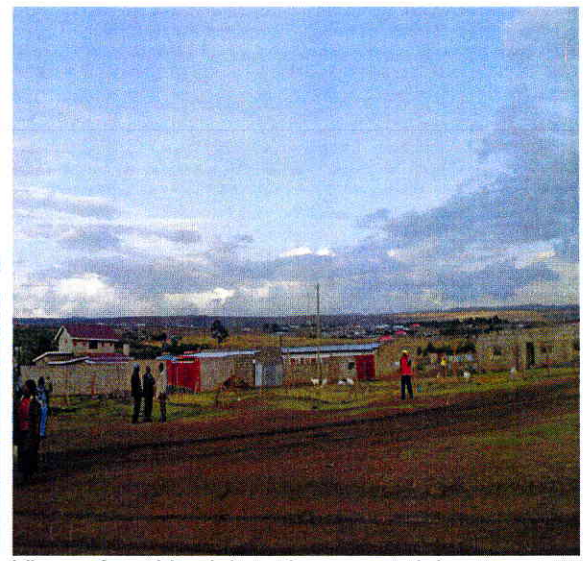
View of structures likely to be lost/affected at Mamboleo centre, Kisumu



View of residential and commercial structures likely to be lost/ affected at Kayole centre, Naivasha

(d) Household budget

Sources of daily, monthly, and yearly household income were sought, including salary as an employee, self-employed business, farming, and casual labour, etc. Assets were also established, including vehicles, agricultural implements, assets for economic activities, and household items. Where available, total annual savings were sought, and whether a loan had been taken established.

Respondents from DCK Centre in Olkaria, Naivasha, were primarily employees, earning a salary of approximately KShs 6,000 per month. Assets included bicycles, TVs, and radios. Information was not provided by the respondents on savings or loan taken, due to the sensitive nature of this information.

The primary sources of household income at Sanctuary in Olkaria were casual labour, and intermittent sale of livestock. Assets included bicycles, and a few motocyles.

Sources of household income from members of Mitimingi centre included salaries as employees, self-employed businesses, and farming. Household items predominantly consisted of the radio.

Jogoo centre residents obtain their household income from salary as employees, self-employeed business such as the numerous *kiosks* by the road side, farming, and casual labour. Assets owned include bicycles, motorcycles, and radios.

Sources of household income in Ngata-Kirobon area include salaries from employment, self-employed business, and farming. Some of the residents in the area are also retired from formal employment.

Salaries from employment, and income from self-employment and farming primarily contribute to household income in Mau Summit Location and Timboroa area. Many household assets in the two areas were destroyed during the 2007 clashes in Kenya, and residents are currently saving up to replace with new ones.

In Lessos and Nandi Hills Divisions, as well as Kayole centre in Naivasha, household income is generated from salaried employment, self-employed business, farming, and casual labour. Assets owned include bicycles, motobikes, cars, agricultural implements (tractors, sprayers, pump sets) and household items (TVs, fridges and radios).

Household income is generated from salaried employment and casual labor in Kibos Village and Mamboleo centre. Assets owned in both centres include bicycles, motorbikes and radios. Additionally, household items such as TVs, fridgtes and radios are owned in Mamboleo centre.

(e) Accessibilities

These include timings, frequency, mode and distance of trips to areas such as local markets, the workplace, school, farm land, health clinic and religious centre. Access to utilities such as potable water, toilet facilities and electricity were also sought.

In DCK centre in Olkaria, Naivasha, the above mentioned areas are located very close to the residential area, due to the 'worker-camp' nature of settlement, established by the flower farms. Most of the engaged workers travelled daily to their places of work, and passed by the market on the way home. Religious centres were visited weekly, and health clinics when required. Most respondents had access to potable water from a common pump well as well as purchase of water from vendors. The pit toilet was shared communally, and electricity was accessed through the power line.

Accessibility was quite high in Sanctuary within Olkaria area, due to its relative proximity to the main road. Additionaly, some of the community members own motobikes, which are used as public transport. There is no potable water within the area, and this has to be ferried from Lake Naivasha. Toilet facilities consist of communal pit latrines, and there is no access to electricity.

Residents of Mitimingi centre accessed potable water through a public borehole, and toilet facilities were of the pit type, and private. Diesel generators were used to provide power, as well as firewood and charcoal.

Jogoo centre residents access potable water through a communal hand dug well, and toilet facilities through communal pit toilets. Access to electricity is through diesel generators, car batteries and solar energy.

There is access to bicycles, motobikes, and cars by residents of Ngata-Kirobon area. Household items in the area include TVs, fridges and radios. Potable water is accessed through hand-dug private and communal wells as well as water vendors. Toilet facilities in the area consist of privately owned pit toilets, and access to electricity is trhough the power line.

Potable water is accessed by communal hand dug wells in both the Mau Summit and Timboroa area, and toilet facilities include both the communal and individual pit type. Access to electricity in Timboroa is through the power line and solar energy.

In Lessos and Nandi Hills Divisions, as well as Kayole centre in Naivasha, residents have access to both communal as well as private hand dug wells and pump wells. Toilet facilities are both private and communal water-pond type and pit type, while access to electricity is through the power line, as well as private and communal generators.

Residents of Kibos village have access to potable water through communal hand-dug wells, and toilet facilities through communal pit toilets, while those of Mamboleo centre have access to potable water through communal hand dug wells and piped water supply. Toilet facilities in Mamboleo centre consist of communal water pond toilets, and communal pit toilets. Access to electricity in Mamboleo centre is through the power line.

(f) Perception of the Project

Respondents were asked whether they thought the proposed project would provide economic benefit to the area, and whether this benefit would include wage employment, business opportunities, industry establishment, as well as others.

Overall, respondents from DCK centre in Olkaria, and Kayole centre in Naivasha expected that the proposed project would provide economic benefit in the area through increased employment opportunities.

Respondents from Sanctuary area in Olkaria hoped that the proposed project will provide economic benefit to the area, especially through wage employment.

The proposed projected is expected to bring economic benefit to Mitimingi centre, through the creation of busioness opportunities such as photocopy services, welding, among others. The project is also expected to be of great benefit to the area hospital, which does not have power-backed cooling facilities, as well as provide benefit to the nearby secondary school, which uses much expensive diesel-generated power.

Jogoo centre residents anticipate that the proposed project will provide economic benefit to the area, through increased business opportunity.

The proposed project is anticipated to provide economic benefit to Ngata-Kirobon area, especially through business opportunities, and the establishment of industries.

Residents of Mau Summit Location, Timboroa, Kibos village and Mamboleo centre expect that the proposed project will provide economic benefit to the area, through wage employment and business opportunity.

(g) Impacts

Social impacts in relation to the wayleave agreement or land acquisition under the project were sought. Choices provided included loss of residential building/ house; loss of agricultural plots; loss of crops, trees and fixed assets; loss of plots/ fixed assets for businesses/ trading; loss of businesses/ trading activities; loss of sources of income and livelihoods; loss of access to working place; loss of access to public facilities and services; and loss of security, among others.

Respondents from DCK centre in Olkaria, Naivasha did not anticipate social impacts from the proposed transmission line. This could be due to the fact that they are tenants, and loss of buildings and land will therefore not be felt by them.

