. In the area around Lake Naivasha horticultural farming for the export market is intensely practiced.

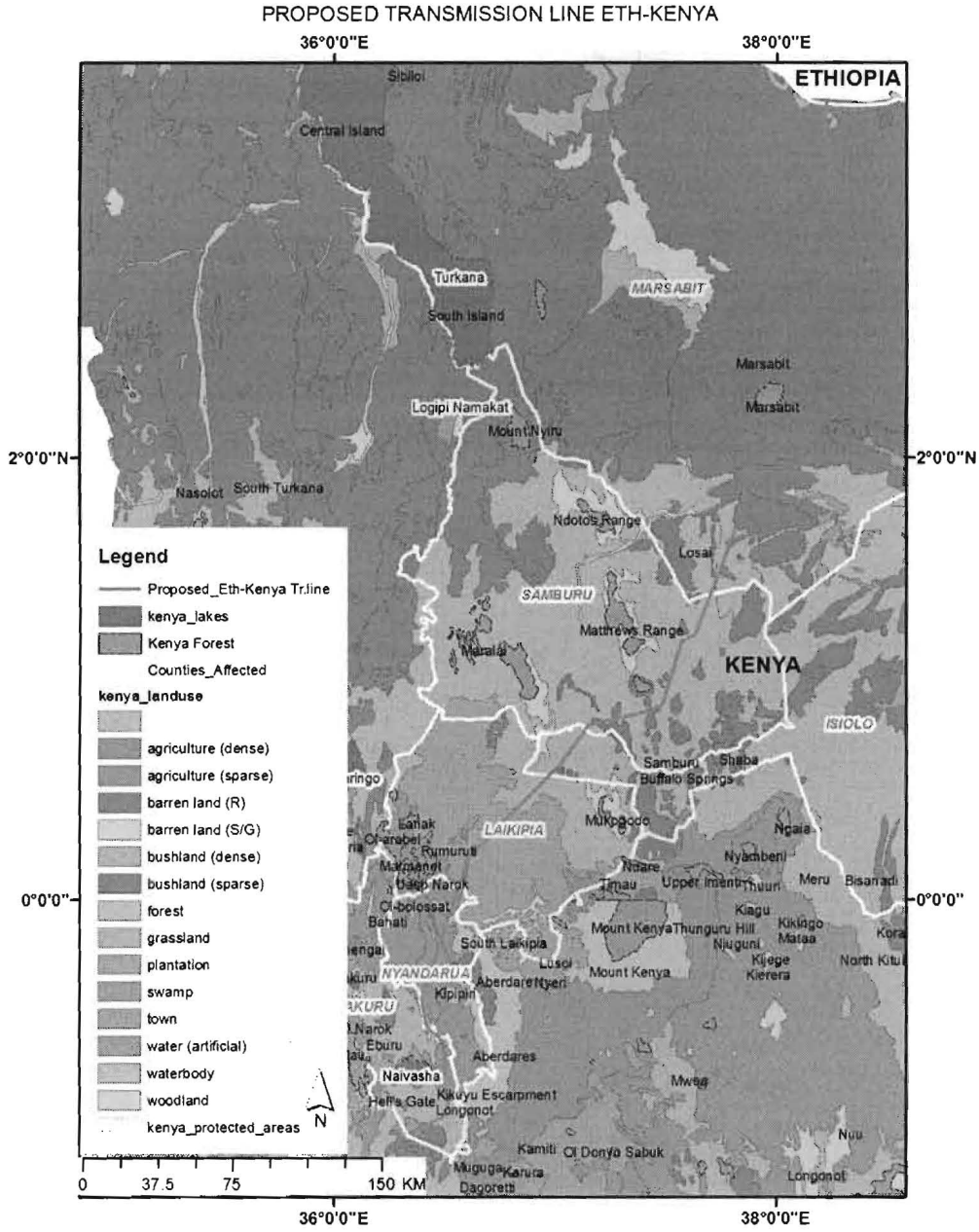


Figure 28: Land use along the alignment

Land along the line is principally under farming, range, conservancy, settlement and business premises. Most of the farming households are in Nyandarua and Nakuru Counties. Conservancy land parcels are in Laikipia Isiolo, Samburu and Marsabit counties. Nyandarua and Nakuru have a more diversified land-use compared to the other counties.

Nakuru and Nyandarua Counties will be most affected by the proposed transmission line with over 3,894 acres and 3,366 acres affected by the RoW. Of the affected land, over 44% is under farming activities.

Table 10: Primary land use by HH by County

PRIMARY USE	COUNTY				Total
	Marsabit	Samburu	Nyandarua	Nakuru	
Farming			224	152	376
Grazing			2	5	7
House			7	10	17
Business			4	5	9
Conservancy	1	2			3
Idle land			1	1	2
Total	1	2	238	173	414

8.6.4.1 Group Ranch/Wildlife Conservancy

There are wildlife conservancies especially in the Samburu – Laikipia ecosystem which are privately managed either by private entities and individuals or groups of ranchers especially the pastoralists. These conservancies are designated by their owners, and not necessarily by the Government, to protect natural resources while supporting sustainable livestock production. Table 11 below shows the ranches / conservancies crossed by the TL and their ownership status.

Table 11: Ranches and conservancies crossed by the TL

Private	Community
Sabuk	Ol Maisor
Kolian	Ngorare
Mpala Loisaba	Naibunga
Loisaba	Ol Donyo Lemboro
	Samburmbur

The ranches are owned collectively by groups of pastoralists or by individual land owners. In the cases of wildlife conservancies the recognized land owner might be member of the respective management committee and the land is held under trust land. Wildlife conservancies are in some cases intertwined with group ranches. Sarara, Sapashe and Meibae Group Ranches fall under the management of Namunyak Conservancy in Samburu County. The county has some private wildlife conservancies under the management of Laikipia Wildlife Forum. Compensation in pastoralist districts will be at two levels: level one, County Council level and level two, individual or Group Ranch Level. The multiplicity of ownership and use rights might further complicate the compensation process and caution will therefore be needed by implementation in this respect.

8.6.5 Aerodromes

The proposed line route stayed clear of the mainly privately-owned aerodromes. The main aerodrome that required to be avoided was the Kenya Air Force Base at Nanyuki in Laikipia County.

8.6.6 Cultural Heritage and Culturally Sensitive Elements

The notable cultural heritage sites in Kenya according to the list of UNESCO World Heritages are:

1. Fort Jesus (25/06/1997)
2. The Great Rift Valley Ecosystem (09/11/2001)
3. Lake Bogoria National Reserve (16/08/1999)
4. Lake Naivasha (16/08/1999)
5. Lake Nakuru National Park (16/08/1999)

6. Mombasa Old Town (26/06/1997)
7. Lamu Old Town (2001)

A Tentative List is an inventory of those properties which each State Party intends to consider for nomination during the following years. States Parties are encouraged to submit in their Tentative Lists, properties which are considered to be cultural and/or natural heritage of outstanding universal value and therefore suitable for inscription on the World Heritage List. Boundaries are not included in the short description of the sites. Relevant for the Project would be the Great Rift Valley and Lake Naivasha. The mentioned sites of the Great Rift Valley Ecosystem: Koobi-Fora, Olorgesailie, Hyrax Hill, Kariandusi, Lothagam, Kanapoi, Tugen Hills are located far from the proposed route and therefore would not be impacted by the project.

Lake Naivasha is also a Ramsar site (wetland of international importance). The lake provides diverse habitats for a variety of mammals, birds and fish. The lake environment is fragile, but dynamic. Nevertheless Lake Naivasha and its shores are intensively used, e.g. for fishery, horticultural industry and tourism. Lake Naivasha's biodiversity is critically threatened by human induced factors, including: habitat destruction, pollution (from pesticides, herbicides and fertilizers), sewage effluent, livestock feeding lots, and water abstraction. The investigated routings avoids the lake and its shores with a distance of at least 7 km.

8.6.7 Archeological Resources

The archaeological survey reported here was undertaken in the regions of Rift Valley (Nakuru, Laikipia and Samburu counties), Central (Nyandarua County) and Eastern (Isiolo, and Marsabit counties) between September 12, 2011 and September 26, 2011.

The purpose the archaeological survey was to:

- Identify archaeological sites and other evidence of past cultural heritage located in the Way leave of the proposed Ethiopia-Kenya Power Systems Power Line.
- Assess the cultural significance of the identified archaeological and other cultural heritage.
- Recommend the appropriate action to be undertaken, if any, to avoid destroying the concerned past cultural heritage.

In order to get a good picture of the results of the archaeological survey, it is necessary to first have a glimpse of the archaeological context and the culture history of the survey area.

8.6.7.1 Archaeological Context of the project area

The chronological framework for dating archaeological heritage in sub-Saharan Africa (where the survey area lies), is based on two systems:

The traditional system premised on the Three Age System – from which the past is sub-divided into the Stone Age, which is sub-divided into the Earlier Stone Age **(ESA)**, Middle Stone Age (MSA) and Later Stone Age **(LSA)**, Bronze Age, and Iron Age that is subdivided into the Early Iron Age **(EIA)** and the Later Iron Age **(LIA).** In the survey area, concern is with the Stone Age and Iron Age sites, since there was no Bronze Age in East Africa.

The J.D Clark System based on lithic (stone) technology is the other system. This was proposed by archaeologist David Phillipson to avoid an 'apparent ambiguity' in the terms Early, Middle, and Late Stone Ages. This alternative terminology is based on a hierarchy of 5 modes of stone technology that were aimed at helping to minimize artificial divisions of continuous processes of technological and cultural development. Examples of these modes are:

Mode 1: Comprises simple rudimentary tools representing the earliest culture known as the Oldowan, with the characteristic tool type being the chopper.

Mode 2: Comprises bifacial tools, e.g., handaxes and cleavers characterizing the second technological phase of humanity, the Acheulian Industrial Complex.

Mode 3: Constitutes flake tools produced from prepared cores. This correlates with all but the latest phases of the Middle Stone Age.

Mode 4: Comprises punch-struck blades with steep retouch. This mode comprises technologies developed in some areas of Africa during the final phases of the MSA plus some industries regarded as belonging to the earlier part of the LSA. Such industries are found in some parts of northern and north-eastern Africa. As will be reported later on, sites of this technology were identified in the survey.

Mode 5: This comprises microlithic components of composite tools. This mode falls in the LSA. Here, there is a reduction in tool size and the resultant tiny tools are hafted, fitted into handles, several at times used as a composite tool. Also, backing retouch was developed and helped to hold the stone inserts in place in their hafts.

8.6.7.2 Cultural History of Project Area

The oldest culture in the world – the **Oldowan Industry** (tools made with mode 1 technology) of the ESA has been found in East Africa, with the oldest sites found in Kenya and Ethiopia. This pioneer culture is represented in the area of concern. One of these early Oldowan sites is **Koobi Fora** in Marsabit County, which dates to between 2.3 and 2.1 million years ago. Archaeological and paleontological evidence suggests that Oldowan tools were made by the first direct ancestor of humans – *Homo ergaster.*

The second major cultural period, represented by the **Acheulian Industry** (used mode 2 technology in stone tool production) of the ESA, is represented in the survey area by sites from **Lewa Downs** in Isiolo County. Olorgesailie has plenty of typical Acheulian stone artifacts – the handaxe and cleaver. Acheulian tools are believed to have been made by *Homo erectus,* who descended from *Homo ergaster.* Acheulian tools are not limited to Africa like their predecessors, the Oldowan. They are also found in Europe and Asia where they are the earliest archaeological evidence of human settlement anywhere outside Africa. This evidence shows that the two regions were occupied by humans after they migrated from Africa. The Acheilian emerged about 1.8 million years ago and lasted until about 200,000 years ago.

The succeeding cultural timespan, **the MSA** (mode 3 and mode 4 technology), whose sites within the research area have been located within the Rift Valley and the adjacent Eastern highlands, emerged around 200,000 Before Present (BP) and remained in use up to 35,000 BP, and later, in some areas. The MSA sites are located in the Nakuru-Elmenteitan Basin, the slopes of Mt. Eburru and the Kinangop Plateau, the Nyandarua Range, Nanyuki and the lower slopes of Mt. Kenya. At the site of **Nderit Drift**, in the Elmenteita-Nakuru Basin, in Nakuru County, excavations yielded high concentrations of obsidian artifacts and many bone fragments. The artifacts comprise scraper points, bifacial pieces, and grooving and piercing pieces. The most important artifact, however, was **the** leaf-shaped spear point. The MSA industries were the product of fully developed modern humans – *Homo sapiens sapiens.*

The assemblage from Kinangop Plateau in Nyandarua County is dominated by small tanged and leaf-like points, together with scrapers and burins. One of the sites at Kinangop Plateau, the **Cartwright site**, yielded artifacts that could be regarded as being intermediate between the Late Acheulian and the MSA. Projectile points constitute the dominant stone tool types. On the slopes of Mt. Eburru in Nakuru County, is the site of **Prospect Farm**. This site discovered revealed a series of

occupation and working floors. The stone industry from this is characterized by scrapers, knives and points that were either bifacially (both sides) or unifacially (one side only) retouched.

LSA industries succeeded the MSA ones, as early as about 40,000 years ago, according to archaeological evidence. Generally, there is no a clear distinction between the LSA and the preceding MSA particularly in stone tool technology. Some LSA retouched artifacts broadly resemble the MSA ones, suggesting evidence for continuity, with a number of assemblages seeming to fall typologically between the two. However, a closer observation reveals that LSA assemblages are generally much smaller, and at least in the better-known later LSA industries (especially those that date later than 20,000 years ago, they are more standardized.

One of the most diagnostic characteristics of the LSA constitutes the technological advances made in stone tool manufacture. There was continuity in the techniques of stone tool manufacture from the preceding MSA period as evidenced by the occurrences of Mode 4 technology in some LSA assemblages. Enkampune Ya Muto archaeological site from Nakuru County, dated to 46,000 years ago is one of the earliest LSA sites. The Lower Eburran is a lithic industry representing earlier periods of the LSA. This is a **backed blade industrial tradition of Mode 4 technology** based on the production of fine **punch-struck blades**. In the areas where they occur, sites of this industrial tradition largely predate a fully developed mode 5 Technology. A good example of these mode 4 industries in the survey area is the Lower Eburran in the Rift Valley of Kenya (formerly known as the **'Lower Kenya Capsian')**. This industry is best represented at the site of **Nderit Drift** in Nakuru County where it is dated to around 11,000 years ago at the very end of the Pleistocene. Other sites of the Lower Eburran in the central Rift Valley are **Gambles Cave II** , also in Nakuru County, and **Prospect Farm,** in Nyandarua County, where they been dated to about 10,000 BC (12,000 BP). The Lower Eburran of mode 4 technology appears to have evolved to the Upper Eburran Industry of mode 5 technology.

The later part of the LSA period is represented by sites of the **Savanna Pastoral Neolithic (SPN)** and **Elmenteitan** traditions. The Elemeitan traditions include Gambles Cave, Njoro River Cave, Masai Gorge and Ngamuriak, all in Nakuru County. SPN sites in the survey area include Narosura and Salasun in Narok County, Ndabibi, Nderit and Maringishu in Nakuru County, and North Horr in Marsabit County.

8.6.8 Taboos

Among the Rendille the *posha* is the centre of the manyatta where men meet every evening and use it to discuss and resolve all matters. It is also the sleeping place for m ale visitors. The *posha* has burning fire which never extinguishes. Even when the manyatta relocates the spot where the *posha* was located is never tampered with. Therefore during construction the contractor has to consult with the residents to identity that position so that it is not dug up or a pylon erected at the spot. Women are particularly prohibited from accessing that spot. A clause to this effect will be inserted in all construction contracts.

8.6.9 Traditional Ceremonies

Among the Gabbra the months of July and December are particularly sensitive culturally. It is during these months that marriages take place hence there is celebration and seclusion. In the two months construction may be affected especially if local people are employed in the project and expected to take part in the celebrations.

Among the Maasai of Suswa-Longonot area the RoW traverses the virgin area towards Mt. Longonot. This area is used for circumcision (*emuratare*) and *moran* graduation (*eunoto*) ceremonies whenever they are held. Such ceremonies are held in the months of August and/or December. The ceremonies are culturally intensive and involving and

take many days. Therefore sensitivity has to be taken over such months during construction.

Among the Samburu the ceremonies are *Muratare* (circumcision of boys) and *Lmugeti* (graduation ceremony and marking of age sets. They tend to be held during the rainy season when food is plenty either between April –May and October – December and they take about two months. No restrictions occur as long as outsiders consult with village elders in advance. But it may affect the construction of the line if local poele youth are employed at the time of the ceremonies when they are expected to participate.

8.6.10 Ethnicity and Conflict

The main part of the project traverses conflict prone areas. These conflicts include those of the Kikuyu-Maasai, in Longonot area, Samburu - Somali in Isiolo, Archers Post, Rendille - Samburu in Merille, Rendille – Gabbra in Turbi – Forole area and Gabbra, Boran and Rendille around Marsabit. Most conflict is about water and pasture during the dry season. As observed in the community meetings water was prioritized in all the communities. Therefore if the project could contribute towards providing more water points for livestock conflict would be abated.

8.6.11 Conflict in Isiolo

Isiolo district which the ROW traverses at its western tip has often been rocked by conflict between the pastoralist communities. The conflict has always been between the Somali, Samburu, Boran, Turkana and occasionally the Meru over livestock rustling and contested pastures. However, lately from September – October, 2011 the conflict has escalated and dozens of people killed and thousands displaced. The recent conflict is largely political and driven by fear of the Somali and Boran loosing grip of the political power. The population of the Turkana has tremendously grown as per the last national census. The Somali and Boran fear the Turkana may take over political leadership hence the current conflict is intended to uproot the Turkana so that they do not participate in the 2012 general elections. Secondly the declaration of Isiolo as a resort city, construction of a major highway and an international airport has raised the stakes of all the communities who wish to position themselves to benefit. Hence the conflict is driven by the fear to lose anticipated economic benefits of the new status and the drive to be in the centre of economic and political power.

8.7 HEALTH AND HIV/AIDS

Response to the question was not answered through questionnaire and pubic consultations. The information contained in Table 12 was obtained from secondary data.

Table 12: HIV – AIDS prevalence in the project area

County	HIV/AIDS Prevalence
Marsabit	Not surveyed
Samburu	Not surveyed
Isiolo	15%
Laikipia	10%
Nyandarua	5%
Nakuru	12%

District Development Plan, 2003 - 2008

From the trends, it is clear that prevalence of HIV/AIDS is related to the level of urbanization and location within the transport network. Thus HIV/AIDS prevalence is high in Nakuru and Isiolo because the major towns in the counties are located on a major transit corridor, thus hosting high risk groups such as long-distance truck drivers

and sex workers . The more rural counties such as Nyandarua have a lower HIV AIDS prevalence.