Anticipated social impacts expected in Mitimingi centre include loss of agricultural plots, and loss of crops, trees and fixed assets. In Kayole centre in Naivasha, the main concern was loss of residential and commercial buildings.

Jogoo (Elementaita) and Mamboleo (Kisumu) centre residents predict that social impacts of the proposed project in relation to land acquisition will result from loss of residential buildings / houses, and loss of agricultural plots.

In Lessos and Nandi Hills Divisions, there was great concern regarding the social impacts expected in relation to the wayleave agreement or land acquisition under the proposed project. Impacts mentioned included loss of residential buildings/ houses; loss of agricultural plots; loss of crops, trees and fixed assets; loss of plots/ fixed assets for businesses/ trading; loss of businesses/ trading activities; loss of sources of income and livelihoods; loss of access to working places; and loss of access to public facilities and services.

3.4.4 Areas of Conservation Value

Areas of conservation interest near the project area are associated with sites of scenic beauty, the lakes situated on the Rift Valley Floor and the forest reserves associated with the Mau Escarpment (See Section 3.3). Areas of scenic beauty are mainly protected in the Olkaria/ Hell's Gate, Nakuru and Longonot National Parks (See Appendix 9.6). These areas also contain significant wildlife populations.

The three lakes found in the Rift Valley floor (Lake Naivasha and the adjacent Kongoni Sanctuary, Lake Elmentaita and the adjacent Soysambu Game Conservancy and Lake Nakuru National Park) are important conservation areas. Two of the above lakes (Lakes Naivasha and Nakuru) are now designated as Ramsar Sites, that is, wetlands of international importance under the Ramsar Convention. Lake Nakuru was first gazetted as a bird sanctuary in 1960 and upgraded to a National Park in 1968. In 1990, the lake was designated as Kenya's first Ramsar site. Due to its conservation importance, Lake Naivasha was declared a second Ramsar site in 1995, and a comprehensive management plan has been drawn to guide the stakeholders on the multiple uses of the lake.

In addition to the above areas of conservation interest, there are several gazetted forest reserves associated with the Mau Escarpment (also see Section 3.3.1).

An interesting feature of the Mau Forest Complex is the presence of forest dwelling Ogiek people. The Ogiek people are a hunter gatherer community that has used the forest resources since time immemorial. Although the Ogiek have used the forest resources sustainably in the past, their hunter-gatherer lifestyle is now in direct conflict with forest policy. Consequently, several thousands of the Ogiek people have now been evicted from the forest since the mid 1980s and are currently awaiting settlement. It has been confirmed that Alternative 1 does not pass through areas inhabited by the Ogiek (Mau Forest Complex) as would have been expected if Alternative 2 was chosen, which would pass through the Mau Forest Complex.

The Yala Swamp, hosts two globally threatened (vulnerable) species: the Great White Egret (*Egretta alba)*, and Baillon's Crake (*Porzana pusilla obscura)* with Kanyaboli and Kisumu swamps, largely because of destruction of wetland habitats, having smaller populations of these species.

3.4.5 Archaeological, Cultural and Historical Sites

The Lake Nakuru-Naivasha basin has been well surveyed since the late 1970s and more is known about the archaeology of the area than any other part of Kenya. This area and other locations of the Rift Valley Floor have been found to be an important area archaeologically especially the lake basins, which provided favoured habitats for the early hominids and their associated fauna. The project area has yielded stone tool artefacts. Such artefacts (Eburran Industry) dated between 13,000 and 9,000 years ago have been found at the Gamble's Cave and Nderit Drift area near Lake Nakuru. Other areas of archaeological importance are located at Kariandusi near Lake Elmentaita and at Hyrax Hill, near Nakuru.

Tourist attractions in Kisumu district are listed as Ndere Island, Lake Victoria, Impala Sanctuary, Luanda Magere, Kit Mikaye, and National Museum.

Archaeological sites in the proximity of the project area, as presented by the National Museums of Kenya, are summarized in Table 3-1 and Fig 3-6 below, as well as presented in Appendix 9.5. There are no known archaeological sites that the transmission line will pass through.

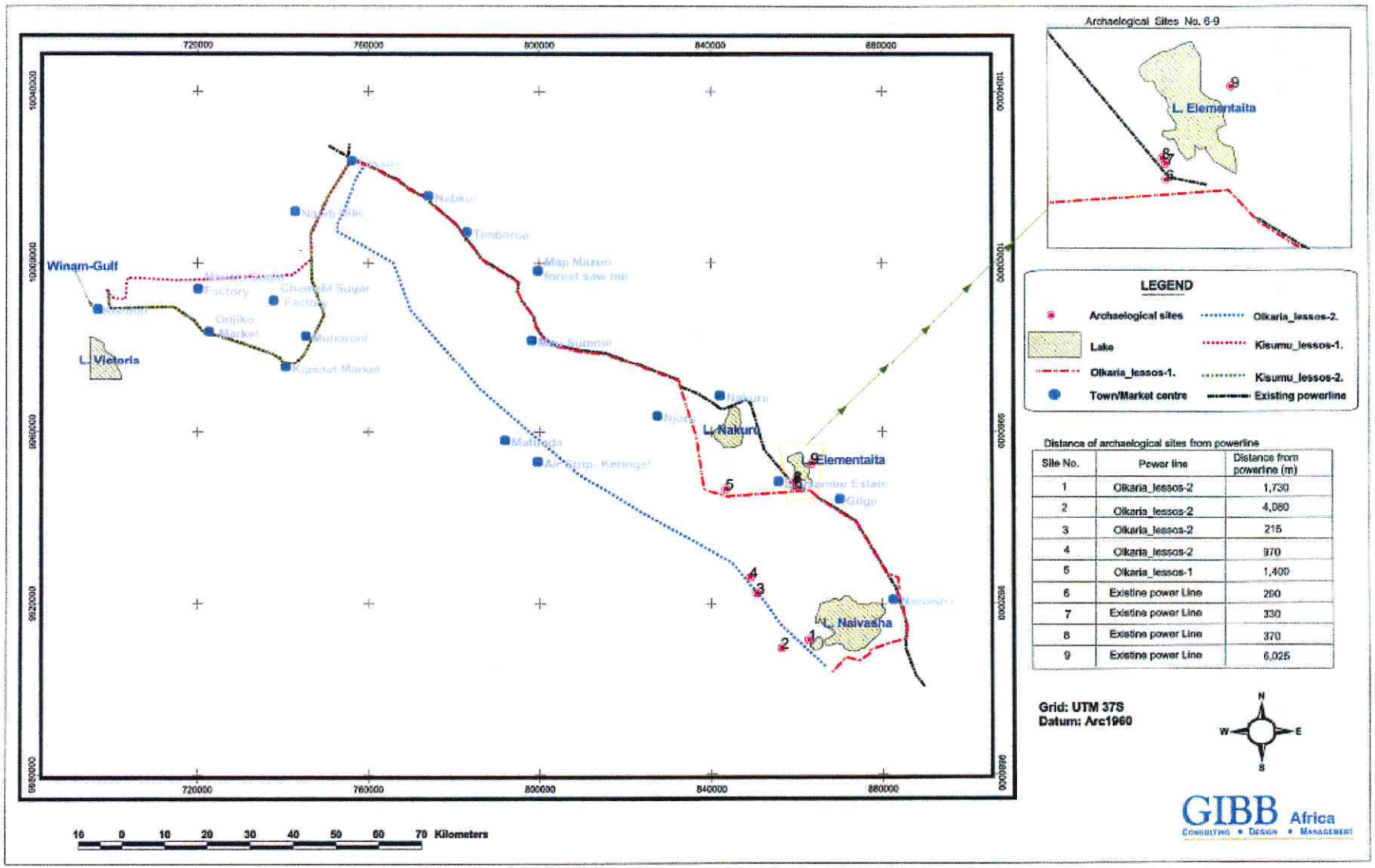
Table 3-1: Archaeological Sites near the proposed Transmission Line