9. POTENTIAL POSITIVE IMPACTS

9.1 CLIMATE CHANGE AND REGIONAL AND LOCAL POLLUTANTS

The transmission line is intended to tap into power generated through clean energy: mainly hydro power. Hydro power is considered green energy because its production does not involve emission of green-house gases.

Improved access to adequate and affordable energy for households and industry will help in rolling back the rate of deforestation and thus help in conserving forest resources, biodiversity, soil conservation and water resources. In addition, access to affordable energy can improve transportation, industrial production and farming methods with the potential of reducing global, regional, and local pollutants emissions such as CO, CO_2, PM NO_x and SO_x to the atmosphere.

9.2 OVERALL NATIONAL ECONOMY

The justification of the power line is based on the ambition of the Kenya Government to be a middle income country by year 2030, and with that the reduction of poverty in the country which is responsible for serious environmental degradation. More importantly, availability of energy will improve the socio-economic status of Kenyans through creation of jobs in industry and availability of power in homes especially in rural areas.

9.3 EMPLOYMENT OPPORTUNITIES

During both construction and operation, direct and indirect employment opportunities will be availed for both skilled and unskilled workers. Further, there will opportunities for income generation activities in sub-contracts such as supply of materials, maintenance of the line, etc.

Available work force and service providers are shown in the Table below. Generally masonry, truck drivers and security personnel are the most available vocations in the project area. This potential workforce will be beneficial to the project as they will be available for hire during the project and thereby reduce the cost of transporting such crafts-people long distances.

Table 13: Available semi-skilled labor in the project area by County

TRADE	Marsabit	Laikipia	Nyandarua	Nakuru	Total
Mason	1,585	705	4,932	9,336	**16,558**
Truck driver	1,233	705	1,938	7,927	**11,803**
Security	9,336	7,398	2,642	7,751	**27,127**
Timber logger	705	3,699	1,409	3,875	**9,688**
Carpenter	1,585	1,409	1,585	1,762	**6,341**
Painter	1,409	1,409	1,585	1,585	**5,988**
Mechanic	352	352	881	881	**2,466**
Welder	176	705	1,057	881	**2,819**
Electrician	176	352	881	528	**1,937**
Heavy machinery operator	352	352	176	352	**1,232**
Blacksmith	528	176	528	176	**1,408**
Total	**17,437**	**17,262**	**17,614**	**35,054**	**87,367**

Source: Gamma Systems Ltd RAP Report

9.4 SMALL BUSINESSES AND ENTERPRISES

Whereas the project area has businesses that offer a range of goods and services, they may not suffice and are located far between in major towns and trading centres leaving wide areas that are unserviced.

Table 14: Number of businesses offering goods and services along the alignment

Service	Marsabit	Samburu	Nyandarua	Nakuru	Total
Transport of goods and materials	4	1	3	4	**12**
Timber/loggers	4	1	3	4	**12**
Canteens/restaurants	4	1	3	4	**12**
Materials	4	1	3	4	**12**
Hotel/lodges	4	1	3	3	**11**
Petroleum products	3	1	3	4	**11**
Financial services	1	1	2	3	**7**
Mobile banking	0	1	3	3	**7**
Mechanical	1	0	1	4	**6**
Heavy machinery	1	0	0	0	**1**
Total	**26**	**8**	**24**	**33**	**91**

Source: Gamma Systems Ltd RAP Report

To meet the expected surge in demand for the various goods and services, the local population will see an opportunity to offer such services to the contractor and the workforce. These will include food vendors, accommodation and supply of local materials.

9.5 IMPROVED ICT ACCESS

Kenya is developing rural-based ICT networks that are geared to benefit the local populations and supply local schools with ICT terminals as ICT is being integrated into school curriculum in line with the country's' MDGs. The policy is to incorporate optical-fibre ground wire (OPGW) in all new lines. The OPGW will therefore be able to supply broad-band communication telecommunication hubs, mobile telephone networks and digital television to population centers and schools along the project affected area.

9.6 ENHANCING THE POSITIVE IMPACTS

Certain actions can be taken to assure the realization of the positive impacts and even to enhance them. Considering the current power supply shortfall in Kenya, the construction schedule should be developed in such a way that the project is realized in the shortest time possible. This will have an additional benefit of reducing the cost of the project and also enabling early return on the investment.

The Government of Kenya should seize the opportunity offered by the project to facilitate the introduction of ICT into the often neglected north of Kenya by initiating a parallel programme of rural electrification in the region specifically targeting institutions of learning and Government Institutions. In addition, the Government should start awareness campaigns amongst the residents of northern Kenya of the possibilities that will be occasioned by the ICT cable. Training targeting teachers and other Government workers should be initiated prior to the arrival of the cables for early take-up of ICT in the region.

The contractor should be encouraged to source non-special materials locally and to give preference to local contractors for semi skilled work such as masonry, carpentry, supply of ballast, sand and water.

10. POTENTIAL ADVERSE IMPACTS

10.1 IMPACTS DURING CONSTRUCTION PHASE

10.1.1 Impact on Project Affected Households (PAPs)

The impact of the project on households will vary as some households will no longer be able to utilize the area in the wayleave for certain farming activities such as growing trees and fruits that grow over 4.5 m tall. Some households will only be affected during construction but will be able to continue using their land as before such as crop farming and animal grazing. For households where transmission line towers will be constructed on their land, the affected portion of land will remain unutilized for the entire period of existence of the transmission line. Other households will suffer loss of secondary assets such as water tanks, gates, animal sheds, lavatories, fences, etc while others will lose their dwellings, businesses or loss of income.

The social effect of resettlement of households will include disruption of education for the school-going children or relocation of employment opportunities for employed household members. It may not be easy to quantify these and other similar impacts but the affected households shall be compensated for disruption of their living conditions.

Mitigation Measures

Adequate consultations with the PAPs are required to reach mutually agreeable compensation. Such compensation should take into consideration social disruption and possible trauma occasioned by relocation. Detailed mitigation measures are contained in the RAP report.

10.1.2 Impact on Land

Parcels of land traversed by the proposed RoW range in size from 0.2 hectare holdings to thousands of hectares tracts of ranches or land held in trust by County Councils and/or owned by local or foreign investment companies or multinational companies. Affected community properties are mainly in urban centres where plots are fairly small (0.2 Ha maximum). All the community properties affected by the project will therefore have to be relocated to new sites.

In all cases except at the towers, households, communities, large-scale ranchers and wildlife conservancies (registered owners) will continue to own the affected parcels of land but will utilize the RoW area in a manner consistent with safe use of high voltage power transmission wayleave. The affected land owners will, therefore have an advantage of earning extra income while continuing to use the land.

Mitigation Measures

Detailed mitigation measures are contained in the RAP. Briefly, land parcels that will be acquired will be compensated at rates commensurate with the loss. For sites where physical infrastructure such as towers will be erected, full compensation will be made. However, where there is only partial loss of use of the land, a proportionate compensation will be considered. The details measures are contained in the RAP.

10.1.3 Impact on Physical Assets

A total of 71 (33.3%) of the 55% of the 433 households have principal structures partially or entirely in the Row. In total there are 227 houses, 7 shops, 34 workshops 1 animal shed in the RoW. The total number of persons benefiting those structures is 39,119 (household and community members). Eighty six percent of households own the properties, while 56% of households do not have other land outside the RoW in

which to rebuild their principle structures if relocated. Among 60 households who had land outside the RoW in which to rebuild their structures, 86% of them owned the land.

73% of the households have secondary structures entirely or partially located in the RoW. A total of 150 secondary structures are affected, of which majority of them (97%) are owned by the affected households. 58% of the secondary structures will not have alternative land for relocation if they are demolished to give way to the proposed power transmission line.

During consultations, the communities gave recommendation on the type of compensation they expected to receive. Since most of the structures are located on small urban plots, all of them will have to be relocated.

Mitigation Measures

All properties that are affected must be compensated in full, and additional consideration should be given to the vulnerable PAPs. Community assets will require special consideration in order not to disrupt their functions. The details compensation actions are contained in the RAP.

Most of the affected households derive their livelihood from farming which includes growing of annual and perennial crops, livestock and some of them operate businesses for a living which include shops and workshops. The impact of the project to these households will be displacement. This means that the affected households will have to move and restart elsewhere. The livelihood activities for resettled families will need time to re-establish to their current position. Compensation for the affected households should enable them to fully resettle in new locations and rebuild their farming or businesses to the level that is more or less per with their current status.

There are diverse business enterprises within the proposed RoW but most of them are not directly affected by the project. The most affected is household small-scale farming which includes growing of crops, woodlots and livestock production. These will be specifically considered for compensation. Other enterprises affected by the project are retail shops mainly owned by households. These too will be specifically compensated for. Large enterprises affected include large-scale ranching and wildlife conservancies. Both of these own large tracts of land and since the main impact to them will be disturbance during construction and O&M of the proposed transmission line,

Mitigation Measures

All the sources of livelihoods and enterprises should be compensated under wayleaves compensation. The details are contained in the RAP.

10.1.4 Social Conflicts and Minority Rights

Whereas social conflicts are not expected, they have the potential to occur as follows:

- Conflicts between the workers and the general community members if their conduct are contrary to the community expectations esspecially with the pastoralists along the northern alignment
- The contractor ignoring the locals in job opportunities especially as non-skilled labour
- The contractor exploiting local resources, such as stones and borrow materials without compensation to the communities
- The contractor and his workers being insensitive to local customs and traditions

Social conflicts have potential of occuring anywhere along the alignment depending on the practices deployed by the contractor.

Mitigation Measures

The contractor should deliberately and preferentially employ workers from the local communities along the alignment. Further, the contractor should have a code of conduct for its employees that enforces respect to the local community cultural and traditional practices. A pro-active community social responsibility program is also recommended on the part of the Contractor and KETRACO.

10.1.5 Marginalized Communities

The transmission lines crosses areas settled by marginalized groups. Marginalized groups according to the community are persons affected by drought, households with no land and livestock, Squatters and Internally Displaced Persons (IDPs). According to the communities, IDPs in Nakuru and Nyandarua and drought victims in Marsabit and Samburu comprise the largest portions of marginalized groups. According to the RAP census, the project is unlikely to adversely affect these marginalized groups, as no IDP camps will be affected, no water or rangeland resources will be adversely either during construction or during operation. Impacts on marginalized groups is expected to be none or insignificant at worse.

Mitigation Measures

The condition of the marginalized groups can only be improved by the contractor taking pro-active steps to employ selected members of the marginalized groups for employment as labourers, security personnel, etc.

10.1.6 Soil

The site most vulnerable to impacts on soil resources is the final 20 km section to Suswa. The other site is the mountain ranges within Samburu County, especially areas that are outside private or community managed conservancies and the Samburu National Park. This situation is caused by overgrazing and reduction of vegetation cover due to tree cutting for fuelwood. For Naivasha – Suswa area, the soils are predominantly volcanic ash that is deep and vulnerable to soil erosion occasioned by both wind and rainfall. This impact could be significant for Suswa area more than the rest of the alignment since it is here that the Power sub-station is expected to be built. Most civil works that disturb the soil, exposing it to wind and freeing dust particles will be concentrated at the specific site for the Station. This is a highly localized impact to the specific area of concentrated construction activities.

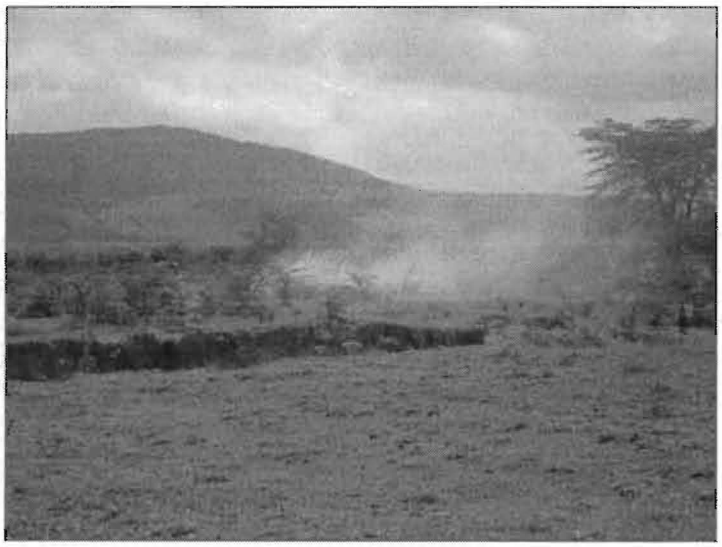


Figure 29: Deep gulley erosion caused by run-off at Suswa, background dust blown by wind

Mitigation Measures

Negative impact of construction activities on soil is low. The contractor will be required to develop a dust management plan for approval by the supervising engineer. At a minimum, the plan should ensure that unnecessary damage to the soil is avoided. Further, construction activities should avoid contaminating the soil through proper waste management and avoiding pollution of soil from oil and lubricants. Where disturbance or damage to the soil is unavoidable, it is proposed that the sites be rehabilitated upon completion of works.

10.1.7 Ground Water

Analysis of impacts indicate that impacts on groUnd water is highly unlikely and their occurrence can only be related to costruction practices. If there is an impact, it also likely to be highly localized to the ground water resources within the vicinity of the main station at Suswa. Construction activities that can have an impact on ground water are as follows:

- Tank/motor oil leakages of vehicles or equipment
- Inadequate handling of fuels in unsealed areas
- Inadequate handling of effluents or hazardous wastes (e.g. waste dumping)
- Inadequate handling of effluents from workers camps or at the construction site can lead to pollution of soil and groundwater.

Mitigation Measures

Best engineering and construction practices can completely avoid this potential impact Therefore uncontrolled discharge of effluents into the ground or groundwater aquifer must be avoided. Furthermore these risks could be managed by:

- use of well maintained vehicles and equipment,
- implementation of an adequate effluent management, and
- suitable organisation of the construction site.

Due to the limited time of the construction activities and the character of the project, this impact is insignificant if mitigation measures are applied.

10.1.8 Surface Water

The main surface water bodies along the alignment are River Pesi and the River Ewaso Nyiro. Lake Ol Bolossat is close to the line but will not be affected in any way. There are also several seasonal rivers and streams along the alignment especially within Laikipia and Samburu Counties. Surface water Impacts of the project can therefore focus mainly on these rivers and Lake Ol Bolossat. The impacts will be related to the positioning of the towers in relation to the water bodies. Unless the towers are located within the riparian zone, it seems to be unlikely that high sediment runoff from tower site works will occur and adversely effect the water quality in any nearby waterbodies.

However, the possibility of impacts on surface water resources still exist and if they occur, they would be caused by:

- oil spills resulting from fuelling or maintenance activities of construction machines or poorly maintained construction machines,
- dumping of waste at/near surface waters or temporary rivers,
- sediment runoff from tower site works or transmission line clearing,
- disturbance of bank vegetation.

The magnitude of this impact is likely to be very low considering the few water bodies and the relatively small works within the tower locations.

Mitigation Measures

If locating a tower within the riparian zone is unavoidable, and if construction is in progress during rainy periods, temporary catch basins or sediment traps could be prepared if excessive erosion occurs at any particular tower site, access track or the station site.

10.1.9 Air Quality

Adverse impacts on air quality will be highly localized and largely restricted to the construction phase of the project. This will be mainly associated with generation of dust at the tower construction sites and at the main station in Suswa. Of these, impacts related to the main substation at Suswa are most likely to be significant for two reasons:

- The soil type, which is predominantly volcanic ash is vulnerable to generate fugitive dust
- The soil is mainly exposed to the elements due to degraded ground cover accompanied by overgrazing
- The site is flat and prone to strong winds

Construction activities will involve soil disturbance occasioned by earthworks to lay foundation for the various equipment including transformers and associated civil works. Since the soils are prone to wind blow, slight disturbance could lead to enhanced generation of fugitive dust within the environs of the station.

The significance of dust is manifested first and foremost with respect to the receptors, in this case with respect to human health. To a small extent, dust can also affect other animals, especially domestic animals and degrade pasture on which the pastoralists in the vicinity are dependent. Except for occasional herders, there is very low sedentary settlement in the vicinity of the site, implying the off-site impacts of dust on humans is very low. On the other hand, fugitive dust generated at the site could have profound impacts on the construction workers if not well mitigated. On the whole, the impact of dust is expected to be low for the general area but could be high for the workers at site. The same argument applies to emissions occasioned by diesel powered construction traffic and earth movers.

Mitigation Measures

The impacts of dust and emissions on the air quality will be limited to the time and area of construction activities only. It is considered to be low because adequate measures will be taken to minimize air pollution.

10.1.10 Noise

Noise will result from construction activities, especially as generated by additional traffic of trucks, contruction traffic and heavy earth movers. Impacts of noise are evaluated against potential noise receptors and points of noise generation. In this regard the potential sites of high noise generation are at the station at Suswa and at the towers. Noise receptors along the alignment are limited to relatively densely populated areas North of Gilgil, Kipiri, and north Ndaragwa. In general, the people and receptors within 100 m of the RoW can potentially be affected, implying that the . actual number of people who could potentially be affected is substantially lower.

Mitigation Measures

Potential impacts should be reduced by adopting the proposed mitigation measures (see ESMP Mitigation during Construction). The construction of the transmission line

will cause noise and vibration exposures to the adjacent areas. Especially the vehicle movements and the operation of the construction equipment for the excavation activities or tower erection could result in noise emissions.

10.1.11 Flora

10.1.11.1 Trees

Since the height of trees in the general landscape ranges between 2 and 7 m, the impact on vegetation is low because vegetation in these areas will be disturbed only in sites where towers will be constructed. Resource census done along the line indicates that there are about 89,930 trees that grow taller than 4.5 m, and these may be affected through regular pruning. A greater percentage of these trees are found in the wetter highlands of Nyandarua County. Out of this category of trees, eucalyptus species constitutes the largest percentage, mostly within farms and homesteads. Eucalyptus is treated as a commercial tree crop often grown as monoculture. By the very nature of its silviculture within the farms and homesteads, the species are grown for commercial purposes and not of much ecological value, except as ground cover and soil conservation. This impact is considered medium.

Mitigation Measures

Trees taller than 5 m will be compensated and hence the commercial value of the tree will be restored to the owners. The impact on ground cover will be restricted to the initial construction period, after which the ground cover is expected to be restored by alternative land use by the landowners. This is very plausible in the highlands of Nyandarua County where dairy farming is a major activity, making it is easy to switch land use to pasture and still maintain or improve potential income foregone due to loss of trees. As discussed earlier, the ecological value of these trees are insignificant, therefore a switch in land use that maintains ground cover can potentially completely mitigate ground cover functions of the lost trees.