Site No.	Position	NMK Accession	SASES No.	Comments
1	Latitude 50 °49'15" Longitude36° 12' 0"	NMK 3476	Gtji 16. Grid Ref. AK 883093	This is a Neolithic habitation site with probable dates of less than 5000 years. The site covers an area of-100m on a linear exposure and yielded flaked obsidian stone tools, pottery, teeth and bones. The site may contain material remains of the first agriculturalists in the area, which would make important for the study of the introduction of agriculture into the central Rift highlands of Kenya.
2	Latitude 0° 48'10" Longtitude36° 15'22"	NMK 3224	Gtji 6, Grid Ref. 944112	This is a latter stone Age habitation site with obsidian stone tools eroding from the surface. It covers an area of approximately 75 square meters. Its cultural identity is similar to #2 above.
3	Latitude 0° 42' 10" Longitude 36°08' 55"	NMK 3121	Gsji 48, Grid Ref. 790232	This is a small cave measuring 11 by 7 metres and is used by Maasai as an Ol Pul (meat and soup feasting site). It forms an important site for Maasai social life. Bones, teeth and un-decorated pottery were recovered from the surface. The history of its use runs back close to a hundred years according to Maasai informants at the time of the survey in 1982.
4	Latitude 0° 40' 08" Longitude 36 07'59"	NMK 3114	Gsji 41, Grid Ref. 799260	This is a later stone age site measuring over 150m linear exposure. It contains obsidian artifacts and appears to have two ages of occupation. The site has low excavation potential.
5	Latitude 0 25'44" Longitude 36 15'51	No NMK Accession	GrJi 6, Grid Ref. 950526	This is a Neolithic site dated to no more then 10,000 BP. A complete stone bowl specimen was recovered and the site is likely to have been a cemetery because this artifact is mostly associated with burials during the Neolithic. The site should be tested to verify the presence of burials.
6	Latitude 0 29 Longitude 36 05	NMK 570	GrJi 02/08, Grid Ref. 728456	Later stone age sites discovered early last century. There is little information on them currently and they deserve another look to get more information.
7	Latitude 0 28'20' Longitude 36 13'44"	NMK 3077	GrJi 23, Grid Ref. 910478	This is a later stone age habitation site with a possible iron age occupation.
8	Latitude 028'45" Longitude 36	No NMK Accession	GrJi 30, Grid Ref. 914445	A later stone age open site with pottery

Site No.	Position	NMK Accession	SASES No.	Comments
	13'44"			
9	Latitude 0 28'26" Longitude 36 13'46"	No NMK Accession	GrJi 29, Grid Ref. 916476	This is a calm burial site and retains covering stone slabs in rock fill.

Source: Data and information from the National Museums of Kenya (Division of Archaeology)

Fig 3-6: Location of Archaeological Sites near the proposed transmission line



4 PROJECT DESCRIPTION AND JUSTIFICATION

4.1 Project Objectives

The principal objective of the project is to construct a new 220kV transmission line, necessary to improve reliability and serve the increasing load through the year 2022. Specific objectives of the proposed project include the following:

- Design and construction of a power transmission line as per specifications provided by the electricity generation regulatory authorities (ERC, KPLC, Ministry of Energy, etc);
- Observe sustainability through complying with all local laws, among them those dealing with environmental protection; and
- Upon completion of construction of the line, hand it to KPLC for operation and maintenance.

4.2 General Project Description

4.2.1 Transmission Line Design

The proposed transmission line shall be designed with steel lattice towers of the type commonly used in Kenya and worldwide. Figures 4-1 and 4-2 show typical designs for the two main types of transmission towers to be constructed. Figure 4-1 shows the design of a suspension tower. These are recognisable because the insulators are mounted vertically. They are of light construction because they do not have to take horizontal loads. Figure 4-2 shows the design of a tension towers (also known as compression towers). Tensions towers are used at angle points, dead end points, at points where the local topography demands it, and at intervals of approximately 5Km along straight stretches of line. They are recognizable because the insulators are mounted horizontally. They are further designed to take horizontal and vertical loads, and are thus the heavier of the two types of towers.

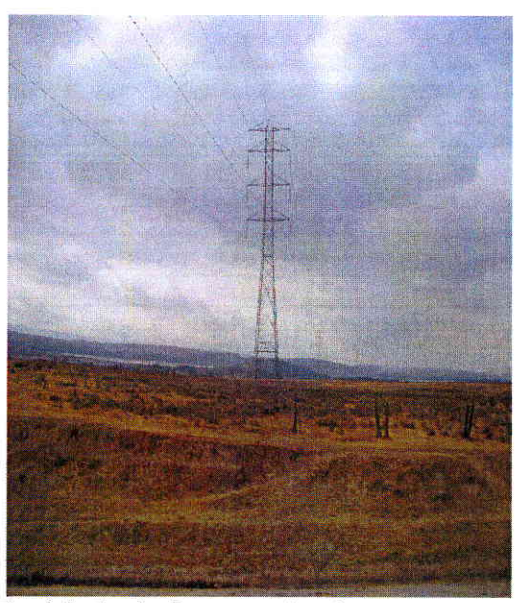


Fig 4-1: Typical suspension tower

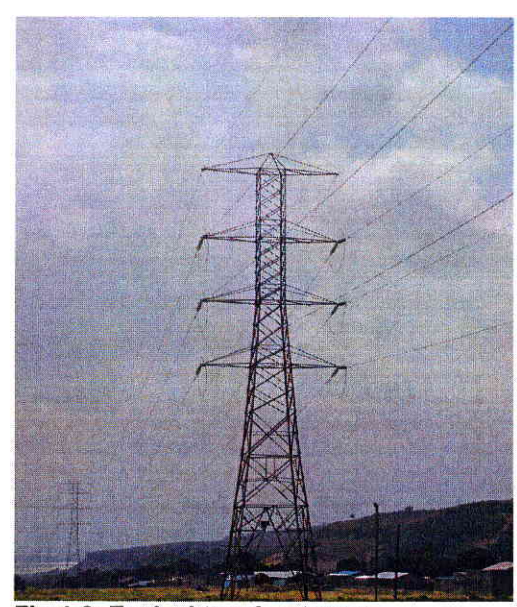


Fig 4-2: Typical tension tower

Concrete pad and chimney foundations shall be used for most towers, although raft foundations may be required for some locations. Additional detail on foundation design and construction is provided in section 4.4.3. Climbing guards shall be installed on all towers to reduce vandalism and to reduce risk to public safety.