10.1.11.2 Woodlands

The woodlands and bushlands within the Laikipia and Samburu Counties are typically below 7 m tall, mostly around 5 m which are well below the height that require regular pruning during maintenance of the line. The project will have an impact on this type of vegetation mainly during the construction phase. The impact on this type of vegetation could be through two processes, all of them during construction:

- Construction of access roads to the alignment RoW for construction of towers and stringing
- Minimal clearing the alignment to allow for stringing

Typically, construction access roads will require roads of between 7 and 10 m width to deliver construction materials. Considering that the alignment is some distance to existing roads in over 60% of the case across this ecosystem, accesses will be required for tower sites and to deliver materials. It is not possible to accurately indicate the extent of vegetation lost but rough indications are that if a total of about 30 km of new accesses may be required across this ecosystem, then about 100 ha of woodlands will be cleared. Considering that this loss is not along a continuous line but several small accesses spread across the vast ecosystem, the impact is considered low and transient.

Mitigation Measures

To mitigate this impact, it suggested that the road be thoroughly scarified to allow vegetation to re-establish naturally. The area being semi-arid, it is not practical to artificially plant trees on these decommissioned roads as the seedlings may not establish. Left to naturally re-generate, it estimated that the impact can be fully

mitigated after about 10 years if the abandoned roads are scarified. However, for erosion prone areas, artificial restoration through planting of appropriate vegetation is recommended. Where trees of value are to be cleared within individual holdings, such individuals will be compensated to enable them replace lost trees away from the RoW.

10.1.11.3 Ndaragwa Forest Resources

The proposed transmission passes at the edge of Ndaragwa where people have recently settled and some cedar trees are likely to be cut to create a wayleave and to allow stringing. This section has approximately 30% tree cover, dominated by *Juniperous procera* (Cedar tree). Using the adjacent Aberdares Forest as a guide, the stem density of an undisturbed forest stand is about 277 stems per hectare. Thus, 30% tree cover translates to about 83 stems per hectare. The proposed wayleave is approximately 1.8 km long across this section. Assuming that 20 m of the wayleave may be cleared of tall tree stems during the construction of the transmission line, an estimated 299 trees may be pruned or cut. This quantity only applies to the short section across Ndaragwa forest.

Figure 30: Degraded part of Ndaragwa forest where wayleave will be acquired

The impact of clearing this section of trees is considered low because (1) an insignificant percentage of the forest will be affected, (2)cedar trees, which will be affected, are a predominant species within Ndaragwa and neighbouring forests, (3) this section is already degraded to an extent that additional degradation associated with the wayleave is insignificant in the long-term. The impact is considered low to insignificant and easy to mitigate or compensated for by additional planting.

Mitigation Measures

In order to address losses associated with ecological functionality of the forest, such as habitat loss, carbon offset opportunities, biogeochemical functions and soil and water conservation; compensatory planting is recommended in adjacent degraded areas of Ndaragwa forest. In addition, stringing should strive to minimize unnecessary cutting of trees along the line. It is recommended that KETRACO liaise with the Kenya Forest Service to explore the most appropriate compensatory planting areas and most appropriate tree species mix.

10.1.12 Terrestrial Fauna

Consultations with communities along the line indicate that the entire length has substantial population of wildlife. The most common animals that have been sighted by the communities within the alignment, and in order of frequency are Gazelle, hyena, leopard, zebra, lion, giraffe, elephant and buffalo. There are also others but at much lower sighting frequency. Ironically and against popular perception, our analysis

indicates that although subtle, potential impacts on wildlife are most likely to occur during construction as opposed to the operation phase.

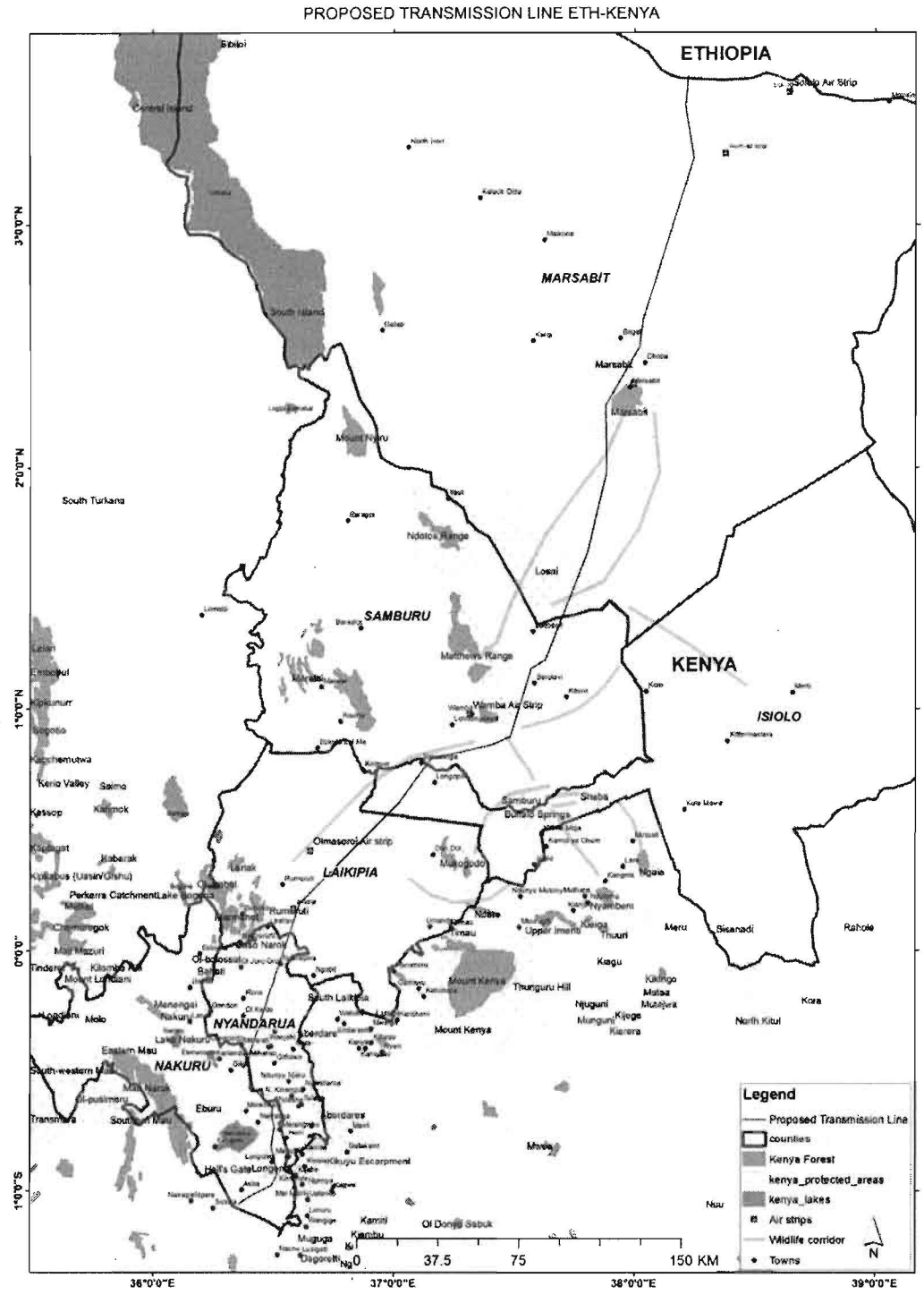


Figure 31: Transmission line avoiding National Parks

During construction, there is potential transient impact on movement of certain wildlife species, especially across Laikipia – Samburu ecosystem, Losai Reserve and Marsabit National Park. However this may only happen if construction across their migratory corridor coincides with their movement across these sections. The potential impacts are restricted to disturbance of wildlife in terms of their feeding, breeding and general movements, and only at the point of intense construction activities, i.e. at the towers and the station. Disturbance could be caused by presence of labour force, noise and vibration. The other possibility is by hunting for game meat by construction workers especially within the sections crossing the wilderness areas North of Ndaragwa to Moyale. The target species are likely to be ungulates especially gazelles and

antelopes. Overall, the impact on wildlife during construction is considered medium to low.

Mitigation Measures

Construction activities across Laikipia, Samburu and Marsabit counties should be done during the dry season when wildlife, particularly elephants are in wetter zones such as Mt. Kenya. However, there are cases where disturbance will not be totally avoided, and to minimize this, the contractor should develop a code of conduct for the workforce, prohibiting killing of game for any reason whatsoever, and the workers should be sensitized on the Wildlife Act that prohibits killing and poaching of game. The proposed route selection avoided the commonly used game migratory routes. Cosnultations and agreement with the KWS on construction schedule should be sought, and such an agreement should aim to avoid or minimize wildlife disturbance especially during migration.

10.1.13 Protected Areas

The alignment has carefully avoided the Marsabit National Park, Samburu and Buffalo Springs National Park and The Aberdares national Park. It however traverses through several conservancies and the eastern edge of Losai Game reserve. Potential impacts on Losai nature reserve has been minimized if not avoided altogether by aligning the line adjacent and parallel to the main road, thus the impacts associated with the road will override those of the Transmission line. No impacts are expected on Marsabit Forest Reserve, Aberdare National Park and the neighboring Forest Reserve, IBA/Ramsar site Lake Naivasha and Longonot National Park. Furthermore when the ecological functions of Marsabit reserve and Losai reserve are taken into consideration, it is assessed that the project's impact will be low to insignificant principally because the areas traversed by the line across the two reserves are extensively used as grazing grounds by the local pastoralists, a process that has degraded these ecosystems considerably. For Losai reserve in particular and as mentioned earlier, the line runs parallel to the main Isiolo to Marsabit road that is already under upgrading to bitumen standards. It is assessed that the project would not present additional impacts on the functions of the Losai reserve since the potential ecosystem fragmentation occasioned by the road is potentially more severe than that of the power line. The project's impact on IBA Lake Ol Bolossat is assessed as low since the lake is about 4 km away and the risk of bird collisions during construction is very low.

Mitigation Measure

It is suggested that the contractor is to follow the ESMP and best practices to minimize construction related impacts on the floral and faunal resources within these protected areas. The section along Lake Ol Bolossat will have reflective spheres mounted on the aerial ground wire to improve its visibility to further reduce chances of bird collision as they fly into and out of the lake IBA.

Whereas the line passes away from Marsabit National Park, it still crosses the wider wildlife dispersal area of Marsabit County. In light of this, environmental safeguards management along this portion can be undertaken in conjunction with the implementation of the AFD – financed Conservation Project. The Project – the Northern Kenya Wildlife Conservation Project – will focus on ensuring the ecological integrity of a) the Marsabit forest, b) the clinal areas immediately adjacent to it on the lower slopes of the mountain (to include three community conservancies and the strengthening of the remaining area of Marsabit National Reserve, c) corridors through ensuring security and water-point connectivity, and d) refuges to which Marsabit is connected through the corridors.

10.1.14 Land Use

During the construction of the transmission line and substations, the crops within the construction areas outside the ROW can be partly lost. Temporary disruptive and damaging effects during tower construction and line stringing can affect all kinds of land use. This is particularly relevant to agricultural crops (e.g. loss of trees or branches during line raising and tensioning). Farming practices will be allowed in the ROW after the construction activities are finalised and as long as the safety requirements are strictly adhered. It is therefore estimated that the crop production of field crops will be disturbed for a period of one year only. Detailed information on permanent and temporary loss of assets is included in the RAP.

The impacts on some farmers might be locally significant, because they might loose a major part of their crops. An detailed investigation regarding the use of land prior to the start of construction and the corresponding suitable compensation must be done. If the construction activities avoid direct loss of crops or any loss or damage of crops are fully compensated then the impacts of the transmission line within the ROW are assessed to be low.

Mitigation Measures

Commensurate compensation of lost land and land-use foregone by the Project Affected Persons (PAPs) is recommended. Further, the PAPs should be educated on the temporary nature of lost opportunities and that they can continue growing crops and grazing livestock beneath the power lines on completion of construction works.

Although difficult to predict, there is the potential accidental damage to crops and properties or structures such as fences during construction and even maintenance. Since this is unforeseen, the Contractor will be required to develop and adhere to a grievance procedure that will allow for compensation of such damages. The grievance procedure should make provisions for involving the local leaders and Government representatives, preferably as a committee. This will be most relevant across Nyandarua and Nakuru Counties.

10.1.15 Aesthetics

Due to erection of towers and construction of access roads during construction, the impact on landscape will be a visible corridor in areas with trees or high bushes and grass, until the vegetation re-establishes. Where the transmission line route runs parallel to an existing infrastructure such as road or railway line, the impact will be considerably lower. The newly installed towers and overhead conductors would be visible over long distances, especially in very flat areas or where they stand out against the horizon. It is therefore preliminarily concluded that the impact will be high.

Mitigation Measures

This impact is difficult to mitigate but as far as possible, the alignment has been selected to avoid areas considered to be scenic. Furthermore in some sections, especially across the Losai Nature Reserve, the line runs adjacent to the road, thus its visual impact is reduced by the presence of the road. Nonetheless, as time moves the shining metallic appearance of towers and conductors will become dull and undergrowth will reestablish and thereby further reduce the negative impact.

10.1.16 Aviation

The impact on air flight is assessed to be low. The project is not expected to affect aircraft during construction. Measures have been taken to route the proposed transmission line away from airstrips and runways, and to notify owners of conservancies of on-going construction work.

Mitigation Measures

In order to further mitigate against this impact, reflective spheres will be installed on the aerial ground wire at the sections closest to the flight path parallel, into and out of the airstrips.

10.2 IMPACTS DURING OPERATION PHASE

10.2.1 Aesthetics and Tourism

The towers and lines will be imposing creating a visible corridor across the landscape. This is potentially one of the most important potential impacts during the operation phase and it relates to tourism within the Laikipia-Samburu area where tourism attraction is principally the wilderness experience. Selection of the route has deliberately avoided proximity to eco-tourism lodges found within the conservancies in Laikipia and Samburu. However, visual intrusion will still persist across this landscape.

Map not to scale

Figure 32: Proposed TL route in relation to tourism facilities and wildlife conservation areas (Not to scale, courtesy of Laikipia Wildlife Forum. Note: the Figure was not editable by the Consultants)

Figure 32 above was obtained from the Laikipia Wildlife Forum but they did not provide the Consultants with the coordinates of the tourism facilities to enable the Consultant provide more details on the exact proximity of tourism facilities to the TL., Figure 32 is a general representation of the distribution of tourism facilities and wildlife conservation areas in relation to the proposed power transmission line within Laikipia and adjacent Counties of Isiolo and Samburu. The fact that the line is on 45 m high pylons set at intervals of 400 m has the potential to visually change the landscape from that of a natural wild setting to an industrialised setting. This in turn could have a direct and adverse impact on Laikipia's tourism sector, and potentially undermine the core value that defines Laikipia as a wilderness destination. The magnitude of this impact is, however, not foreseen to be high enough to diminish tourism in Laikipia. Similar power lines do traverse even more sensitive protected areas with much higher tourism traffic than Laikipia in but the negative effects of such lines have not been noticeably high.

Where the transmission line route runs parallel to an existing infrastructure such as the road north of Merille, the impact will be less. The newly installed towers and overhead conductors will be visible over long distances, especially in very flat areas or where they stand out against the horizon. It is therefore concluded that the impact will be high and difficult to mitigate. The magnitude of this impact in terms of perception will reduce with time and distance as they become more familiar to the observers. For example, there are power transmission lines all over Europe, especially through the Alps and tourism industry has adjusted accordingly and continues to be lucrative.

Comparison with the Tsavo National Park

Tsavo National Park is the largest protected area in Kenya and one of Africa's largest wilderness areas measuring about 22, 000 km^2. It is considered one of the world's biodiversity strongholds, and its popularity is largely attributed to the diversity wildlife that can be seen during any visit.

Tsavo National Park has had a number of national and international infrastructure projects traversing it. Some of these include the Kenya – Uganda Railway, which connects the port of Mombasa to land-locked countries in eastern Africa; the Mombasa – Nairobi Highway, which forms part of the TransAfrica Highway linking Cape Town in South Africa with Cairo in Egypt, also links Kenya to Uganda, Rwanda, Burundi, DRC and South Sudan. The Mombasa – Nairobi high voltage power transmission line, which connects the coastal region to the national grid also traverses the National Park. The main oil pipeline for transporting petroleum products from Mombasa to the Kenyan hinterland onwards to Uganda, Southern Sudan, Ruanda, Burundi, DR Congo and parts of Tanzania also traverses the National Park

Apart from these national and international infrastructure projects, a number of lodges, campsites and a network of roads have been developed within the park over the past two decades. These have been necessitated by increase in the number of tourists visiting the Park and conservation efforts inside the National Park.

In the 1980s, a 132 kV transmission line was constructed for purposes of linking Nairobi and coast power systems. Over the years the transmission line has become very important by supplying power to oil pipeline stations cascaded from Mombasa to Nairobi. In time other loads were supplied by this line. The line traverses the Tsavo East National Park. The existence of the transmission line and its increased importance in the supply of electricity to the urban and rural centres between Nairobi and Mombasa did not reduced the importance of Tsavo National Park as a prime wildlife conservation area and a coveted tourism destination. Since the intended purpose of the 132 kV transmission line was undermined by its increased utilization as a distribution line, a new 400 kV line was designed to run in parallel with the 132 kV

transmission line so as to achieve higher power transfer between Nairobi and the coast. This 400 kV transmission line is currently under construction.

The ESIA and RAP reports for the 400 kV TL project were cleared and licensed by NEMA in 2009. The most significant environmental impacts of the project were the acquisition and maintenance of the RoWy, clearing of vegetation from sites and line corridor within the Tsavo National Park, and construction of access roads, tower pads, and substations. To mitigate adverse impacts related to visual intrusion and degradation of the pristine natural environment in the park, vegetation clearance and other project activities in the protected area are being done with the guidance of Kenya Wildlife Service (KWS).

Despite the presence of major physical infrastructure across Tsavo National Park, research carried out in 2003 to gauge tourist satisfaction with the National Park found that about 77% of the tourists indicated that they had a very satisfactory experience with Tsavo National Park as a quality tourism destination. Approximately 22% of the tourists were satisfied, while 1% was less satisfied. Over 23% were repeat visitors, some of whom had made several trips to the National Park and other wilderness areas in Kenya over the years. It was expected that these tourists would most likely have been less satisfied with Tsavo as a tourist destination if the overall quality of the park's as an ecosystem had reduced.

A comparative analysis of first time and repeat visitors to determine whether there was any significant difference in wilderness experience between the two categories of tourists, indicated no significant difference. Both categories of visitors rated the quality of the park's wilderness experience highly.

Mitigation Measures

The final design has avoided insofar as possible proximities of wilderness view points and tourism lodges. Learning from the Tsavo experience, the project is unlikely to deter well meaning tourists from visiting the area. Further this is not the only infrastructure project across Laikipia. For example there are extensive perimeter fences around most private conservancies and these have not deterred tourists from visiting the Laikipia area.

10.2.2 Soil

Impacts on soil is expected to be low to insignificant along the entire line, however some highly localized impacts could be associated with the operations at the main station at Suswa. However, across erosion prone areas north of Nanyuki, cleared areas for purposes of access tracks and tower construction could remain unvegetated for long due to low and erratic rainfall. If such conditions persist, then it could lead to wind and rainfall induced soil erosion. Other than soil erosion, soil pollution could also occur during operation.

The following sources of soil pollution are possible in the operation phase:

- Contamination because of hazardous liquids and materials
- Liquids used for insolation, or oils and greases used in Suswa station can lead to soil contamination, if not correct handled and disposed off, after usage.

Mitigation Measures

If not mitigated after construction, soil erosion occasioned by prolonged exposure of soil to the elements can be mitigated through planting of indigenous vegetation on excavated sites. Furthermore, such sites will be inspected at quarterly intervals to

ensure that any local erosion features that develop are promptly repaired. However, occurrence of exposed soil will imply a failure of the contractor to adhere to the ESMP.

Prevention and mitigation measures against soil contamination including correct handling of hazardous liquids and other substances and use of unleaded paint will ensure that impact on soil is low. It is highly recommended that mechanical or manual means of weed control be adopted as opposed to chemical means. This is the current practice at KETRACO and should be upheld.

10.2.3 Water Resources

During normal operation conditions it is not anticipated that the project will have any impacts on water resources, either through conflict with other users or through contamination. However, there is only a remote possibility of contaminant leakage from the Suswa substation, but even in such an event, the quantity is not likely to be large enough as to reach the local aquifer.

Mitigation Measures

Ensure operations that are responsive to environmental requirements as provided for by EMCA Regulations on effluent management. Follow the provisions contained in the ESMP.

10.2.4 Impact on Avifauna

The risk of bird injury from power lines is highest for waterfowl and water birds, for example ducks, geese, herons and cranes, as they are not as able to quickly maneuver around the lines. This often happens because power lines are difficult for them to see and can sometimes appear invisible due to background or low light conditions. The impact of the proposed power line on birds is considered to be low across the entire project area. However, there are important bird areas at three locations where bird collision with the power line is possible. These are Dida Galgalu, Pesi Swamp and Lake Ol Bolosat.

10.2.4.1 Dida Galgalu IBA

The impact of the power line on bird species at Dida Galgalu is considered insignificant because the species are adapted to a desert environment, which is devoid of trees and water bodies. These generally nest on the ground and low lying shrubs. Thus, cases of bird collision with power line are expected to be rare. However, the towers and power lines can create hitherto non-existent vantage positions for raptors to perch and easily spot prey on the ground. This could create a new ecological dynamic into the ecosystem. However, considering the vastness of the Dida Galgalu IBA, this impact is unlikely to impact on the overall ecological dynamics of the ecosystem.

10.2.4.2 Pesi Swamp

This swamp is located 10 km away from the proposed power line and therefore birds associated with it are unlikely to be impacted.

10.2.4.3 Lake Ol Bolossat

The most vulnerable bird species in Lake Ol Bolosat include Red-knobbed Coot, *Felica cristata*, African Jacana, *Actophilornis africanus*, Blacksmith plover, *Venellus armatus*, Black-winged Plover, *V. Melanopterus*, African Snipe, *Gallinago nigripennis*, Yellow-billed Duck, *Anas undulate*, Red-billed Duck, A. *erythrohychna*, Purple Swamphen, *Porphyrio porhyrio* and Gray Crowned Crane, *Balearica regulorum.*

The power line runs approximately 3.7 km east of the edge of L. Ol Bolossat. Water fowls which are the most vulnerable to power line collisions are unlikely to be affected as their migratory path is predominantly to the west and South-West of the lake,

particularly to other IBAs such as lakes Naivasha and Baringo. Some of the bird species that use this migratory route include Palaearctic and Afro tropical migrants. Impact of the proposed power line is considered low for the entire project, but medium for Lake Ol Bolossat.

Mitigation Measures

Fitting overhead conductors with brightly coloured 'aviation' balls or reflective spheres, thickened wire coils, luminescent, shiny flashing or flapping devices is recommended for the 7.5 km to enhance the visibility of overhead conductors for birds. The design has already appropriately off-set the line from the lake by about 3.7 km to avoid bird collisions as they fly into or off the wetland.

Figure 33: The 7.5 km section to be fitted with overhear reflective spheres (red line)

10.2.5 Terrestrial Wildlife and Wildlife Habitats

Experiences with high voltage power transmission lines within the region have illustrated that they have low impacts on terrestrial wildlife including elephants. However the power lines do electrocute primates. Arboreal (tree-dwelling) primates' natural instinct is to avoid coming down to the ground where they are more at risk from predators and they use any available material, natural or otherwise as pathways through the forest. A study in Diani at the Kenyan Coast where a power line runs through Diani Forest indicate that for a period of four years, over 60 cases were confirmed of arboreal primate electrocution by power lines that pass through the forest (Wildlife Direct, Colobus Trust 2008 http://colobus.wildlifedirect.org /2008/09/01/working-together-to-reduce-wildlife-electrocutions-a-breakthrough-at-last/). Impacts on primates are however, assessed to be insignificant along the alignment since, in most cases, the alignment passes across an expansive landscape that does not restrict the primates Nonetheless it is recommended that primate electrocutions be monitored across the 1.8 km Ndaragwa forest and if noted, then actions should be taken by KETRACO. The study in Diani Forest suggested that within across forested areas, the conductors could be insulated, for example by use of plastic material around the conductors to mitigate primate electrocution. For the more terrestrial animals, the wide span between towers at between 300 and 400 m, and the lowest sagging height of overhead conductors of about 11 m do not offer any barrier to movement or any other form of restriction including elephants. Across the bushlands and wooded shrublands of Laikipia – Samburu Ecosystem, Losai National Reserve and across Marsabit County, vegetation typically grows to a height of 7 m hence no major pruning is expected during maintenance and therefore will not change the vegetation structure and by implication the ecological functions of these vegetation types and their role as wildlife habitats.

Mitigation Measures

Construction work within the wild animal migratory routes should be scheduled in seasons of low wildlife migration. Prior to commencement of construction work, the contractor should consult the Kenya Wildlife Service in Laikipia and Marsabit on the exact timing of wildlife migration so as to schedule work to reduce conflict with migrating animals and birds. It is recommended that these consultations be included as a requirement in construction contracts. Further, during operation monitoring of primate electrocutions should be done across Ndaragwa forest, and if noted, then measures to insulateconductors should be undertaken by KETRACO. The measures could be borrowed from what was applied by the Kenya Power Company (formerly Kenya Power and Lighting Company) in Diani forest

10.2.6 Exposure to Electromagnetic Field

Throughout the length of the transmission line, humans, plants, birds and animals will be exposed to the electromagnetic field at some stage. We find the impact of such exposure to be insignificant for a number of reasons. Exposure at a distance away from the wayleave is low due to the rapid decay of these waves (Bailey et al, 1997). People who are indoors are shielded by building materials from the intensity of electric field and ionized air, but not from the magnetic fields. The conductive tissues at the surface of the body serve to shield tissues below the surface from external electric fields and ionized air. Ionized air that is inhaled can access the mouth and upper respiratory tract, but most of the ions are retained in the nose and bronchi with none reaching the deep alveoli of the lung (Bailey et al, 1982). Thus, even those who may be exposed to the electromagnetic field of the transmission by virtue of cultivating crops near it are largely out of danger of adverse impacts.

10.2.6.1 Impact on Reproduction, Longevity and Health of Wildlife

The impact of air ions on reproduction by wildlife and other animals has been found to be insignificant. Studies carried out over four successive generations have shown no impact of air ion exposure on reproduction, life span and health of animals (Kellogg et al, 1985; Kellogg and Yost, 1986). The impact of the DC line electric field on wildlife and other animals is assessed to be medium. Studies on the effect of intense electric fields on isolated cells and tissues show that intense internal electric fields are not induced by external DC electric fields (Bailey et al, 1997). On the other hand, no influence of electric fields has been reported for spontaneous behavior, or brain neurochemistry. DC fields can give rise to shocks to persons who contact large metallic objects, that are close to a transmission line. Shocks occur when charges collected on the metal discharge through a person to ground, but they are generally negligible in terms of impact on the body.

The impact on reproduction and development with regard to the number born, surviving young, organ functions, blood cell counts, and growth of offspring has revealed no adverse effects of DC field exposure (Fam, 1981). We assess the impact of the DC magnetic field on wildlife and other animals to be low. Studies on the impact DC magnetic field on animal biological processes with regard to genetic effects (chromosomal changes), cell growth, reproduction and development, and directional orientation and behavior have demonstrated that neither static nor electric or magnetic fields have a potential to cause genotoxic effects (McCann et al, 1993). Also, studies have not shown any consistent responses on cell growth nor reported any differences in the developmental process (Hiraoka et al, 1992; Sato et al, 1992; McDonald, 1993).

This analysis is particularly relevant for IBA Dida Galgalu National Reserve; Marsabit National Reserve; Losai National Reserve; wildlife conservancies and ranches that are traversed by the transmission line in Samburu, Isiolo and Laikipia counties; and IBA Lake Ol Bolossat, Malu Conservancy and Longonot wildlife dispersal area.

10.2.6.2 Impact of the DC Transmission Line on Livestock

The impact of the DC transmission line on livestock is assessed to be low. Studies conducted three years before and after construction a DC power line in USA to determine the effects of the electrical environment of the transmission line on cattle from farms located near the transmission line illustrated that milk production per cow, herd average milk production, milk fat content, reproductive efficiency and the health and productivity of the herds were the same before and after construction of the power line. The impact was also found to be unrelated to distance of the herds from the transmission line (Raleigh, 1988; Angel et al, 1990). This analysis is relevant for livestock rearing areas adjoining the proposed power line in Marsabit, Samburu, Isiolo, Laikipia and Nakuru counties. It applies also to areas where beef and dairy farming is practiced in Nyandarua and Nakuru Counties.

10.2.6.3 Directional Orientation for Birds

The impact of the DC transmission line on directional orientation for birds is assessed to be low. It has been reported that birds, such as homing pigeons, respond to small changes in the intensity of the Earth's magnetic field, but it is a natural process that does not affect them biologically (Bailey et al, 1997).

The mechanism allowing for this magnetic sensitivity is thought to be a receptor for magnetic fields - chain of iron oxide (Fe_2O_2), known as magnetite. The presence of magnetite has been described in a number of species including birds, bees, bacteria, and recently humans. Many questions are still unanswered about the role of magnetite in the detection of magnetic fields. However, since the Earth's magnetic field is much stronger than that of the DC transmission line; the transmission line is not expected to affect the directional orientation of birds in their habitats such as IBA Dida Galgalu, Marsabit National Reserve, conservancies in Samburu, Isiolo and Laikipia, IBA Lake Ol Bolossat and Malu Conservancy.

10.2.6.4 Impact of the DC Transmission Line on Humans

We assess the impact of the proposed DC transmission line on human health to be low. One of the most comprehensive studies on the potential effects of air ions or static fields on human health was a cross sectional study of a densely populated community through which the Pacific Intertie DC transmission line traversed. The Pacific Intertie was first energized in 1970, and runs from Washington State to Los Angeles.

The health endpoints surveyed among the residents included headaches, number of illness days, depression, drowsiness, and respiratory congestion. These endpoints were selected based upon the existing animal and human studies. Participants in the study were divided into groups depending on how close they lived to the DC transmission line corridor and was subdivided into those people who lived right on the edge of the corridor and those who lived beyond the corridor. Data were collected on 438 individuals from 128 households.

The responses from all the groups were compared, and no differences for any of the endpoint measures were observed, indicating no health impacts (Nolfi and Haupt, 1982). Other studies on the possible response of the nervous system's "biological clocks" to magnetic fields, and also on the health of workers exposed to strong magnetic fields demonstrated no significant increase or decrease in the prevalence of 19 categories of disease among control and exposed workers (Budinger, 1992). This analysis is relevant for all sections adjoining the proposed power line, and particularly for densely populated areas in Nyandarua and Nakuru counties.

10.2.6.5 Impact of the DC Transmission Line on Plants and Natural Vegetation

We assess the impact of the DC transmission line on plants and natural vegetation to be insignificant. Studies on the potential effects of exposure of plants and ecological

communities to electric and magnetic fields associated with high voltage DC transmission lines have indicated that it has no adverse effects on plants (Bailey et al, 1997). This assessment is relevant to all sections traversed by the proposed power line where its electromagnetic field is likely to come into contact with naturally growing plants, planted trees and the general landscape.

10.2.7 Impact of Corona Discharge and Audible Noise, Radio and Television Interference

Corona

Intense electric fields may occur at the surfaces of conductors and other "live" components of high-voltage systems. In some circumstances, this leads to ionization and electrical breakdown of the air immediately surrounding the conductor. This effect is known as a corona discharge, or simply corona.

Corona can generate high-frequency electromagnetic noise (which may interfere with radio and television reception), audible noise and traces of ozone and ions. The audible noise from corona consists of both broadband noise ("crackling") and discrete tones ("humming"). Certain other forms of discharge and sparking can also give rise to radio and television interference.

The presence on the conductor surface of even small protrusions, such as water drops, insects, or the raised edges of nicks in the metal, produce strong local enhancements of the field. The corona activity consequently varies markedly with surface and atmospheric conditions, and depends on altitude and weather.

During the few months of the line energization, the corona activity is often slightly greater than the expected or ultimate level. This is because it takes time for the surface of the conductors to age and so permit water drops to flow freely over them. Also, any initial dirt or surface abrasions get washed off or eroded away during this time. Care is, however, necessary when installing new conductors to minimize surface contamination and damage and sharp edges.

Audible noise is a major consideration for overhead lines operating at voltages more than 220 kV and for these high voltages the line fittings are designed or screened so that only corona on the conductors is a potential source of audible noise. In our case, corona is not a danger factor because the line has a wide reserve of 65 m which will be devoid of any settlements, therefore the impact is expected to be low to insignificant and no special measures will be considered.

Aeolian Noise

In addition to corona noise, another type of noise may be produced by high-voltage overhead transmission lines. This second type of noise occurs under certain wind conditions and is caused by the wind striking on the different components of a line, e.g. steel towers, conductors and insulators.

The two meteorological factors which affect the level and frequency of this noise are wind speed and direction. The different line components give rise to different types of noise. The noise is not dependent on whether or not the line is energized. The occurrence of Aeolian noise from the various components of high-voltage line is uncommon, since the conditions under which the noise occurs are very specific.

The impact of the DC transmission line regarding audible noise, and radio and television interference is assessed to be medium in densely populated areas in Nyandarua County because of the much lower corona effect of a DC transmission line compared to an AC line. The impact is assessed to be low within conservancies and ranches in Samburu, Isiolo, Laikipia and Nakuru counties, and in Marsabit and Losai National Reserves because of the sparse human population density and the likelihood of the wayleave to be located far away from buildings and offices.

Mitigation Measures

Final detailed design should avoid densely popualted areas and should be at least 200 m away from institutions that use sensitive electronic equipment such as health care facilities, broadcasting and telecommunication stations.

10.2.8 Historical, Cultural and Archeological Resources

This survey revelealed potentially new areas of archeological value within areas around Nyamathi Village, Mairugushu, and Light of Hope Childrens' Home in Naivasha counties, which had 'moderate' distribution of obsidian stone tools. Other than these 'potential' sites the survey did not encounter any site with an abundant distribution of archaeological materials within the Way Leave of the proposed power line. Most of those detected were mostly either outside or of the edge of the Way Leave. Also most of such sites had a sparse distribution of the cultural materials. Therefore, there is no apparent danger of destroying past cultural heritage if the proposed project proceeds. No other cultural or historical sites were identified along the alignment.

Mitigation Measures

Care should be taken while excavating tower foundations along the entire line but especially areas around Naivasha. If any suspect cultural or material sites are identified, then the finding should be reported to the KETRACO and to the National Museums of Kenya.

At a minimum, if materials of paleontological (fossil bones and human bones of human heritage) or archaeological nature (stone, iron or other prehistoric artifacts or features) are encountered (discovered) while, for instance drilling or excavating by machine, the following steps have to beundertaken.

- an archaeologist should be consulted to assess the cultural heritage value of the finding
- in case the finding is determined to be a monument or object of archaeological or paleontological interest, this should be reported to the National Museums of Kenya (the institution charged with the responsibility of safeguarding Kenya's cultural heritage).

The above steps would be in line with the Laws of Kenya. According to the National Museums and Heritage Act of 2006 (the law responsible for the protection and preservation of cultural heritage in Kenya), under Part IV (Searches and Discoveries), Section 30 on Notification of Discoveries states as follows:

"Where a person discovers a monument or object of archaeological or palaeontological interest, the person shall, within seven days, give notice thereof, indicating the precise site and circumstances of the discovery, to the National Museums, and in the case of an object, shall deliver the object to the National Museums or to the District Commissioner"
This is done partly to enable or to allow rescue excavation (salvage)to avoid destroying the archaeological, paleontological or other object or site of past cultural heritage.

10.2.8.1 Chance Find Procedure

The following *"chance find"* procedures to be included in all civil works contracts:

If the Contractor discovers archeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall:

- Stop the construction activities in the area of the chance find;

- Delineate the discovered site or area;

- Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local Heritage Warden or the national Museums of Kenya take over;

- Notify the supervisory Project Environmental Officer and Project Engineer who in turn will notify the local Heritage Warden and the National Museums of Kenya (NMK) immediately (within 24 hours or less);

Responsible local authorities and the Culture Department within the County would then be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archaeologists of the National Museums of Kenya. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage, namely the aesthetic, historic, scientific or research, social and economic values.

Decisions on how to handle the finding shall be taken by the NMK. This could include changes in the layout (such as when finding irremovable remains of cultural or archeological importance) conservation, preservation, restoration and salvage.

Implementation for the authority decision concerning the management of the finding shall be communicated in writing by relevant local authorities.

-Construction work may resume only after permission is given from the NMK concerning safeguard of the heritage.