The towers will be about 50m in height, although the specific height of any individual tower will vary. The wayleave for the 220kV line is 40m. Where lines run in parallel, KPLC requires a minimum of 5m separation between the conductors. No permanent structures, such as houses or outbuildings, will be allowed to remain or be constructed within the wayleaves. Growth of crops will be permitted, but limited to a height of 1.8m or less – thus most annual crops and low growing perennial crops such as tea are permitted. Trees are not permitted.

4.2.2 Substations

(a) Existing Substations

The following existing substations will form part of the proposed project:

- Olkaria;
- Lessos; and
- Mamboleo (Kisumu).

Additional bays will be set up to accommodate the proposed line in each of the above substations, and in some cases, such as Lessos, additional land, up to 50 acres, acquired to cater for the proposed substation expansion.

4.3 Wayleave Acquisition Procedure

The following general steps are followed when acquiring wayleaves for new transmission lines:

- Confirmation from design department on expected route of new transmission line;
- Purchase cadastral and survey plans;
- Mark angle points on these plans;
- Verification of cadastral plots affected by surveyor;
- Search at Land Office – obtain plot numbers and names;
- Survey confirms actual trace per person;
- Sensitize community through Provincial Administration;
- Obtain logistical and financial support from government;
- Call for *barazas* to further explain to community + obtain their views;
- Mark specific angle points on ground by surveyor;
- KPLC Property Department values affected land using available values & guidelines. These rates are constant within specific regions, to prevent disparity and discord within the community due to uneven compensation;
- Prepare Compensation Schedule detailing land owner, plot number, acreage affected, actual land value, compensation rate.
- Prepare Wayleave Agreement Form, which includes a 60 day notice (required by law);
- Prepare non-prejudicial Letters of Offer. These allow for further negotiation between KPLC and the land owner.

It should be noted that the current KPLC compensation is approx 50% of land value to be acquired. KPLC operates through Lease Agreements, not direct purchase. Leasing enables the land owner to continue using the land within agreed conditions, e.g. crops can be grown as long as they do not exceed 1.8m (6 feet) in height. Trees and structures are not allowed under these Agreements. Structures, however, are fully compensated, based on amounts presented by registered land valuers, while damage to crops and trees is fully compensated, based on rates acquired from District Agriculture offices.

The above procedure is undertaken following a confirmation by the Contractor of the exact trace of the transmission line, and prior to construction.

4.4 Construction

4.4.1 General

An engineering, procurement and construction (EPC) contractor has not been selected yet for this project, thus, the information provided in this section may change once the preferred EPC Contractor has been selected. Any such changes would be incorporated into the Environmental Action Plan for the project.

The EPC activities are generally divided into the following separate components:

- Engineering
- Procurement, Manufacturing and Transport; and
- Construction.

The first component involves the design and specification of all transmission line components, with the next task involving the actual procurement of these components, and the logistics of transportation. The construction component will involve the tasks of site survey, route clearance and access, civil works (i.e. construction of foundations), tower erection, conductor stringing and inspection testing, commissioning, operational acceptance and handover. The timing and schedule of the overall program will be confirmed following selection of the EPC Contractor.

4.4.2 Engineering

Detailed engineering will include completion of geotechnical and engineering surveys to provide detailed information needed for:

- Placement of towers;
- Design of foundations;
- Design of towers; and
- Substation design.

Engineering and detailed design will commence upon award of the EPC Contract. At this stage, minor adjustments may be made to the route to allow the EPC Contractor to optimise the design including number of towers and span distances between towers, foundation designs, and number of heavy angle towers.

4.4.3 Procurement, Manufacturing and Transportation

A major portion of the material incorporated into the transmission line project will be components that are only manufactured outside of Kenya (e.g. tower steel and components, conductors, insulators, transformers and switchgear). Materials and goods that may be procured from within Kenya include:

- Concrete;
- Aggregates; and
- Miscellaneous supplies and services.

Materials for the transmission line construction will be stored in one or more temporary construction yards. The location for the yards will be determined by the EPC Contractor. Each yard would require an estimated 0.5 to 1.0ha with the following general characteristics:

- Hard standing or graded and pre-compacted soil;

- Office space;
- A workshop;
- Water and electricity;
- Sewerage;
- Security (fencing and a gatehouse); and
- A close location to the Naivasha-Eldoret-Kisumu highway.

It is expected that the EPC Contractor would rent a developed site for the yard(s). Each site will be returned to its original state at completion of construction or as specified in the rental agreement. No staff accommodation will be provided at the storage yard, other than for site security.

Material for the substations will be stored on-site, or if additional room is needed, on suitable nearby property to be selected by the EPC Contractor.

Steel components for the transmission line project will be produced outside Kenya. These, along with conductors, insulators and fittings, and transformers, will be delivered by ship to the port of Mombasa. All material and equipment procured internationally will be transported by rail or road to a bonded warehouse in a selected area, and from there to the storage yards via public highways.

Materials and equipment procured locally or nationally will be transported directly to the storage yard. Sorting, inspection and reconciliation of quantities will be carried out upon delivery to the storage yard.

Material destined for the transmission line will be trucked from the storage yard to site via public highways and the wayleave itself. It is planned that a multiple number of teams will work on the transmission line at any one time, using the storage yard as a depot. On this basis, there will be a high number of vehicle movements per day due to the presence of the storage yard, including deliveries and movement of light/personal vehicles.

4.4.4 Construction Activities

(a) Transmission Lines

(i) Foundations

All the towers on the transmission line will be constructed prior to the installation of conductors. Tower foundations will vary according to the prevailing geology. Analysis of soil at chosen sites will have been already carried out to determine that the sulphate content of the soil and ground water, in accordance with British Standard 1377. This will be followed by the marking of tower footings, whereby the orientation of the tower is obtained with a theodolite set up at the tower's central position. The distance between the centres of the tower footings are taken from the relevant foundation drawing. Diagonals are then checked, and each footing pegged at its centre, and further pegged out from its central point to the correct dimensions.

Excavation for foundation setting in normal soil is carried out by hand, and using a jack hammer in soft rock excavation. Hard rock, where present, is blasted out using explosives. The excavation material will be levelled after completion of the concrete.

Stub setting is carried out using a dumpy level, and a stub setting template. The process involves levelling of the bottoms of the holes, followed by erection and propping of the template at the required height above ground level. The four stubs are then fixed onto the template, thus giving them the required slope. Using the level, are four stubs are levelled and back to back dimensions and diagonals are checked.