11. CUMULATIVE IMPACTS

Cumulative impacts are Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project. For this project, the significant impacts of the project that could progressively lead to cumulative impacts are mainly the positive impacts discussed earlier in the report. These relate to socio-economic development in Kenya arising from access to cheaper, cleaner, and more reliable energy, thus driving economicdevelopment in a sustainable manner. Potential cumulative adverse impacts can only be occasioned by impacts that have already been identified as significant. These are as follows:

High impacts

Aesthetics
Settlements and community facilities (RAP)

Medium impacts

Natural vegetation
Safety and health

Low to insignificant Impacts

Chemical pollutants
Agriculture along the TL in Nyandarua and parts of Nakuru
Fauna including avifauna
Electric and magnetic fields
Land degradation
Noise (ozone, corona and wind)
Substance abuse and communicable diseases
Solid waste
Ambient air quality
Aviation

Uncertain

Potential Hazards

Of these impacts, those that would have cumulative impacts are those that are permanent and therefore would manifest themselves throughout the operation phase of the project. These are as follows:

Aesthetics
Ambient air
Noise, ozone, corona and wind
Potential hazards

Out of these only aesthetics was assessed to have high impacts. The rest are either insignificant or uncertain. Aesthetics is a matter of individual perception and is not an actual and quantifiable impact and does not cause secondary impacts on other environmental components or create or enhance new or existing environmental impacts. In summary, it is assessed that the project does not have significant negative cumulative impacts.

12. SUMMARY OF RESETTLEMENT ACTION PLAN

The RAP Report covers the Kenyan portion of the project. A review of the 2009 proposed right-of-way RoW was carried out in view of comments from the financiers and other stakeholders on environmental hotspots mainly around Matthews Range and Losai Game Reserve in Samburu and Mandera Counties respectively. The stakeholders also wanted a more detailed assessment of the bird flight paths and wildlife migratory routes and mitigation measures be put in place against the impacts. It was also envisaged that a more direct and hence shorter route could be established to link the terminal substations at Sodo and Suswa in Ethiopia and Kenya respectively.

The RAP study commenced with the review of Fichtner 2009 report and collection of baseline data which culminated in selecting of an optimized route which was approved by the EEPCO, KETRACO and the financiers. Field data in a proposed RoW band of 65 m wide was collected through household census and community consultations. During field data collection minor changes on the proposed RoW were effected so as to avoid physical and topographical structures. The field data was analyzed and results are discussed in this report.

Study findings indicate that the Kenyan section of RoW is 606 km long which gives a total land area within the RoW in Kenya as 39.39 km^2. Some major community structures including schools, dispensaries, churches, etc were found to have been constructed on the proposed RoW established under the 2009 study. These structures have now been avoided and consequently the compensation cost has reduced drastically. A route change was also effected at the region near Wamba Town so as to avoid Matthews Range Forest Reserve which had generated a lot of discontentment among stakeholders. This deviation also resulted in drastic reduction of compensation requirements to households in the area. In particular, the route deviation in this area avoided many disadvantaged and marginalized groups that inhabit the area. Since some remote chances exist of interfering with cultural properties of these groups, under this RAP, a Vulnerable and Marginalized Groups Action Plan (VMGAP) was developed in line with the World Bank's OP 4.10 policy requirements.

Compensation has been worked out based on KETRACO's Resettlement Policy Framework (RPF) which is in line with Kenyan statutes, WB and AfDB policies as well as other safeguard policies. Compensation for the affected land is worked out at 30 - 70% of market value generally but small residential plots that are to be vacated compensation of up to 100% has been considered. Compensation for primary assets which include dwellings and associated structures and for secondary structures has been worked out based on KPLC rates reviewed on 26th April 2011. Disturbance and assistance for the disadvantaged (marginalized and vulnerable), both at 15% was added to the assets value. For annual crops such as maize, beans, vegetables, etc and some perennial crops such as coffee, it was assumed that only 10% will be damaged during construction. Compensation for community assets was also computed using KPLC rates. The budget for compensation worked out at approximately KShs. 1.2 billion which is equivalent to US$ 14,094,943 at exchange rate of KShs. 85 to the dollar.

The RAP report has set out a comprehensive governance structure, conflict resolution process and regular internal and external auditing of for RAP implementation process. The report further incorporates queries and comments raised by the stakeholders during the Stakeholders' conference that took place on the 8th December 2011 at the Safari Park Hotel Nairobi and others that were received after the conference.

13. ENVIRONMENTAL MANAGEMENT PLAN

The overall objective of environmental and social monitoring is to ensure that mitigation measures are implemented and that they are effective. Environmental and social monitoring will enable response to new and developing issues of concern. Environmental monitoring will be carried out to ensure that all construction activities comply and adhere to environmental provisions and standard specifications so that all mitigation measures are implemented.

13.1 INTERNAL MONITORING

It will be the responsibility of KETRACO to conduct regular internal monitoring of the project to audit direct implementation of environmental mitigation measures contained in the ESMP and the project's construction contract clauses. KETRACO will also have the direct responsibility to implement and monitor land acquisition and compensation issues as outlined in the RAP Report. The clients monitoring team will include an environmental monitoring and management specialist and a sociologist experienced in land acquisition and compensation issues. Monitoring is defined as a systematic evaluation of the activities of the contractor as specified in the Monitoring Plan. Together with responsible Government organs, KETRACO will be responsible for implementing resettlement and compensation activities and will also be responsible in carrying out regular internal monitoring of the process. The objective of internal monitoring and audit will be:

- To find out any significant environmental hazards and the existing control systems in force to mitigate against their impacts
- Meeting the legal requirements as stipulated in the Environmental Management & Coordination laws of Kenya
- The client will be responsible for mitigation monitoring during the operation phase of the project.

13.1.1 External Monitoring and Evaluation

An independent consultant will be hired to carry out Annual Environmental Audits in line with NEMA's requirements. NEMA has the overall responsibility of issuing approval for the project and ensuring that environmental guidelines under EMCA are followed during project implementation. NEMA will not normally be directly involved in project monitoring unless some specific major environmental issue arise. Project proponents through the supervision consultant will furnish KETRACO and NEMA with reports on environmental compliance during the project implementation as part of their annual progress reports and annual environmental auditing reports.

Depending on the implementation status of environmentally sensitive project activities, they will perform annual environmental reviews where environmental concerns raised by the project will be reviewed alongside project implementation. The project teams of the Financial Institutions (AfDB, WB & AFD) will receive regular progress reports on the implementation of the ESMP and will conduct periodic site visits as part of their project supervision and implementation support. In particular AfDB's *Environmental and Social Auditing Guidelines* and Annex 9 require that regular pre-project audits and on-project audits be carried out. The project affected persons (PAPs) and affected communities will be represented through relevant project committees and public participation forums conducted during the ESMP audits.

13.2 INSTITUTIONAL ARRANGEMENT

The responsibilities of implementation of Environmental Management Plan will be jointly shared between the Contractor and KETRACO. Organization to undertake these responsibilities will need to be set-up and should employ two ways communication at

all levels of management. There will be various institutions involved in the process of ESMP planning and implementation.

13.3 INSTITUTIONAL RESPONSIBILITIES

It is proposed that the institutional responsibilities for implementing the Environmental Management Plan shall involve:

- The Contractor, which shall include an Environmental Manager (EM);
- KETRACO, which in addition to its own internal capacity, shall contract a Supervising Engineer (SE) with one or more qualified environmental specialists; and
- An Independent Consultant Firm contracted by KETRACO to support KETRACO in implementation and capacity development.
- The National Environment Management Authority (NEMA) and the representatives of all affected Counties

13.3.1 Responsibilities of the KETRACO

As the project proponent, KETRACO shall bear the greatest responsibility and will undertake the following tasks:

- Oversee the development and implementation of the Final ESMP and coordinated by the Independent Consultant.
- Oversee and facilitate the implementation of all time-bound (non-recurrent) environmental management measures in the Final ESMP by the Independent Consultant.
- Make KETRACO staff available for environmental training, including working collaboratively with the Independent Consultant's personnel to implement particular environmental management measures.
- Oversee the work of the Supervising Engineer and the Civil Works Contractor and associated subcontractors; facilitate adaptive responses to any unforeseen environmental problems that arise during project construction; and apply all appropriate financial penalties in case of non-performance or serious non-compliance with the Final ESMP or other environmental legal requirements.

13.3.2 Responsibilities of the Civil Works Contractor

The main Civil Works Contractor shall be responsible for full compliance with the ESMP provisions, as well as health and safety measures specified in the Construction and Workers' Camp Management Plan that. The Civil Works Contractor-and all associated sub-Contractors shall also ensure compliance with all Kenyan environmental laws and regulations, as well as international conventions.

The Civil Works Contractor shall appoint a Workplace Environmental Manager (EM) and additional environmental specialists and staff as needed. The Contractor will be responsible for ensuring that all sub-contractors and workers are adequately informed and trained to comply fully with the letter and spirit of all environmental requirements specified in the ESMP, the Environmental License(s) granted by NEMA and other Kenyan and international legal requirements. The Civil Works Contractor should also follow the guidance on chance find procedures in this ESIA.

13.3.3 Responsibilities of the Supervision Engineer

The Supervising Engineer will be a firm contracted by KETRACO to supervise closely the daily work carried out by the Civil Works Contractor and relevant sub-contractors, including the environmental, health, and safety aspects. The environment-related staff

of the Supervising Engineer will include (at a minimum) an Environmental Supervisor, who will lead the supervision of the environmental aspects of civil works, in accordance with the Construction and Workers Camp Management Plan that comprises part of the Final ESMP to be prepared by the contractor. The responsibilities of the Supervising Engineer include the following:

- Carry out regular environmental site surveillance to investigate the Contractors' site practice, equipment, and work methodologies with respect to pollution control and adequacy of environmental mitigation implemented, and to ensure that the Construction and Workers Camp Management Plan is complied with
- Monitor regularly the implementation of environmental mitigation measures and the Contractor' compliance with environmental protection, pollution prevention and control measures, and contractual requirements; advice to the Contractor and associated sub-contractors on environment improvement, awareness, proactive pollution prevention measures;
- Specify remedial mitigation measures that the Contractor must carry out, in the case of non-compliance with any part of the Final ESMP or other environmental legal requirements. Oversee the implementation of remedial measures to reduce environmental damage;
- calculate the financial penalties that the Contractor will suffer for particular types and length of environmental non-compliance;
- Ensure that environmental, health and safety issues are prominently mentioned in the Supervising Engineer's periodic progress reports to KETRACO.

13.4 Sub-plans and Tasks

The Environmental Management and Monitoring Plan provides a framework for addressing the potential environmental issues identified as part of the assessment. It provides a series of measures to be adhered to during the construction process along with longer term measures that should be integrated in to the operations of the power line. Given these longer term objectives the ESMP recommends a number of plans that need to be developed and implemented during the project. These should be prepared by the contractor with the support of an independent professional consulting firm. The cost of support consultant should be included in the contract sum and paid for by the contractor. Specific measures include the following:

Construction and Workers Camp Management Plan to mitigate construction impacts, along with rigorous Environmental Supervision by the Supervising Engineer to ensure that the main Civil Works Contractor and all sub-contractors comply with the environmental requirements of the Final ESMP;

An Environmental monitoring Plan for the monitoring of primarily impacts that were identified in the ESIA.

13.5 Construction Phase Environmental Management Plan

13.5.1 Construction and Workers Camp Management Plan

The Independent Consultant will review and revise the specifications outlined below in the Construction and Workers Camp Management Plan, as needed and submit any revisions to KETRACO for approval.

The plan shall contain specifications for technical and management procedures for mitigating environmental impacts from construction and workers camps, i.e. construction sites, workshops, temporary stockpile sites, fuel installations, other storage and work areas and workers accommodation.

13.5.2 Objective

The objective of the Construction and Workers Camp Management Plan is to minimize the potential negative impacts of construction activities, including workers' camps and construction traffic, wildlife and the environment.

13.5.3 Specifications

Requirements for workers and construction camps and sites Construction camps includes all construction sites, workshops, temporary stockpile sites, fuel installations, other storage and work areas, required by the Contractor, subcontractors and suppliers.

The camps shall be constructed and operated so that nuisances of operations and pollution of air, soil, groundwater and surface waters are avoided or minimized. In addition the safety of workers and the local population shall be taken into consideration. Specific requirements for the construction and operation of the sites to fulfill this are outlined in the following.

13.5.3.1 Locality and Site Plan

The Contractor shall submit a locality and site plan for all construction camps indicating the location of fuel supplies, stockpile sites, offices and the construction area for approval by Supervising engineer and the KETRACO prior to establishing any camps. Site offices and storage and workshops shall be located more than 200m from existing residential settlements.

13.5.3.2 Fencing of the Sites

The "sites" here refers to all areas required for construction purposes. The boundaries of the site shall be demarcated prior to any work commencing on the site. It is the responsibility of the Contractor to decide on an appropriate system of protective fencing for the site. The site boundary demarcation fence shall be removed when the site is decommissioned.

The Contractor shall ensure that all his plants, labour and materials remain within the boundaries of the site and he shall ensure that materials used for construction on the site do not blow on or move outside the site and environs.

13.5.3.3 Materials Handling and Storage

In order to mitigate pollution of soil, groundwater and surface water the procedures for handling the storage of materials outlined below shall be complied with.

- The Contractor shall ensure that information on all petroleum, chemical, harmful and hazardous substances are available to all personnel on site. The Contractor shall furthermore be responsible for the training and education of all personnel on site who will be handling the material about its proper use, handling and disposal.
- Fuel Storage: Fuels required for use during construction shall be stored in an enclosed central depot at the construction camp at distances of at least 50 m from any water course, water body or well.
- Fuel tanks shall be placed on a concrete, or similar impermeable, base surrounded by a brick bund without drainage points or other breaches. The bund shall have a volume of at least 110% of the maximum capacity of the tank. If more than one tank is stored within the bund, the system must be capable of storing 110% of the capacity of the largest tank or 25% of the capacity of all tanks.

- Accumulated rainwater in bunds shall be pumped out of the bund to either drains or the ground if uncontaminated. In case of fuel spillage the spilled fuel should be recollected and contaminated bund treated by the absorbents: sawdust, sand or straw. All fuel/hydrocarbon dispensing nozzles are to be of a drip control design and securely locked when not in use.
- Tanks containing fuels shall have lids and shall remain firmly shut. Only empty and externally clean tanks may be stored on the bare ground. All empty but externally dirty tanks shall be stored on an area where the ground is protected (e.g. concrete slab, covered store house, etc).
- Gas and liquid fuel shall not be stored in the same storage area.
- The Contractor shall take all the necessary precautions to prevent fires or spills at the fuel store. No smoking shall be allowed inside the stores and within 3 m of a bund.
- The Contractor shall ensure that there is adequate fire-fighting equipment at the fuel stores.
- Lubricant Storage: Lubricants shall be stored in drums or tins that are either sealed or have tightly fitting caps. All containers must be closed unless in use. Decanting of lubricants must be carried out in a specific area that has been previously identified and suitably protected.
- Lubricants shall be stored under cover in a no smoking area.
- All lubricant impregnated cotton waste and rags shall be promptly disposed of and handled as hazardous waste.

13.5.3.4 Servicing and Refueling of Construction Equipment

The Contractor shall ensure that all servicing and/or refueling of vehicles and equipment takes place within the construction camp at a designated area situated more than 50 m from any water course, water body or well. Vehicles must not be left without supervision during refueling.

The ground under the servicing and refueling areas shall be protected against pollution caused by spills and/or tank overfills. The method of protecting the ground shall be identified by the Contractor and agreed in writing with the supervising engineer prior to being installed. All waste shall be collected, contained on site and stored in water-tight containers prior to disposal off-site as hazardous waste at a site approved by the supervising engineer. All equipment that leaks shall be repaired immediately or removed from the site.

13.5.3.5 Accidental Spills

- The Contractor shall take all reasonable precautions to prevent the pollution of the ground and/or water resources on and adjacent to the site as a result of his activities. Such pollution could result from the release, accidental or otherwise, of chemicals, oils, fuels, sewage and waste products, etc.
- The Contractor shall be responsible for establishing an emergency procedure for dealing with spills or release of petroleum, chemical, harmful and hazardous materials. He shall ensure that the relevant construction personnel are familiar with these emergency procedures. All spills or accidents involving such materials are to be recorded. The cleanup of spills and any damage caused by the spill shall be for the Contractor's account.
- The Contractor shall ensure that no oil, petrol, diesel, etc. is discharged onto the ground. The Contractor shall remove any spill or oil-soaked soil immediately and shall dispose of it as hazardous waste.

13.5.3.6 Cement and Concrete Operations

- Cement and concrete shall be regarded as materials that are potentially damaging to the natural environment on account of the very high pH of the material, and the chemicals contained therein. The Contractor shall ensure that all operations that involve the use of cement and concrete are carefully controlled.
- Concrete mixing shall only take place in the construction camp or in agreed specific areas on site. Concrete must not be mixed directly on the ground.
- Water and slurry from concrete mixing operations shall be contained to prevent pollution of the ground surrounding the mixing points. Old cement bags shall be placed in wind and spill proof containers as soon as they are empty. The Contractor shall not allow closed, open or empty bags to lie around the site.
- Where exposed aggregate finishes are specified the Contractor shall collect all cement laden water and store it in conservancy tanks for disposal off site at an approved disposal site.
- All visible remains of excess concrete shall be physically removed immediately and disposed off as waste. Washing the visible signs into the ground is not acceptable. All excess aggregate shall be removed.

13.5.4 Solid Waste Management

- The Contractor shall institute a waste control and removal system for the site.
- All waste shall be disposed of offsite at an approved landfill site. Burning of waste on any construction site is forbidden.
- The Contractor shall supply waste bins/skips throughout the site at locations where construction personnel are working. The bins shall be provided with lids and an external closing mechanism to prevent their contents blowing out and shall be scavenger-proof to prevent baboons and other animals that may be attracted to the waste. The Contractor shall ensure that all personnel immediately deposit all waste in the waste bins for removal by the Contractor. Bins shall be emptied on a daily basis and the waste removed to a temporary storage site where it shall be properly contained in water and windproof containers until disposed of. The bins shall not be used for any purposes other than waste collection.
- It shall be forbidden to mix non-hazardous waste with hazardous waste. Petroleum, chemical, harmful and hazardous waste throughout the site shall be stored in enclosed areas. The enclosed areas shall be clearly marked. Such waste shall be disposed of offsite at a hazardous waste disposal site.
- The personnel involved in the handling of hazardous and non-hazardous waste shall undergo specific training in:
    - Waste handling;
    - Waste treatment; and
    - Waste storage.

13.5.5 Waste Water Management

- **Discharge of Construction Water:** The contractor shall construct and operate the necessary collection facilities for wastewater to prevent pollution. The Contractor shall dispose of collected wastewater in a manner agreed with the Authorities.

- The Contractor may discharge "clean" silt laden water overland and allow this water to filter into the ground. However, he shall ensure that he does not cause erosion as a result of any overland discharge.
- All washing of plant/equipment/concreting equipment etc. shall take place within the construction camp. Water from washing operations shall be collected in a conservancy tank removed them the site and disposed of in the agreed manner. The Contractor is encouraged to recycle dirty wash water to minimize the amount required to be removed off-site.
- Kitchen wastes shall be disposed into soak pits. Wastewater from campsites will be discharged and disposed in a kitchen sump located at least 15 meters from any water body. Sump capacity should be at least 1.3 times the maximum volume of wastewater discharged. The bottom of the pit should be filled with coarse gravel and sides shored up with board, etc. to prevent erosion and collapse of the pit.
- Sanitary wastes shall be disposed into septic tanks.

13.5.5.1 Storm Water Run-off from Construction Camp

- This will be applicable mainly at the Suswa station site. Natural run-off shall be diverted away from any camp. If deemed necessary, storm water drainage systems to discharge all surface run off from the camp site to a silt retention pond which shall be sized to provide a minimum of 15 minutes retention for storm water flow from the whole site.
- Again if deemed necessary, all run-offs from working areas, which contains sediment, should be collected in settling ponds before being discharged from the premises. Water from washing, screening, or dust reduction plants should be treated in a like manner. Accepted methods for removal of sediment from run-off include settling ponds, aggregate filters, wetlands (shallow ponds planted with suitable swamp plants). For borrow pits in vegetated areas, run-off should be directed through vegetation prior to reaching any watercourse to enable further filtering of sediment.

13.5.5.2 Erosion Control

- Erosion control measure shall be applied during construction activities to prevent soil erosion at the main station and at tower sites across Wamba area.
- Contractor will plan all excavations, topsoil and subsoil storage so as to reduce to a minimum any runoff. Contractors will be required to organize and cover material storage areas and to isolate wash down areas from watercourses by selecting areas that are not free draining into any watercourse.
- Where any area of the spread is at risk from silt pollution washing off into a watercourse of water body, effective measures will be put in place to ensure that such pollution does not occur. Such measures include:
    - Use of silt fences
    - Use of straw bales to deflect and filter water
    - Use of a system of bunds and grips to prevent water from entering watercourses, etc.

13.5.5.3 Control of Noise and Air Pollution

Construction machinery and vehicles generate noise and air pollution in the form of exhaust gasses. Dust from transported and stockpiled material also contributes to air pollution.

- **Noise and Exhaust Gases:** The Contractor shall employ Best Practicable Means to control all noise generating activities. The Contractor shall identify all noisy activities together with appropriate control mechanisms.
- Mitigations of impacts of noise and exhaust gasses can be achieved through the following measures.
- Confining operations to reasonable operating hours. This is the simplest means of avoiding unreasonable noise impacts. Another effective means is to provide appropriate separation distance to enable the noise to decay to acceptable levels;
- Establishing enclosures around stationery noisy activities. Solid barriers, such as bund walls and topographical features, provide the most effective 'in line' reduction of sound levels;
- Avoid using any vehicles, either on or off road with grossly excessive, exhaust or noise emissions; and
- Regular maintenance of engines to ensure that emissions are minimized, for example by cleaning fuel injector. Routine maintenance will be high standard to ensure that vehicles are safe and that emissions and noise are minimized.
- **Dust.** The following measures should be applied to minimize dust nuisances:
- The speed of vehicles is an important factor in the generation of dust. The speed of all construction-related traffic should be at or below 15 km/h on roads within 200 m of the site; In addition, where transport routes are along unsealed roads, it may be advisable to slow down in the vicinity of residents along these routes.
- The nature of the material being transported and its potential to emit dust should be considered in the loading of trucks. Generally, the highest point of the load should not exceed the height of the tray walls, unless the load is covered.
- Spray water at the site, and on dirt roads, cut areas and soil stockpiles or fill material as needed to minimize dust levels at areas close to housing areas
- Stockpiles, work areas and dirt access roads can be sprayed regularly with water which reduces dust development.

13.5.5.4 Sanitation

- The Contractor shall provide the necessary ablution facilities for all site personnel.
- The Contractor shall supply an adequate number of suitable and approved toilets throughout the site where construction personnel will be operating.
- Toilets shall be easily accessible and where applicable shall be capable of being relocated.
- The Contractor shall ensure that no chemicals and/or waste from the toilets are spilled on the ground at any time. The contractor will be required to provide a suitable and approved and to remove accumulations of chemicals and waste from the site and dispose of it at an approved waste disposal site or sewage plant base at his own expense.
- Answering call of nature anywhere other than in the toilets shall not be permitted. The Contractor shall be responsible for cleaning up any waste deposited by personnel.

13.5.5.5 Site Restoration

- The Contractor shall ensure that all temporary structures, equipment, materials, waste and facilities used for construction activities are removed upon completion of the project. Any oil and fuel contaminated soil shall be removed and buried in waste disposal areas, soak pits and septic tanks shall

be covered and effectively sealed off and the sites shall be grassed and the site shall be restored to a similar condition to that prior to the commencement of the works or to a condition agreed to with the owner of the land.

- The Final construction ESMP will also specify occupational health and safety measures to be followed during project construction and operation, including measures to prevent the spread of HIV-AIDS and other communicable diseases.

13.5.6 Environmental Rules for Civil Works Contractor

The Civil Works Contractor shall inform all its workers and sub-contractors of Chance Finds Procedures for physical cultural resources that will need to be followed during every phase of project construction. Under these procedures, if any construction worker or other project-related employee or contractor discovers any potential archaeological relics, fossils, human remains, or other items or sites of potential cultural interest, they must immediately notify the Environmental Supervisor or other staff of the Supervising Engineer. The Supervising Engineer will promptly examine the evidence and, if warranted, (i) order the temporary suspension of construction activities that might otherwise harm the item or site in question and (ii) promptly notify the relevant authority responsible for physical cultural resources, to obtain further guidance regarding whether and how the item or site in question should be salvaged, protected, and/or documented.

The Civil Works Contractor (and any associated sub-contracts) shall enforce a Workers Code of Conduct that will emphasize on the need to protect wildlife.

13.5.7 Specific actions on Fauna

Across the Laikipia – Samburu ecosystem, the contractor is expected to cease construction across the migration corridors of large mammals especially elephants during the actual migration days. In order to time the cessation of works without causing undue delays, the contractor, with the assistance of the Supervision Engineer, shall consult the KWS and other key conservation stakeholders in the project area to allow proactive construction planning across this ecosystem.

13.5.8 Environmental Emergency Procedures

- Prior to construction commencement, the contractor shall prepare an Environmental Emergency Plan specifying actions in the event of accidental leaks, spills or emissions. The plan shall be reviewed on regular basis and updated if necessary.
- In the event that accidental leakage or spillage of diesel/chemicals/chemical wastes takes place, the following response procedures shall be followed immediately by the Contractor(s):
- The person who has identified the leakage/spillage shall immediately check if anyone is injured and shall then inform the Environment Manager.
- The EM shall ensure any injured persons are treated and assess what has spilled/leaked;
- Should the accident /incident generate serious environmental pollution (e.g. spillage / leakage of toxic or chemicals, large scale spillage / leakage, or spillage / leakage in nearby water bodies Contractor should immediate inform KETRACO through the resident engineer;
- The Contractor shall arrange maintenance staff with appropriate protective clothing to clean up the chemicals/chemical waste.
- Spilled chemicals must be flushed to local surface drainage systems.

- The possibility exists for environmental emergencies of an unforeseen nature to occur during the course of the construction and operational phases of the project. By definition, the nature of such emergencies cannot be known. Therefore, the Contractor shall respond on a case-by-case basis to such emergencies and shall initiate event-specific measures in terms of notifications and reactions.
- The Contractor shall prepare a report on the incident detailing the accident, clean-up actions taken, any pollution problems and suggested measures to prevent similar accidents from happening again in future.

13.5.9 Environmental Awareness Training

- The Contractor should ensure that all concerned staff is aware of the relevant environmental requirements as stipulated in NEMA environmental legislation and the Contract specifications. The Contractor is responsible for providing appropriate training to all staff. This should be tailored to suit their level of responsibility for environmental matters. The Contractor should also ensure that all site staff members are aware of the emergency response procedures. All staff should receive environmental induction training and managerial staff should receive additional training.
- All those responsible for the management and operation of any aspect of the ESMP shall be adequately trained for their role. Evidence of training should be maintained on site, for inspection/auditing purposes.
- Training should be conducted for, as a minimum:
    - Hazardous Substance Management and Emergency Procedures;
    - All staff involved in the handling and use of chemicals, fuel and explosives must be trained in handling, spill and emergency procedures. Evidence of training should be kept for inspection / auditing purposes;
    - Concrete management;
- All staff involved in the manufacturing, transport and handling of concrete and asphalt must be trained in handling, spill, dust, water management and emergency procedures. Evidence of training should be kept for inspection / auditing purposes;
- Sediment Control, and Control of Discharges. Training shall be provided by a third party, or provide evidence of previous training, for the construction, maintenance and monitoring of environmental protection and discharge treatment devices. Evidence of training should be kept for inspection / auditing purposes; and
- Traffic Management and Driver Education. Training shall be provided by a third party, or provide evidence of previous training, for the safe control and driving of heavy road-construction vehicles. Training shall also be provided for the management of traffic (including pedestrians) in and around the project construction areas, to ensure safe passage during and after working hours. Evidence of training should be kept for inspection/auditing purposes.

13.5.10 Community Relations

To enhance adequate community relations the Contractor shall:

- Inform the affected community about construction and work schedules, blasting schedules, interruption, of services, traffic detour routes and provisional bus routes, and any other information as appropriate.
- Limit construction activities at night. When necessary ensure that night work is carefully scheduled and the community is properly informed so they can take

necessary measures and mitigation measures for construction methods can be agreed to by all parties.

- Inform the local community as early as possible and repeat at least one day in advance of any service interruption (including, water, electricity, and road access). The community must be advised through postings at the project site, at schools, places of worship and other meeting places, and in affected homes/businesses.
- All community infrastructures such as schools affected during construction must be restored to the satisfaction of the communities and approved by the KETRACO.
- All construction access roads used by the Contractor will need to be decommissioned if continued use is not desired by the community.
- Establish and maintain a unit to receive, process and reach resolution on community complaints arising from construction activities. Records of such complaints and their resolution must be kept.

13.5.11 Grievance Resolution Mechanism

Considering that the line passes through rural areas, especially in Nyandarua and Nakuru counties and that construction may involve damage to crops, structures such as fences, it is recommended that the contractor formulates a workable grievance resolution mechanism before embarking on the project. Typically the grievance mechanism should heavily borrow from the provisions contained in the RAP since most of the complaints are likely to emanate from damage to properties. At a minimum, the contractor should include village elders, Government representative and KETRACO in ad-hoc committees to address grievances.

13.6 Environmental and Social Management Plan Matrix

Reference / Issue / Potential Corresponding Impact	Mitigation Action	Responsibility	Timing	Cost estimates (KES)
Construction planning	○ The contractor to prepare the following plans: ○ Construction and workers camp management plan ○ Solid Waste Management plan ○ Effluent and waste water management plan – for construction works at the sub-station ○ Grievance resolution mechanism ○ Detailed ESMP monitoring Plan	Contractor under supervision of KETRACO	Construction	To be included as a contractual clause Cost of Short term environmental expert Sh. 5,000,000 Sh. 4,000,000 for grievance resolution mechanism

Reference / Issue / Potential Corresponding Impact		Mitigation Action	Responsibility	Timing	Cost estimates (KES)
Soil	Soil compaction, soil sealing and soil erosion	○ Utilisation of existing main roads and existing village tracks for the construction traffic as far as possible. Where this is not possible, routing of the access tracks should prevent the destruction of, buildings and ecological sensitive areas. ○ The extent of construction tracks, workers camps and temporary storage areas shall be limited to as less space as possible. ○ Driving cross country shall be prohibited. If access tracks will be used, these shall be clearly marked and used to avoid the broadening of driving activities. ○ Open soils shall be covered if possible, to prevent erosion in case of heavy rainfall ○ Where applicable, vegetation cover shall be secured at the beginning of building activities, and restored when completed. If possible, open soils should be replanted with suitable (means indigenous in relation to the location) plants to close the vegetation covers again.	Contractor Supervision engineer	Construction	Included in contract cost
	Pollution of surface water in case of heavy rainfall events	○ All liquid materials and lubricants shall be stored in closed containers or barrels on roofed and sealed ground ○ Construction material as bags of cement etc. shall be stored in containers in order to avoid rinsing out. ○ Proceeding of excavation works as far as possible during the dry season	Contractor / Supervision engineer	Construction	To be included as a contractual clause

Reference / Issue / Potential Corresponding Impact		Mitigation Action	Responsibility	Timing	Cost estimates (KES)
	Pollution of surface water in case of heavy rainfall events	○ Temporary sewage treatment facilities shall be provided for the construction site and workers camps or ○ Septic tanks	Contractor / Supervision engineer	Construction	10,000,000
Water resources	Pollution of ground water	○ Performing of the construction works in the dry season, no earth works in the rainy season. ○ Good and regular maintenance of all vehicles and machines used on site is mandatory. ○ Maintenance activities of the vehicles shall be performed in regular service stations. ○ Maintenance and re-fuelling of the construction equipment shall be done aside of the excavation and only on sealed and enclosed areas (careful handling and careful maintenance, especially of the fuel tanks). ○ On site storage of fuel, engine oil and lubricants in locked tanks and on sealed and shadow roofed areas. ○ All wastes generated through the use of fuel, engine oil and lubricants like drums and containers shall be collected and properly disposed of. ○ Staff training to increase awareness of waste minimisation and appropriate waste disposal.	Contractor / Supervision engineer	Construction	Included in contract cost

Reference / Issue / Potential Corresponding Impact		Mitigation Action	Responsibility	Timing	Cost estimates (KES)
Air	Air pollution (dust, emissions)	o Covering of construction material transport vehicles with tarpaulins. o Limitations on size, weight or axle loads of vehicles using particularly difficult roads. o Reducing of speed and limited movement of vehicles. o Optimised transportation management to avoid needless truck trips. o Routine service and maintenance of vehicles and machines to reduce engine emissions o Burning of rubbish on site must be strictly forbidden.	Contractor / Supervision engineer / KETRACO	Construction / Operation	Included in contract cost
Noise	Noise emissions	o Noisy construction works within densely populated areas in Nyandarua should be scheduled to the daytime	Contractor / Supervision engineer	Construction	-
Flora, Fauna & Habitats	Bird collision risk	o Aligning transmission corridors to avoid critical habitats (e.g. nesting grounds, heronries, rookeries, bat foraging corridors, and migration corridors) o Horizontal design of conductor arrangement in wetlands, woodlands and open savannah areas. o Use reflective spheres on the conductors near L. Ol Bolossat o Maintaining at least 1.5 meter spacing between energized components and grounded hardware or, where spacing is not feasible, covering energized parts and hardware;	Contractor / Supervision engineer / KETRACO	Construction / Operation	2,500,000

Reference / Issue / Potential Corresponding Impact		Mitigation Action	Responsibility	Timing	Cost estimates (KES)
	Primates electrocution	○ Additional insulation across Ndaragwa forest	KETRACO	Operation	To be determined if electrocutions are detected
	Large-game migratory corridor	○ Construction activities in Laikipia, Samburu and Marsabit counties should be done during the dry season when wildlife, particularly elephants are in wetter zones such as Mt. Kenya. ○ Whereas the proposed route selection avoided the commonly used game migratory routes, still for work across Laikipia, Isiolo and Samburu, workers should be on the look out for movement of unusually large groups of animals, and if such movements are noted, they should inform the Project Manager with a view to suspending work for a period. This is important also for their own safety	Contractor	Construction	To be a contractual clause
	Consumption or sale of bush meat	○ The contractor should develop a code of conduct for the workforce, prohibiting killing of game for any reason whatsoever ○ Workers should be sensitized on the Wildlife Act that prohibits killing and poaching of game.	Contractor	Construction	To be included as a contractual clause

Reference / Issue / Potential Corresponding Impact		Mitigation Action	Responsibility	Timing	Cost estimates (KES)
	Loss of large trees	○ Consult the KFS when constructing the line across Ndaragwa forest to minimize loss of trees and to ensure compensatory planting ○ Compensate lost trees and ensure, at a minimum, planting of similar number and species of trees within the neighbourhood by the affected person or by the contractor ○ Determination of necessary lay-down areas with environmental site manager to prevent the cutting of trees. ○ Protection of large trees which are not required to cut, but are located adjacent to the construction site . ○ Limitation of the construction activities to the construction corridor ○ Marking of the extent of the laydown areas and the routing of the access road, ○ Minimisation of the distance between the new TL and existing roads (but avoidance of buildings and huts). ○ Each tree which have to be cut for the construction of the TL shall be compensated by the plantation of five indigenous trees of appropriate size in the area adjacent to the TL corridor.	Contractor / Supervision engineer / KETRACO	Construction / Operation	Compensation contained in the RAP 8,000,000 for Tree planting
	Disturbance of sensitive areas through construction activities	○ Routing of TL as far as possible outside of forests, woodland, wetland and protected areas ○ Instruction of the employees not to disturb the animals, especially birds, hunting/ poaching shall be prohibited in general.	Contractor	Construction	Included in contract cost

Reference / Issue / Potential Corresponding Impact		Mitigation Action	Responsibility	Timing	Cost estimates (KES)
Landscape & Land use	Land take and land use change	o Accessing of tower sites and stringing of lines should be included as contract conditions with clauses relating to minimising damage to fruit trees and field crops.	Contractor / KETRACO	Construction	Compensation contained in RAP
Local communities and socio-economic aspects	Resettlement	o All properties within the 65 m wayleave should be compensated in full o Basically the sites of the towers should be shifted as far as the maximum span length is reached. o This shall be done to minimise adverse impacts and to avoid the location of tower sites on buildings, hats or other valuable areas. o Routing of access tracks and temporary occupied areas should consider avoidance of huts, buildings and ecologically sensitive areas. o Avoidance of locating tower sites on buildings or huts by varying the span length. o Compensation procedures should be paid to the individual farmers for the unavoidable damage of fruit and crops and are addressed Resettlement Action Plan (RAP)	KETRACO	Planning stage	Compensation estimates contained in RAP 5,000,000 for counseling included as part of the RAP
	Financial loss for local population through crop damage and loss of property	o Payment of compensation by KETRACO for crop damages and temporary and permanent loss of agricultural areas.	Contractor / KETRACO	Construction / Operation	Compensation estimates contained in RAP
	Unhealthy living and working conditions on construction site	o Adequate housings including clean and safe drinking water and a proper waste disposal and sewage treatment system shall be provided to the workers	Contractor	Construction	Included in contract cost