Concrete pouring is the final stage in foundation setting, and equipment used includes a concrete mixer, 7 ton truck water tanker, tractor and trailer, and vibrators. Sulphate resisting cement is used as required. A dump is chosen at various tower positions for aggregate delivery. The water in the water tanker and the cement bags in the small dump truck follow the

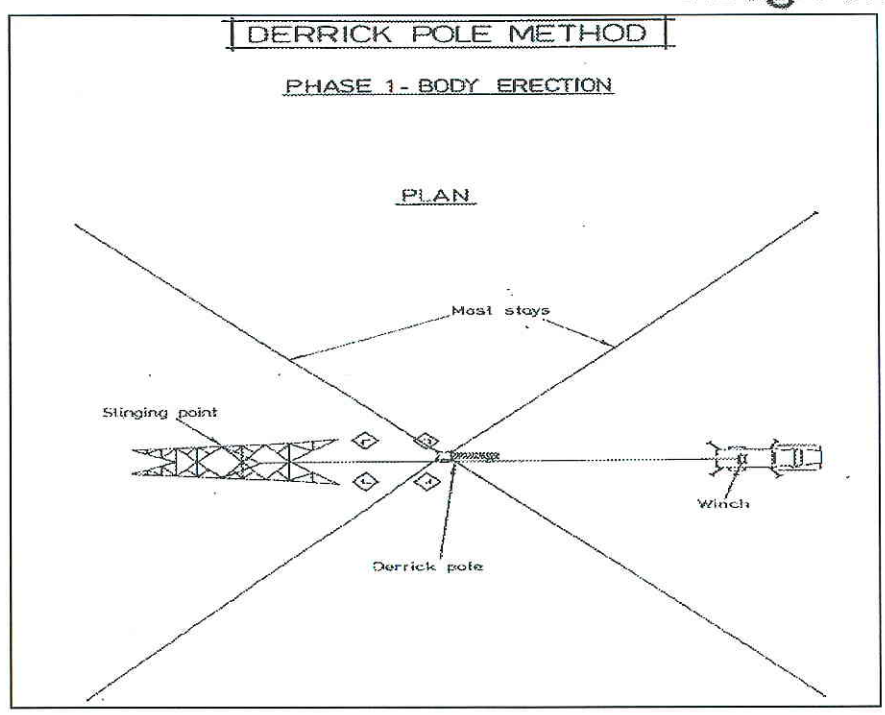
mixer to each tower location. Mixing for concrete takes place at the tower site, with the concrete being poured a few minutes later. A truncated mixer chute is used to restrict the free fall of concrete, and minimise separation. One spare vibrator is kept at site in the event of breakdowns. Concrete strengths are tested using the British Standard 1881.

(ii) Tower erection

The erection procedure will start with transport by trucks equipped with cranes, between the storage yard and tower site. Each tower will be packed in several bundles of angles, crossarms, bolts, etc. according to bundling schedule. During transportation, storage and erection, particular care needs to be taken to ensure that the surfaces do not get damaged. Tower assembly will be carried out by experienced gangs, and section by section, with a light mast, or Derrick pole.

The method of erection by Derrick pole consists of three phases: body erection, Derrick erection, and head erection. The following figures, which are generic drawings taken from Clough Smith Ltd, an international contractor, show the phases of tower erection:

Fig 4-3: Phase 1 of Tower Erection – Body Erection



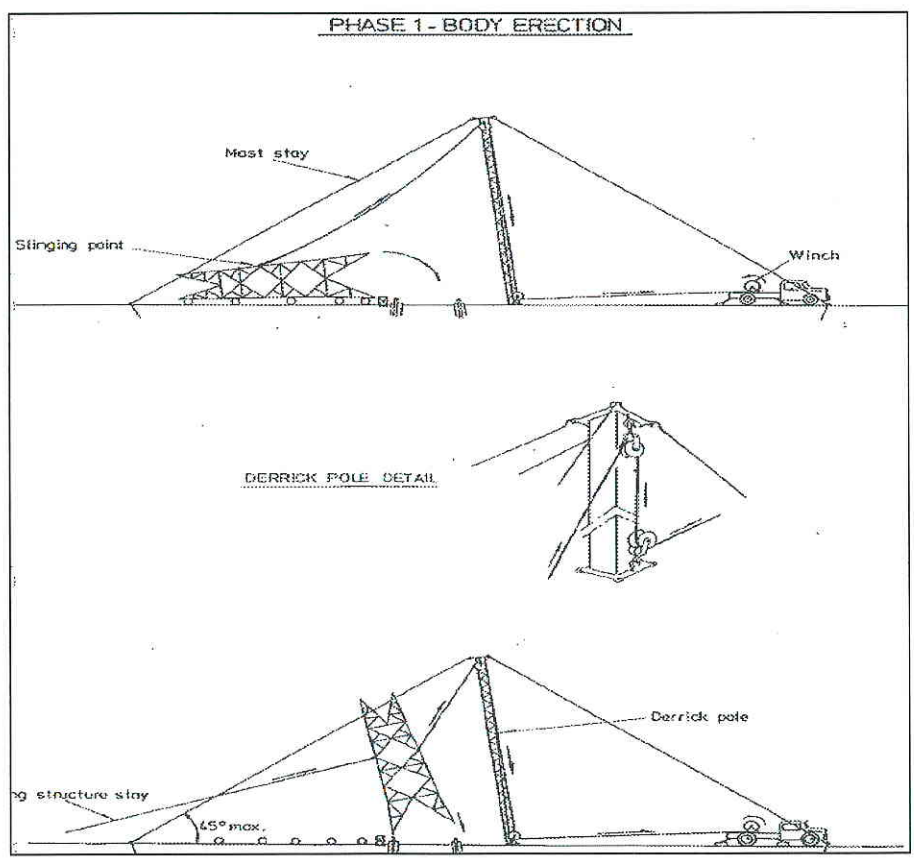
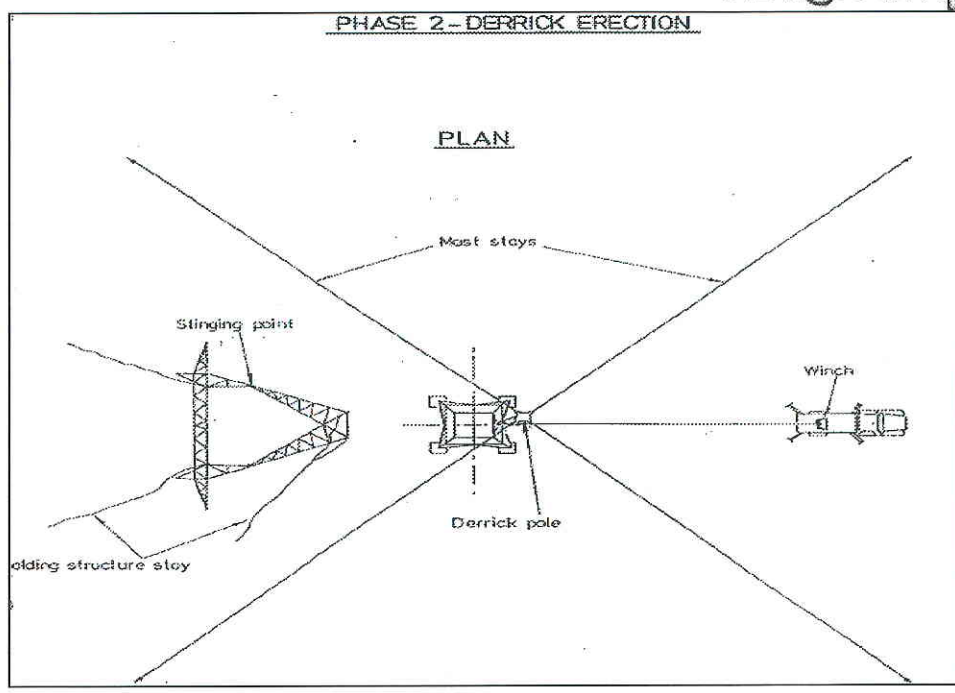