Reference / Issue / Potential Corresponding Impact		Mitigation Action	Responsibility	Timing	Cost estimates (KES)
Electric and Magnetic Fields	Clearance of the RoW	○ Though the RoW and the design of towers shall ensure the compliance to limit values of magnetic and electric fields, ○ KETRACO must ensure that no settlements will be established in the RoW	KETRACO	Operation	Design issue
Waste	Waste water Management (More importantly as applies to the substation)	○ The Contractor shall dispose of collected wastewater in a manner agreed with KETRACO through the supervising engineer and relevant the Authorities. ○ The Contractor may discharge "clean" silt laden water overland and allow this water to filter into the ground, but careful enough to avoid erosion. ○ All washing of plant/equipment/concreting equipment etc. shall take place within the construction camp. Water from washing operations shall be collected in a conservancy tank removed them the site and disposed of in the agreed manner. ○ Kitchen wastes shall be disposed into soak pits. ○ Sanitary wastes shall be disposed into septic tanks.	Contractor / Supervision engineer	Construction	Contained in the BoQ
Soil and Water Resources	Adequate handling of hazardous substances	○ It must be assured that liquids, oils and greases used in substations are handled adequately on sealed grounds, considering best practice. This is also applicable for the storage of such substances. ○ All wastes generated by the project must be handled and disposed off adequately.	Contractor	Construction	Included in contract cost
Landscape & Land use	Aesthetics	○ The line should avoid scenic sites and proximity to tourist lodges. This measure has been taken up in the alignment of the TL	KETRACO	Operation	-

Reference / Issue / Potential Corresponding Impact		Mitigation Action	Responsibility	Timing	Cost estimates (KES)
	Restricted land - use	○ In the ROW the land use will be restricted to achieve compliance with the safety distances. This will be especially applicable for tree plantations, forests and nurseries.	KETRACO	Operation	Compensation as contained in the RAP report
Historical and cultural sites	Effects on historical and cultural Sites	○ Training of the construction workers in identifying signs for materials of archeological and historical value such as bones, shards, metal works, etc. ○ On suspicion of findings, the contractors to cease work, notify the supervising engineer of the find or disputes relating to archaeological relics or cultural religious sites. Thereafter to follow the chance find procedure as follows: • In case of a find the following steps have to be undertaken ○ an archaeologist should be consulted to assess the cultural heritage value of the finding ○ In case the finding is determined to be a monument or object of archaeological or paleontological interest, this should be reported to the National Museums of Kenya (the institution charged with the responsibility of safeguarding Kenya's cultural heritage).	Contractor / Supervision Engineer	Construction	Included in contract cost
Local Communities & Socio-economic Aspects	Safety/ Health risks through TL for local population	○ Reduction of EMF in settlement areas by raising the tower height. ○ Measuring of electric and magnetic fields after beginning of operation of the TL in adjacent settlements ○ Regular line testing, insulator cleaning and parts replacement maintenance	KETRACO	Operation	Design and O&M issue

Reference / Issue / Potential Corresponding Impact		Mitigation Action	Responsibility	Timing	Cost estimates (KES)
	Land development / People settling beneath the TL	o Determination and proceeding of suitable measures to prevent new settlements within the ROW	KETRACO	Operation	O&M issue
	Conflicts	o Source all unskilled labour from the communities within the specific sites, e.g. o For construction of towers north of Laikipia, the contractor should provide proportionate employment to all communities where there is mixed settlement by different tribes	Contractor	Construction	-
	Employment opportunities	o Source all unskilled labour from the communities within the specific sites, e.g. o For tower construction, provide contracts for supply of locally available materials such as ballast, sand to local suppliers o Give special consideration to vulnerable groups and women	Contractor	Construction	-
	Communicable diseases including HIV-AIDS	o Conduct worker education on avoidance and preventive measures o For employees housed in camps, avail condoms for free	Contractor	Construction	12,500,000
	Gender issues	o All types of compensation should be sensitive to gender o Female members of the household should be involved when compensation payments are done o Job opportunities should consider gender balance as contained in the Kenyan constitution	Contractor / KETRACO	Construction	-

13.6.1 Cost of mitigation measures

The ESMP matrix above has provided some indicative costs of some mitigation measures. In most part, mitigation actions will be included in contract costs. Table 15 below presents the summary of additional costs:

Table 15: Mitigation cost items

Item	Cost (KES)
Grievance resolution mechanism	3,000,000
Temporary sewage treatment and septic tanks	10,000,000
Reflective spheres (or coloured balls) for bird warning	2,500,000
Tree planting and conservation	8,000,000
Counselling	5,000,000
Short term environmental expert	5,000,000
Communicable diseases, HIV AIDS awareness, provision of protective condoms, training	12,500,000
TOTAL	46,500,000

14. MONITORING PLAN

14.1 CONSTRUCTION PHASE

During the construction phase, the monitoring activities will mainly focus on the regular follow-up of ESMP measures for compensation with performance standards. These activities will be based on a day-to-day follow-up and various levels of technical reviews.

14.1.1 Monitoring Parameters

The monitoring parameters are those that have been identified in the mitigation measures and indicated in the ESMP. The Contractor's responsibility is to ensure that the construction works are carried out as per the detailed design, and the measures defined in the ESMP. Further, the contractor is required to comply with all the NEMA regulations and KETRACO environmental policy. This implies that all construction activities are carried out according Kenyan and international best practice and adhere to the applicable requirements regarding health, safety and environment. Monitoring of the construction activities will be limited to the construction area, which includes the construction sites, temporary storage areas, workers camps and their environs. The following topics and parameters shall be considered as a minimum for the Environmental monitoring of the Project.

14.1.1.1 Fauna

Construction across migration corridors should be undertaken outside periods of known migration of animals, especially elephants. The contractor is expected to liaise with the Kenya Wildlife Service to know the migration period and avoid construction activities during that window. Normally the onset of migration will be known and the exact time of crossing can be accurately predicted.

Monitoring Parameters:

- Records of contractor's schedule across the corridors
- Conformation of liaison with KWS
- Cessation of construction during migration across the corridor

14.1.1.2 Vegetation

Construction will be accompanied by minimal vegetation clearance to allow construction of tower foundations and stringing. The most ecologically and economically important trees are found in Nyandarua County and parts of Nakuru County. These include a large population of indigenous trees including mature Cedar trees and Croton. Others are the more common fruit trees and exotic commercial trees such as Eucalyptus, Grevillea, Wattle, Pears, Pawpaws and Cypress.

Monitoring Parameters:

- The number and species of trees taller than 4.5 m that are removed at any given site
- Ownership of the trees
- Compensatory planting of cleared trees all parties

Monitoring of vegetation clearance will be conducted by the supervising team against the provisions of the ESMP. The results of such monitoring will be included in the monitoring reports.

14.1.1.3 Agriculture

Agricultural activities will be affected along the RoW during construction. This will be mainly across Nyandarua and Nakuru Counties. Mitigation measures include compensation for damaged crops and for lost farming opportunity and compensation for damaged tree crops.

Monitoring Parameters:

- Appropriate compensation
- Compensatory planting of tree crops
- Extent of crop damage for permanent crops

Monitoring should also involve household members and an assessment of their food security done.

14.1.1.4 Soil Erosion

Earth works for the excavation for construction of the towers and the substation, temporary and permanent access roads, work camps and storage facilities have the potential to cause soil erosion. It is therefore the responsibility of the construction Contractor to ensure the implementation and control of effectiveness of erosion prevention measures. The measures shall focus on construction sites where soil is disturbed.

Monitoring Parameters:

- Establishment of erosion control measures at Suswa substation and at tower points in erosion prone areas
- Rehabilitation measures
- Covering of stockpiles
- Monitoring rehabilitation of work sites

The Contractor must ensure that areas used as temporary campsites for workers, storage areas or access roads are progressively rehabilitated as they are no longer required. Once a site is rehabilitated, it should be inspected and approved by both the Supervision Engineer and KETRACO.

Monitoring Parameters:

- Number and species of trees planted against those removed
- Grassed areas against the areas excavated (in m^2)
- Extent of excavated areas that have been levelled
- Approvals granted for expenditure on rehabilitation of sites

14.1.1.5 Occupational Health and Safety

KETRACO, through the Supervising Engineer will have overall responsibility to oversee that all occupational safety and health (OSH) measures are put in place and that all relevant regulations are enforced.

Monitoring Parameters:

- Warning signs are posted where necessary at appropriate locations in order to minimize health hazards, and the risk of electrocutions and other accidents;
- Awareness building measures shall be taken regarding sexually transmitted diseases, especially HIV/AIDS,
- Records of site meetings on implementation of OSH measures
- Existence of proactive preventive measures to reduce/eliminate diseases whenever appropriate;
- Records of periodic health checks for workers.
- Presence of warning signs on the boundaries of the construction sites, on towers, etc.;
- Presence and quality of water treatment system, sanitary facilities and waste management system at workers camps;
- Level of the community awareness pertaining to dangers and risks associated with construction activities and power lines;
- Presence and review of accident reports.
- Documentation on actual accidents associated with the construction works and information on changes of the health status in the local community could be compiled with the help of local health workers, medical staff, and officials.

14.1.1.6 Solid Waste Management

It is proposed that the Contractor shall institute a waste control and removal system for the site especially at the substation.

Monitoring Parameters:

- Existence of an approved disposal site
- Presence of waste bins/skips throughout the site at locations where construction personnel are working.
- Frequency of emptying the bins and records of collection
- Existence of efforts of separation of waste
- Existence of separate hazardous waste storage area
- Records of training of waste handling personnel or contract agreement with a waste handling company

14.1.1.7 Noise

Although noise generation during the construction phase is not expected to be a significant problem outside of the workers camps, noise generated by workers across wildlife dispersal areas north of Laikipia could be important. In addition construction noise near residential areas could be a nuisance to the residents.

Monitoring Parameters:

- Complaints from the public

- Adherence to construction schedules across migration corridors

It is recommended that noise monitoring by use of equipment is unnecessary since the impact is adjudged low to insignificant.

14.1.1.8 Discharge of Construction Water at substation

The contractor shall construct and operate the necessary collection facilities for wastewater to prevent pollution.

Monitoring parameters

- Existence of waste water disposal plan
- Signs of new erosion in the immediate vicinity of the substation
- All washing of plant/equipment/concreting equipment etc. take place within the construction camp.
- Water from washing operations collected in a conservancy tank
- Soak pit for kitchen waste water
- Sanitary wastes disposed into septic tanks.

Livelihoods, Resettlement, Compensation and community properties

Monitoring procedures for these important socio-economic issues are contained in the RAP report. Briefly, monitoring parameters include:

- Record of PAPs, with additional category of vulnerable people
- Valuation records of all properties
- Compensation rates
- Presence of grievance resolution mechanism
- Counselling mechanism
- Follow up programme

14.2 Operation and Maintenance Phase

This phase will mainly be driven by monitoring of the performance of mitigation measures that have been proposed for minimizing environmental and social impacts. A framework is proposed for developing a set of interconnected performance indicators that should assist in assessing environmental performance against the set targets for all the mitigation actions. The framework provides a feedback mechanism that allows adjustments to be made to the corrective actions that have been set, and also actions that are proposed to enhance positive environmental impacts.

14.2.1 Description of the Monitoring Framework

The **pressure** that will lead to impacts: Environmental pressure refers to both direct and indirect pressures exerted on the environment by the project such as line maintenance through regular pruning.

The current **state** of the environment: Environmental state refers to the quality of the environment and the quality and quantity of natural resources. Indicators of environmental conditions or state include contaminant concentrations in water and soil, human health

effects from exposure to electro-magnetic fields – if any, actual effects of the line on fauna including birds.

The proposed **response**: Response refers to designed actions and reactions intended to mitigate, adapt to or prevent negative effects on the environment, halt or reverse environmental damage already inflicted, and preserve and conserve nature and natural resources. Responses can variously involve alterations in expenditure on environmental protection from an earlier estimate, changes in action plans and general environmental management. By highlighting links between pressure, state and response (PSR) the PSR framework helps decision makers see how environmental and other issues are interconnected.

To achieve the objectives of the PSR framework for Environmental Performance Assessment, the following are required:

- Institutional capacity and continuous commitment by KETRACO;
- Development of reliable database from which to estimate indicator state and trends and;
- Linking EPA results with socio-development plans to ensure environmentally soundness.

The overall goal is to enable KETRACO to assess the performance of mitigation measures through a continuous review process.

Capacity building and database development should commence early in the planning stage of the project. As indicated in institutional analysis, KETRACO's environment division will require to be enhanced to cope with EPA of this project as well as other projects within its stable.

14.2.2 Identification of Priority Issues

For EPA to be useful, the number of priority concerns cannot be overly large. This is for both practical and statistical reasons. An important statistical consideration is that as the number of indicators increases so does the possibility that they are interrelated, rendering one or more unnecessary. For example, a strong correlation typically exists between awareness levels of the risk of power line and the incidence of electrocution. In such cases it may be unnecessary to compile data on both indicators. Simply monitoring awareness levels amongst the locals will indicate whether avoiding possible exposure to electrocution has been avoided. Although both sets of data are functional, only one may be strictly necessary for EPA purposes.

14.2.2.1 Environmental Performance Indicator Selection

Environmental performance indicators (EPI) are tools for assessing environmental performance. Comparison of the value achieved for a well-chosen indicator against a quantifiable and specified target provides a useful indication of the degree of success in reaching said targets. Selecting the most suitable indicators of performance corresponding to priority concern is therefore of prime importance. Key considerations in selecting indicators are their policy relevance, analytical soundness and measurability. Additional considerations relating to the credibility of indicators are data availability and quality.

Emphasis should be given to quality rather than quantity in selecting indicators. Factors that will determine indicator quality are policy relevance (or correlation with policy targets) and

measurability (availability of data and cost of filling data gaps). With respect to policy *relevance* an environmental indicator should: (i) provide a representative picture of environmental conditions, pressures on the environment or management responses; (ii) be simple, easy to interpret and able to reveal trends over time; (iii) be responsive to changes in the environment and related human activities; (iv) provide a basis for international comparisons; (v) be applicable to the Project environmental issues and (vi) have a threshold or reference value against which to compare it, to allow the significance of the values associated with it to be assessed. With respect to *measurability*, the data required to support the indicator should be: (i) readily available or made available at a reasonable cost; (ii) adequately documented and of known quality; and (iii) updated at regular intervals in accordance with reliable procedures.

Table 16: Broad Environmental Indicators for monitoring

Environmental concern	**Type of Indicator**		
	Pressure	State	Response
Aesthetics	• Visual intrusion	• % of tourists visiting the project area at the moment	• Encouraging new tourist circuit away from where intrusion is an issue
Vegetation	• Vegetation pruning to 4.5 m within the 65 m RoW	• Habitat loss • Reduced possibility of obtaining merchantable timber	• Adjustments to compensation • Additional compensatory planting
Noise	• Noise associated with energized lines	• Inconvenience • Sleep disorder	• Awareness creation amongst the affected population
Toxic contamination (during construction)	• Presence & generation of hazardous wastes at Suswa • Discharge onto water bodies • Consumption of water containing hazardous wastes or posing a hazard	• Inorganic contaminant concentrations in water & soil • Area of contaminated land • Quantity of hazardous wastes generated	• Inventory of toxic waste and disposal mechanism
Air pollution by stationary sources (substation) and mobile sources during operation	• Volume of SO_2 and PM emissions	• SO_2 and PM concentrations exceeding NEMA air quality standards • % of dischargers in violation of	• Expenditure on air pollution abatement measures

Environmental concern	Type of Indicator		
	Pressure	State	Response
		permit conditions	
Potential hazards	• Energized HV lines	• Residents within the neighbourhood of the power line	• Expenditure on awareness campaigns • New warning signs
Wildlife including Birds	• Bird collision with power line • Primate electrocutions	• Mortality of birds and primates linked to collisions	• New measures to reduce bird collisions • Additional insulation across Ndaragwa forest
Electro-magnetic fields	• Ionization of ambient air around the power lines • Interference with telecommunication frequency and waves, TV signals	• Human health issues related to ambient air quality	• Additional insulation across densely populated areas

14.2.3 Proposed Plan for Regular Monitoring

14.2.3.1 Day-to-Day Monitoring

Monitoring on a day-to-day basis will be implemented by the Environment Manager (EM) appointed by the Contractor but supervised by the Project Proponent (KETRACO). Other more technical parameters such as bird collisions and impacts on wildlife could be monitored by the Kenya Wildlife Service. The main tasks for the EM will include:

- General follow-up of all tasks of ESMP
- Preparation of the Environmental Plans.

Maintenance of appropriate records of the monitoring results

These monitoring activities will be partly complemented by the monitoring obligation of KETRACO.

14.2.3.2 Quarterly or 6 Monthly Reviews

When carrying out the monitoring, the EM will be assisted by the KETRACO environment team. KETRACO team will be expected to critically review of results obtained during the last

period and a re-adjustment, when required, of the monitoring and mitigation strategies, methodologies and work plan.

Each review will include basically:

- The review of data obtained, reports by the contractor, specific plans available at the time of the review.
- The setting-up of monitoring criteria and the selection of quantitative and qualitative indicators.
- Field inspection including direct observations and data collection, interviews with selected local and project affected persons.
- Evaluation and comment on Project performance, with recommendations and remedial actions.
- Definition of the scope of work for the period before the next review
- Recommendations for additional tasks or changes to the present ESMP.

14.2.3.3 Annual Review

The annual review will involve, in addition to the representatives from the project, the Ministry of Energy and representative from lenders (most probably the World Bank, AFD and AfDB).

The annual review will be combined with one of the 3 monthly or 6 monthly reviews every year.

14.2.4 Audit

Government of Kenya through NEMA, Ministry of Energy, Ministry of Lands and lender organization(s) and any other that will be identified may visit the project site at any time and when deemed necessary during the construction period.

14.2.4.1 Personnel Involved

The consultant Engineer will provide one qualified Environmental Specialist who will assist informally the EM and will participate in the monthly, half yearly and annual reviews.

This specialist will be assisted where necessary by other specialists having expertise in Wildlife, agriculture, social science and, civil engineering.

14.2.4.2 Reporting

Day-to-day monitoring activities will be recorded in daily, weekly and monthly reports by the EM.

Reviews will involve the production of Review Reports which will be supplied to KETRACO, Contractor, NEMA, the financier and other relevant Government Authorities.

The basic format for the report will include:

1. Overview of the review
2. Specialist personnel involved
3. Status of work progress

4. Overall conclusion
5. Specific points requiring attention
6. Performance indicators for the monitoring
7. Specialist reports, if any
8. Compliance
9. Compliance will be evaluated through the adherence to the mitigation measures, to other criteria also presented in the ESMP and to the Contractor environmental obligations.