Fig 4-4: Phase 2 of Tower Erection – Derrick Erection



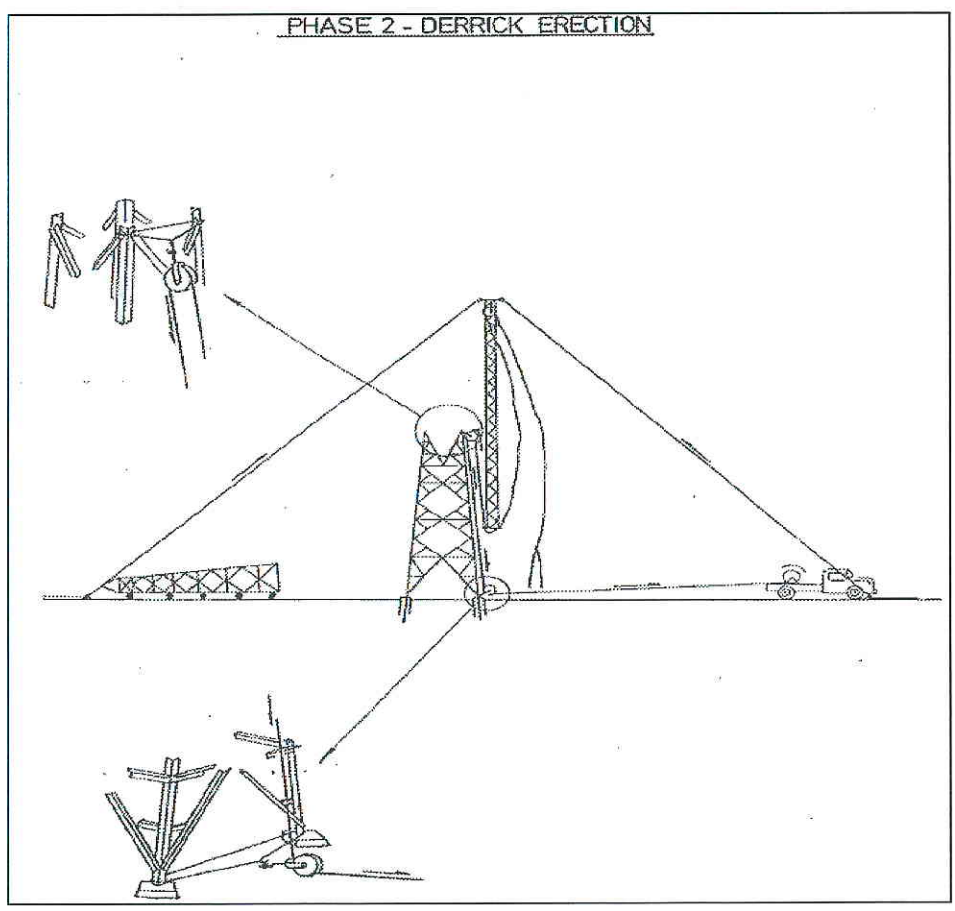
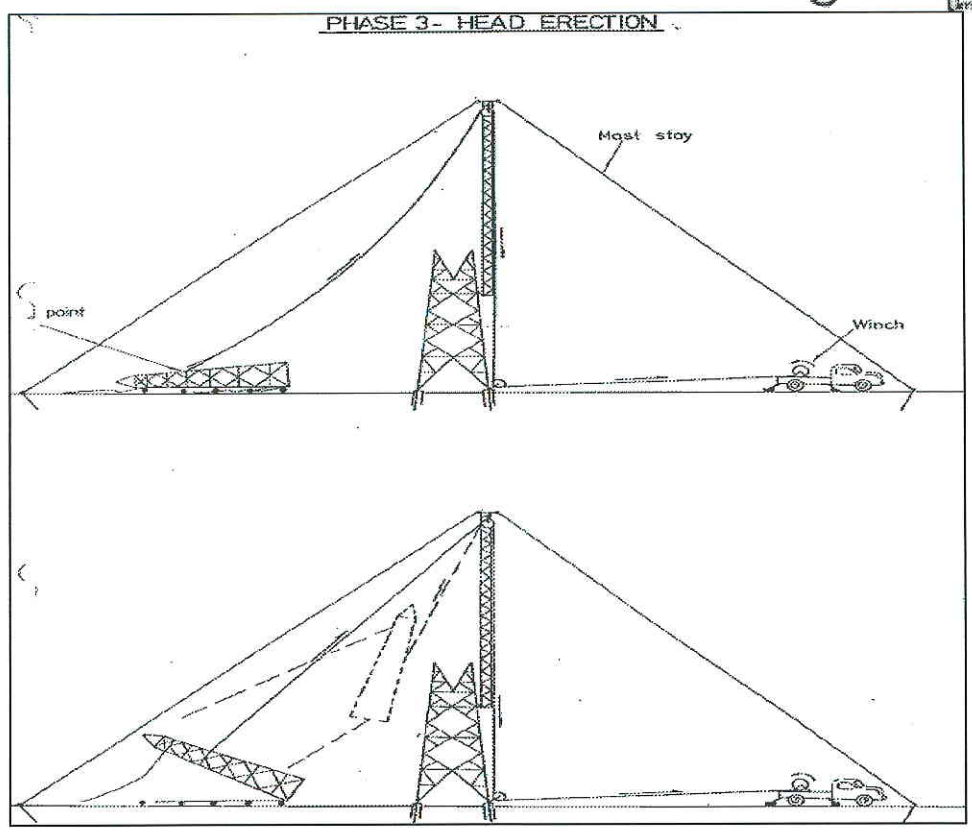
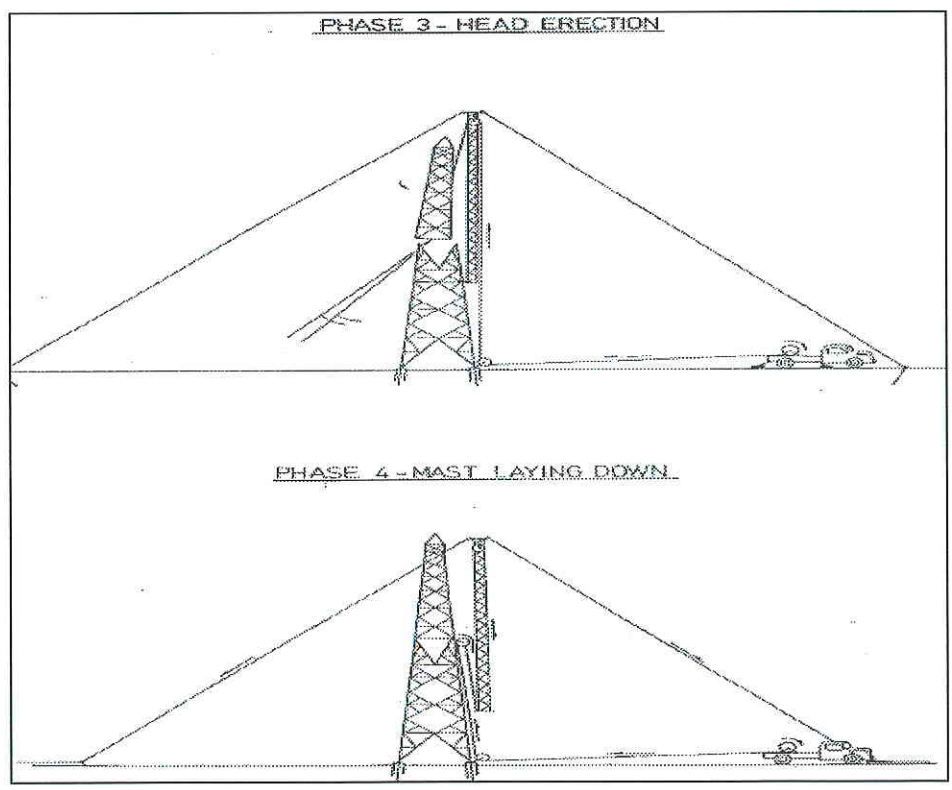


Fig 4-5: Phase 3 of Tower Erection – Head Erection





(iii) Stringing procedure

(iii).1 General

The stringing operation consists of the erection of fittings, insulators, conductors, and earth wire, and erecting these to pre-calculated erection tensions. The stringing of the conductors and earth wire is carried out under tension to avoid dragging the conductors on the ground and damaging them. This method requires tension stringing equipment which consists of a tensioner; conductor puller; drum winder; and a hauling bond. Other equipment consists of conductor stringing blocks with neoprene lined sheaves; line stringing swivels to prevent the conductors from twisting; stockings (wire mesh grips) to join and pull the conductors; and drum stands and a drum trailer.

(iii).2 Choice of the stringing section

The length of the section to be strung is determined by the length of the conductor on a drum (this varies with the size of conductor); vehicular access to site; and amount of stringing equipment available. The location for the puller and the tensioner is selected at a point where good access is available.

(iii).3 Stringing of the pilot line

During stringing of the pilot line, road crossings, telephone lines, small power lines, etc should be protected by scaffolding or other supports to obtain adequate clearance. A line gang will attach fittings, insulators, running blocks to crossarms, and will thread a nylon rope through each block. At angle towers, the running blocks may be attached to the crossarms. The pilot line with either a special swaged steel rope or a non-rotating nylon rope is pulled out by a tractor. By utilising the rope threaded through the block, the pilot line is pulled through the stringing blocks. One pilot line is required for each phase, and is tensioned so that it is raised clear off the ground throughout the stringing section.

(iii).4 Stringing of the conductors

Prior to stringing of the conductors, each section of the line should be studied and the following noted: location of puller and tensioner; tension at which the conductor should be pulled to keep it clear of the ground without creating uplift in the pilot conductor; towers where uplift of the pilot could occur; position of the conductor stockings after conductor is pulled out (they should be in such a position to allow the joints to be made on the ground when conductor is lowered); and final position of the joints after sagging of the conductors.

The stringing of conductors can be carried out by pulling the phase conductors on the same level at the same time. The conductors are passed through the tensioner and then attached to the pilots by means of stockings. The pilots are pulled by the puller and rewound on the pilot line drums or the drum winders. The tension in the conductor to keep it clear off the ground is controlled by the braking action of the tensioner. The pilots are pulled until they are replaced by the conductors throughout the stringing section. When the conductors are in place in the whole section, the tension is reduced to lower the conductor.

After securing the conductor on either side of the stocking, the stocking is removed and a compression joint made utilising a suitable hydraulic compression tool. Where the route is undulating, it may be necessary to hold down the stringing blocks on the towers to avoid uplift caused by the difference in weight of the pilot line and conductors. The drums are transported on trucks equipped with a crane. They are placed on special drum stands equipped with brakes and located immediately before the tensioner. During the stringing operation, radio communication is essential between the tensioner location and puller location to enable stringing operations to be quickly stopped should any problem arise.

(iii).5 Tensioning and Sagging

After all the conductors have been strung in a section between tension towers, they are terminated at one tension tower in the strung section and adjusted to the correct sag at the other tower. Two or three spans may be selected in each section for checking the sag (preferably sections where the support towers are at the same ground level). Sighting boards are attached to one tower in each of the selected spans at a point below the conductor attachment point equivalent to the calculated erection sag for that span at the temperature of the conductor. At the other tower in the span, a sighting instrument (gun sigh level, etc.) is set up at the same level. The conductor is pulled up by the puller until the lowest point of the conductor just touches the horizontal line connecting the instrument and the sighting board. The conductor is marked at the dead end fitting position, lowered to the ground and the dead end fitting compressed onto the conductor. This procedure is repeated for the other conductors and earthwire in the section.

Where the sagging sections are very long, it is possible to divide the section into two smaller sections. The conductors are pulled out to the end of the first section, the towers first being securely anchored, and the conductors held until the second section is strung. The mid span joints are installed and conductors sagged as described above.

In order to improve sag regulation between conductors in a section and allow the individual stranding to become well bedded down, the new conductor is pre-stressed at a tension 10% above erection for at least one hour before being marked for cutting. Long term creep is allowed for by the introduction of a specified dimension of 600mm to the design of the tower.

(iii).6 Clamping

When the dead end fittings have been made off, the conductor is clamped at the suspension points. The conductor is lifted from the running out blocks using a lifting tool and pull lift attached to the crossarms, and transferred to the suspension clamp attached to the insulator string. When all conductors are clamped in, vibration dampers are fitted. It is recommended that temporary earths are attached to the conductors to avoid the risk of electric shock due to the induced voltages.

(iii).7 Temporary Anchoring or Staying

Where temporary staying is necessary, this may be provided by an appropriate number of concrete blocks or by the installation of 'deadmen'. The earth conductors may be held by separate anchor. Where temporary stays/anchors are used, they should be protected to avoid accidents. Temporary anchors should remain in place for a minimum period of time only.

(iv) Equipment

The tension stringing equipment used in Kenya for the erection of the transmission lines is composed of the following:

(iv).1 Puller

This piece of equipment consists of a multi-groove bullwheel cable puller, powered by a diesel engine and pressure-compensated, hydrostatic transmission. The speed, torque, and direction of the transmission are regulated from the centrally located control panel. Each bullwheel drive train is equipped with an anti-rotation brake that prevents pay out of conductor if a power failure occurs during pulling.