14.3 REPORTING

Reporting must satisfy three objectives:

- To provide a regular update on implementation of mitigation measures and identification of unforeseen impacts
- To set up a formal framework for performance achievement evaluation
- To assist a fast decision making procedure in order to implement within the shortest time any decision taken by concerned parties

The proposed system is based on 7 types of reports:

Day to day report: prepared by the Environmental Manager (EM) in order to take formal notes of daily events, decisions, actions. These reports are only marked for further consultation when necessary,

Weekly report: prepared by the EM and submitted to the Project Manager (PM). This is a concise summary of daily reports.

Monthly report: prepared by the EM for submission to PM who will in turn submit to KETRACO. The reports will summarize:

1. Activities carried out during the month, tasks completed, personnel involvement, schedule of activities,
2. Problems encountered, decisions taken,
3. Major issues under consideration, proposed solutions,
4. Proposed activities for the coming months,
5. Budget situation: expenses, invoices, fund reallocation etc
6. List of major meetings held during the month,

d) **Meeting reports:** minutes of monthly (or ad-hoc) coordination meetings held to be prepared by the EM for submission to supervising engineer.

e) **Review reports:** to be submitted to KETRACO and financier, every three months the first 2 years and every 6 months after. These report will summarize major issues addressed, major achievements, major pending problems, budget situation, recommended strategy and work plan until the next review. They will be prepared by the review team.

f) **Annual review report:** to be submitted by KETRACO and EM to the line ministry and financiers, summarizing the progress of environmental mitigation and monitoring activities

during the last 12 months of activity and presenting strategy and work program for coming 12 months.

g) **Technical report:** prepared by the EM, sub-contracted Agencies or consultants and submitted to KETRACO according to schedule.

Table 17: Summary of the ESMP reporting Programme

Report Types	By:	To:	Purpose
Daily Report	EM	Project files	Registration of daily events
Weekly Report	EM	PM	Follow-up of social and environmental activities
Meeting Reports	EM / Consulting Engineer	KETRACO	Signed by concerned parties & summarized in monthly report
Technical Reports	EM, Consultants	KETRACO	According to technical requirements
Monthly Report	EM	KETRACO	Monitoring of ESMP implementation
Interim Review Reports(3 to 6 monthly)	EM	KETRACO / financiers	Progress in EMP, implementation issues & achievements
Annual Review Report	EM	KETRACO / financiers / MoE Lenders (if any)	Annual status of ESMP / achievements

15. INSTITUTIONAL ANALYSIS

The main institutions in Kenya responsible for environmental management in the energy sector are as follows:

- Kenya electricity Transmission Company (KETRACO)
- Ministry of energy
- National Environment Management Authority
- Energy regulatory board

15.1 KENYA ELECTRICITY TRANSMISSION COMPANY (KETRACO)

KETRACO is wholly owned by the Government of Kenya. Its core business is to plan, design, build, operate and maintain new electricity transmission lines and associated substations as part of the National Transmission Grid.

The stated intention by KETRACO is to have a power grid that will:

- Improve quality and reliability of supply;
- Reduce transmission technical losses;
- Increase access to electricity service countrywide;
- Reduce the cost of electricity to the customer; and
- Provide a link with neighbouring countries.

The Kenya Power and Lighting Company (KPLC), however still retains its current stock of existing 132kV and 220kV transmission lines.

15.1.1 KETRACO's Environmental Policy

KETRACO's environmental policy states that it is committed to environmental protection and conservation based on the principle of sustainable development and guided by the Environmental Management and Co-ordination Act (EMCA), 1999 among other local and international legal legislations including donors conditionalities KETRACO's policy further states that it ensures all its project activities undergo a process of thorough investigation to identify impacts they may have on the environment and social well being and formulate mitigation measures that are necessary to avoid, minimize or offset predicted adverse impacts. The policy emphasizes that KETRACO cooperates with Environmental Agencies, Donors and the Public on programmes to protect the environment; provide the necessary training for its employees to ensure that they have the knowledge and capability to conduct operations in a manner that is consistent with sound environmental practices; and also provides the necessary resources, advice and guidance to ensure implementation and communication of this policy.

15.1.1.1 Health and Safety Policy

KETRACO has a policy to conduct all its operations in a healthy and safe manner and in compliance with Occupational Safety and Health Act (OSHA), 2007 and other relevant legislations. In the policy, KETRACO recognizes that prevention of accidents and ill health is essential to the efficient operation of its business. According to KETRACO, the control and management of health and safety issues commands at least equal prominence, when balanced against operational and commercial considerations. KETRACO's principal safety and health objective is to provide a safe working environment, for employees, contract

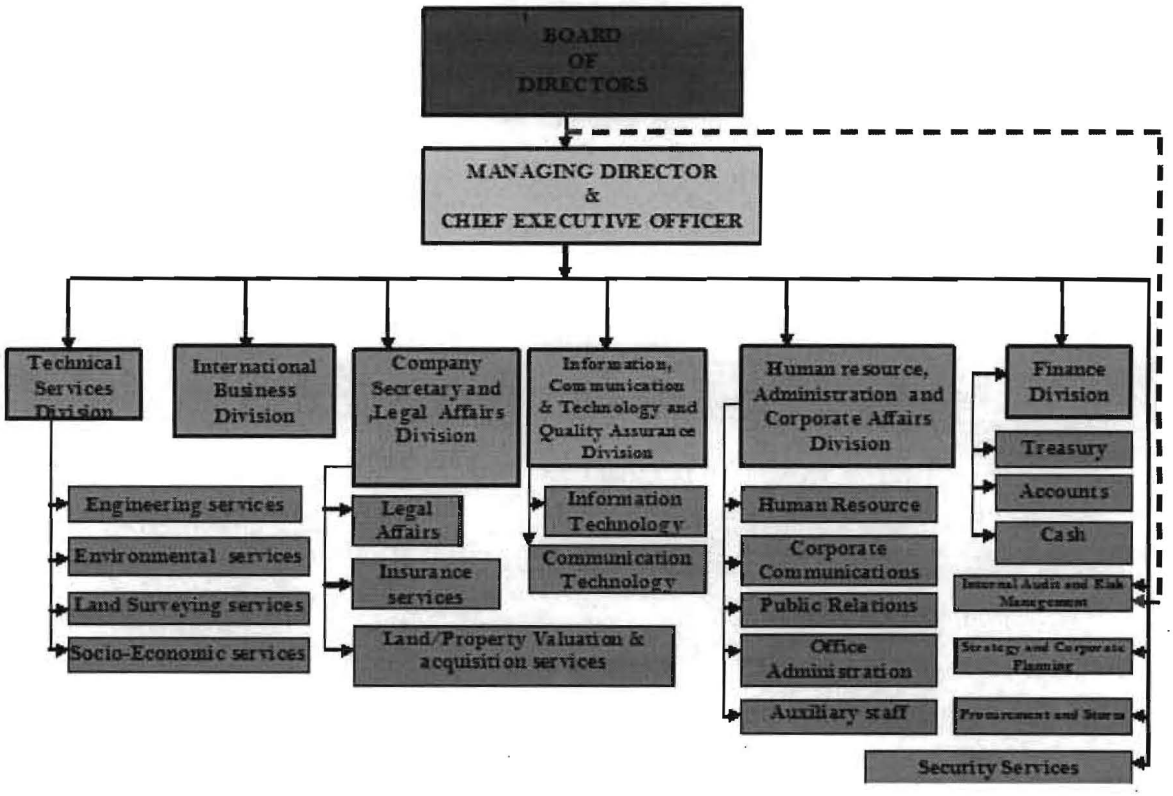
personnel and members of the general public who may be put at risk by the activities of the Company. KETRACO recognizes the value of its employees and considers their well being to be the major factor in the success of all its business activities.

KETRACO aims to assess potential EHS impacts of planned projects and operation and to maintain high standards of awareness and training.

The company's policy states that its EHS Management System takes into account international and national legislation requirements and demonstrates its commitment to continued improvement in EHS performance. The Company commits to provide the necessary resources, advice and guidance to ensure implementation and communication of the policy, monitor and audit all aspects of its compliance and develop contingency plan for emergency situations.

15.1.2 KETRACO Management structure

KETRACO has a structure whereby there are six divisions and three departments as shown below;



The Environmental and Socio-economic sections report directly to the Head of Technical Services Division. Although KETRACO has only eight senior environmental and socio-economic experts and three junior experts, the company also out-sources these services to consultants.

15.2 Ministry of Energy

The Ministry of Energy was formed in 1979 upon Kenya Government's realization that energy was a major component in the country's development process. The ministry provides policy guidance and oversight roles for the energy sector in Kenya.

The Ministry is particularly charged with the following responsibilities:

- Energy policy development
- Hydropower development
- Geothermal exploration and development
- Thermal power development
- Petroleum products – import/export/marketing policy
- Renewable energy development
- Energy regulation, security and conservation
- Fossil fuels exploration and development
- Rural electrification Programme

The Ministry also has an oversight role over the following parastatals and statutory bodies in the energy sector:

- Kenya Power and Lighting Company Limited (KPLC)
- Kenya Petroleum Refineries Limited (KPRL)
- Kenya Electricity Generating Company Limited (KenGen)
- National Oil Corporation of Kenya (National Oil)
- Kenya Pipeline Company Limited (KPC)
- Energy Regulatory Commission (ERC)
- Rural Electrification Authority (REA)
- Energy Tribunal
- Geothermal Development Company (GDC)
- Kenya Electricity Transmission Company (KETRACO)

The Ministry is structured along core departments namely; Electrical Power Development Department, Geo-Exploration Department, Renewable Energy Department, Petroleum Energy Department, and other departments – General Administration Department, Central Planning & Project Monitoring Department, Finance Department, Accounts Department, Human Resource Management Department, Public Communications Department, Information Communications Technology Department, Human Resource Development Department and Procurement Department, providing support services.

15.3 ENERGY REGULATORY COMMISSION

Energy Regulatory Commission (ERC) was established as an Energy Sector Regulator under the Energy Act, 2006 in July 2007. ERC is a single sector regulatory agency, with responsibility for economic and technical regulation of electric power, renewable energy, and downstream petroleum sub-sectors, including tariff setting and review, licensing, enforcement, dispute settlement and approval of power purchase and network service contracts.

15.3.1 ERC Environmental Policy

Environmental, Health and Safety Policy framework which is an additional regulatory instrument developed by the Electricity Regulatory Board (ERB) for purposes of enforcing environmental and safety regulations in the electric power sub-sector as provided for in the *Electric Power Act, No. 11 of 1997*. The major regulatory instruments currently used by the Board include licences and Power Purchase Agreements. The Board is the *Lead Agency* in the electric power sub-sector, and its environmental and safety mandate emanating from Section 121(1) (c) of the *Act*.

15.3.2 Environmental Management Role of the ERC

The EMCA 1999 recognizes the role of lead agencies in protection of the environment. Lead agencies are defined as "any government ministry, department, parastatal, state corporation or local authority, in which any law vests the functions of control or management of any element of the environment or natural resource". In this respect therefore the Energy Regulatory Commission (ERC) is a lead agency in the energy sector since the Energy Act No. 12 of 2006 empowers it in Section 6(c) to "formulate, enforce and review environmental, health, safety and quality standards for the energy sector, in coordination with other statutory authorities".

The instruments for achieving this as envisaged in the Act are essentially "Command and Control" types such as Licenses, Permits for example for Construction and Power Purchase Agreements incorporating conditions requiring operators to comply with environmental standards and regulations. In granting or rejecting applications for licences, the Energy Act No. 12 of 2006 in Sections 30 and 90 requires the Commission to consider among others, the need to protect the environment, conserve natural resources, and protect the health and safety of workers, service users and the public at large. In particular compliance with EMCA 1999, environmental regulations and other relevant legislation, e.g. on occupational health and safety is considered. Therefore in executing its mandate the Commission regularly monitors the performance of licensees vis-à-vis the performance standards stipulated in their respective licenses.

ERC is currently in the process of drafting regulations, rules, procedures and operational guidelines, for the energy sector through a consultancy supported by the Energy Sector Recovery Project funded by the World Bank. This will set the framework for the establishment of industry performance standards as well as enforcement mechanisms and appropriate penalties to ensure compliance.

15.3.3 ERC environmental policy Relating to Transmission Lines

- The key instruments used by the Board to regulate the conduct and operations of KETRACO as the sole transmission company are the licenses issued to it.
- The EHS impacts of the transmission network on the quality of the environment are mainly the displacement (permanent or temporary) of persons and communities; emission of noise as well as electromagnetic waves of various frequencies; and the danger of electrocution. Other impacts include aviation safety and animal safety in respect of birds with large wing spans
- The Board shall recognise such expenditure as may be required for EHS reasons in the network operators' revenue requirements and may revise such expenditures to account for changes in EHS legislation which have a material impact on future expenditure.

- It is the responsibility of KETRACO to operate the network efficiently while conserving resources and with the least possible adverse environmental impact
- The network should be operated in such a manner as to conserve resources e.g. by minimising system losses; facilitating the abatement and prevention of environmental pollution; and minimising environmental degradation in general.
- The network operators shall comply with prescribed EHS quality and performance standards as well as the statutory annual reporting requirements, including minimising system losses
- The network operators shall establish and adopt an EHS policy and ensure that all employees working with the network are familiar with it and are guided by it.
- All the employees working with the network should receive training and education on matters relating to EHS to ensure effective EHS performance and continuous improvement in the same. In addition the network utilities should ensure that staff have appropriate levels of authorisation as appropriate.
- For the whole network the licensee is expected to audit and review the EHS performance with a view to continually improving the same.
- At the end of each Financial Year the Board will compile and make public the EHS performance of the transmission and distribution utilities in Kenya's electricity supply industry.

15.4 National Environment Management Authority (NEMA)

NEMA has the mandate to enforce Environmental Impact Assessment (EIA) and Environmental Audit (EA). EMCA provides guidelines for EIA and EA. These guidelines are applicable to both public and private sector development projects and programmes. Project types that should be subjected to EIA/EA are specified in the Second Schedule of EMCA. Besides the scheduled activities, the Act empowers the Minister to prescribe for EIA/EA appraisal upon any other activity which in his view is likely to have significant environmental impacts.

Under the EMCA 1999, The National Environmental Management Authority (NEMA) has gazetted several regulations. These are Environmental (Impact Assessment and Audit) Regulations, 2003, Legal Notice No. 101, Environmental Management and Coordination (Water Quality) Regulations, 2006 Legal Notice No. 120, Environmental Management and Coordination (Waste Management) Regulations, 2006 Legal Notice No. 121, Environmental Management and Coordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing.) Regulations, 2006 Legal Notice No. 160.

NEMA has the mandate to ensure that the project is managed according to the conditions attached to the license and this will be supervised by District NEMA at Nakuru, Nyandarua and Marsabit with oversight provided by the Headquarters.

15.5 Recommendations for the Implementation of the Project

KETRACO is the implementing organization of the project and therefore, must have a responsive structure and adequate personnel to ensure implementation of the project. This has to be seen in light of the other projects underway and those that will commence during project implantation since they will place human capital, logistical and financial demands on KETRACO.

Considering that environmental and social impact issues are becoming very critical in project implementation, it is important that KETRACO ESIA experts are continouously exposed to training in international best practices which capture emerging issues and technologies.

It is therefore recommended that KETRACO carries out a training needs analysis periodically, to make sure that its experts have the requisite expertise.

16. CONCLUSIONS AND RECOMMENDATIONS

The project is a cross border project involving Ethiopia and Kenya. In this regard, environmental policies and legislations of the two countries apply. The project covers a wide range of bio-physical and socio-economic conditions along its entire length, implying that the baseline socio- economic and bio-physical conditions are as varied.

From a broader perspective, the project has low overall environmental impacts since it will source energy from green sources (hydro-electric) thus reducing environmental consequences of thermal energy production that is currently used to complement hydro-power production in Kenya. When alternatives are considered, it is clear that this project will provide Kenya the opportunity to reduce her carbon footprint over time.

The intensity of impacts will be relatively higher at the tower construction sites within the RoW and at the substation construction site at Suswa. These impacts are related to land degradation, noise, waste handling, air quality and vegetation clearance. These potential impacts are easy to mitigate through proper construction planning. However, impacts on vegetation could be locally substantial during construction phase since stringing may necessitate removal of some trees to create access. This impact on vegetation is transient and reversible. Impacts on wildlife during construction are related to possible effects on animal migration if tower construction and stringing across animal migration corridor coincide with their movements. This is easily mitigated by scheduling construction so that it does not coincide with animal migrations.

During construction, potential impacts on local communities and enterprises are largely positive, as the construction activities provide direct job opportunities and indirectly create income from trading through supply contracts, food vendors, accomodation, entertainment etc. However these positive impacts are limited to the duration of the construction activities and would not have a significant sustainable positive impact on the local economy.

There are some 433 homesteads, 71 principal structures, 150 secondary structures and 6 community social facilities which might be wholly or partially affected, but these have been identified and the properties valued and should be compensated as suggested in the RAP report.

During operation, the project will have subtle direct impacts on the biophysical environment because the towers will be widely spaced and land use underneath the ROW will only be restricted to settlements, commercial structures and tall trees. All other activities are allowed below the conductors. There will be reasonable loss of vegetation along the entire corridor during construction of towers and stringing. This loss will be relatively high across Ndaragwa forest, where the entire 65 m corridor will be permanently devoid of trees. However the loss of these trees can be adequately mitigated by compensatory planting within the degraded patches of the same forest.

Impacts on wildlife are foreseen to be insignificant during operation. Since potentially the most important impacts relate to animal movements and habitat integrity, the TL will not affect these factors since vegetation is typically short, thus pruning which could affect these habitats will not be required. Further, the line will not impede movements of animals across it since the lowest sagging height is around 11 m. Impacts on birds, especially migrant species is low since only two spots, L. Ol Bolossat and Dida Galgalu could be affected. However, L.

Ol Bolossat is some 3.7 km away while Dida Galgalu is an extremely large area so effects will be diluted. Nevertheless, bird protection measures will be implemented. .

No cultural heritage and historical sites are located along the route. However, care is required during construction and chance finds procedures will be followed if excavation unearths any historical or religious artifacts. Socio-economic impacts relate to relocation of a relatively small number of households, and compensation of assets including land. This impact could be high at the initial stages but absent during operation.

Possible impacts of electromagnetic fields and ionic effects are remote and insignificant beyond interferences with radio waves and TV signals.

Aesthetics occasioned by visual intrusion of the towers and conductors could impact on tourism within Laikipia- Samburu ecosystem. However, the line has been routed such that it avoids the scenic sites and tourism lodges insofar as possible. In sum, the identified impacts are subtle and easy to mitigate