(iv).2 Tensioner

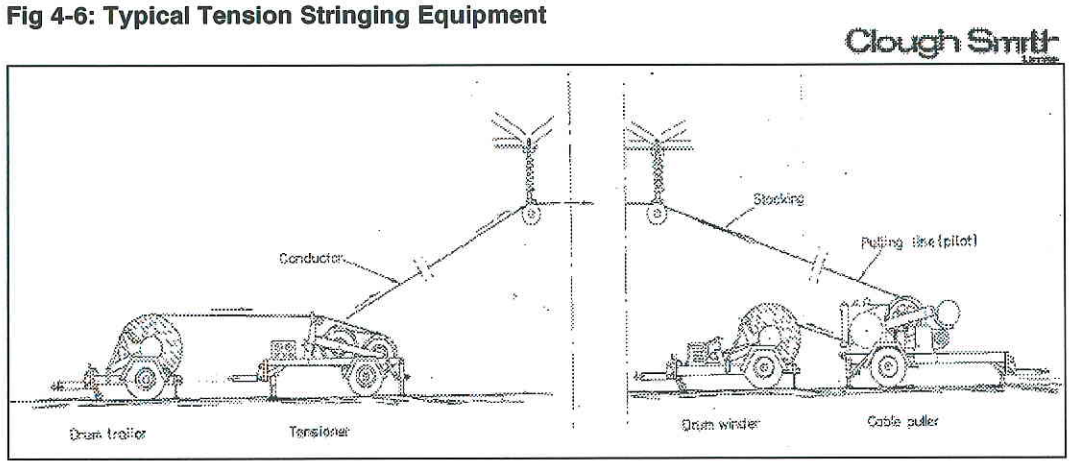
This piece of equipment consists of a multi-groove tensioner designed to control the pay out of the conductor from the storage drums. The bullwheel is equipped with a large diameter hydraulic calliper disc brake.

(iv).3 Drum Stand

This piece of equipment is a heavy duty drum stand designed to support a conductor drum and release conductor under low tension to a tensioner. The spindle is removable to facilitate drum changes and is equipped with a hydraulic calliper disc brake to retard drum rotation for light tensioning and to prevent overspin. The unit is also equipped with a manual rewind mechanism for re-spooling unused conductor.

The figure below presents typical tension stringing equipment, again taken from Clough Smith Ltd, an international contractor.

Fig 4-6: Typical Tension Stringing Equipment



(v) Tower Accessories

The following accessories shall be provided for every tower:

(v).1 Anti-climbing device and climbing steps

All towers will be provided with the anti-climb device on each leg at the height of 3m to 5m above the highest ground level at all tower locations. The device installed on the step-bolted legs shall be provided on all towers. Gates shall be designed to open upwards only and shall be secured with galvanised bolts and nuts. No padlocks are required.

Each tower shall be provided with step-bolts of an approved type on diagonal sides of the tower at a spacing no more than 380mm, starting immediately above the anti-climbing device and continuing to the earth wires. Holes for removal step-bolts below the anti-climbing guards shall be provided at not more than 380mm centres on the step legs.

(v).2 Danger, Number and Helicopter patrol plates

Danger plate which shows warning sign for tower climbing of other people than maintenance crew will be provided on all towers. Number plates which show tower number set serially will also be installed on every tower.

On the top of every 5th tower, additional number plates will be provided to aid helicopter patrol over the transmission line. Lettering and size of plates shall be to the employer's requirements, and should be both sides of the number plate for clear identification when patrolling from either end.

All plates shall be of anti-corrosive material. If enamelled iron plates are used, the whole surface of each plate including the back and edges shall be properly covered and resistant to corrosion. On all plates, the colours shall be permanent and free from fading. With enamelled plates, washers or fibre or other approved material shall be provided back and front of the securing bolts.

(v).3 Tower Earthing

No separate earth conductor from top to bottom of towers is required, and earthing continuity will therefore depend on surface contact between bolted members. All structures shall be provided with means for connecting earthing devices at or around nominal ground level, on each leg and for connecting earthwire bonds to each top crossarm or earthwire peak.

Each leg of towers will have an earthing rod underneath its foundation to act as basic grounding required by good transmission line engineering. Basic grounding shall be constructed in such a way that isolation from the tower and concrete foundation is possible to allow earthing survey if required during line service life.

Maximum earthing resistance of a tower is targeted at 10 ohms, and in case of higher resistance than 10 ohms, additional horizontal counterpoise earthing system will be added in the ground longitudinally to the line route with more than 50cm depth.

(v).4 Aircraft Warning Devices

Due to the activity of aircraft in the vicinity of certain parts of the transmission line, it may be necessary to mount warning spheres on earthwires at some locations. Aircraft warning spheres shall be capable of being clamped securely to overhead earthwire. The sphere itself shall be of plastic or fibreglass construction of at least 0.5m in diameter and coloured orange or yellow as required by local regulations.

(v).5 Bird Warning Devices

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and humans. Negative interaction takes many forms, but common problems are electrocution of birds and other wildlife, birds colliding with power lines and birds causing short circuits in the electricity supply through various activities on electricity structures. Other 'indirect' forms of interaction are destruction of wildlife habitat and disturbance of wildlife as a result of construction and maintenance activities.

(v).6 Bolts

Where appropriate, all metal parts shall be secured with bolts and nuts with single spring washers. When in position, the bolts shall project through the corresponding nuts by at least three threads, but such projections shall not exceed 10mm. No screwed threads shall form part of a shearing plane between members.

Special anti-theft bolts shall be applied to safeguard tower members from ground level up to 1 metre above the anti-climbing device from theft and vandalism. The bolts shall be approved by the employer. The bolts are of the type that shears once the full torque has been applied.

The nuts of all bolts attaching phase conductor insulator set, earthwire sets, maintenance brackets/plates shall be locked in an approved manner preferably by locknuts. The bolts of any one diameter in a tower shall be one grade of steel. Leg members shall be joined in such a way that electrical continuity is maintained to ground.

(b) Existing Substations

The following existing substations will form part of the proposed project:

- Olkaria;
- Lessos; and
- Mamboleo (Kisumu).

The schedule of work at this substation will be confirmed once the EPC Contractor is selected, and will involve installation of additional infrastructure to cater for the proposed transmission line. Tasks required during the construction phase will be similar to those outlined in the next section, but on a smaller scale.

More specifically, additional bays will be set up to accommodate the proposed line in each of the above substations, and in some cases, such as Lessos, additional land, up to 50 acres, acquired to cater for the proposed substation expansion.

4.4.5 Access Roads

Access to the transmission line wayleave will be gained solely by use of existing public highways and access roads. No new roads will need to be constructed. Where the new transmission line will follow the existing line, the existing access track within that wayleave will be used. Access to the new tower locations will be gained via a short 'spur' from this track.

Where an existing KPLC access track is not present (i.e. in areas where the new transmission line does not follow the existing line), an access track of approximately 5m width will be cut through all vegetation along the wayleave, where possible following the centreline of the wayleave. Clearance for housing and other buildings will be maintained by local adjustment of the route. Cut trees will be left for the use of (or sale by) local owners.

In areas of the wayleave other than the access track, clearance of vegetation will be minimised, but a certain amount of clearance will be required in the immediate area of the towers. Only so-called 'dangerous trees' will be cut, i.e. those that could damage the transmission line if they fell on it (typically large trees within 40m of the transmission line). All clearance of vegetation will be done by hand and will not use heavy machinery. Soil will not be left exposed.

During conductor stringing, construction workers will need walking access in a direct line between towers in order to hang the pilot wire. This will be done with minimal damage to crops. This access will not be required in low-lying areas such as permanent or seasonal swamps.

No new access roads will be constructed, except for a short (approx 100m) extension from where the existing access road ends to the substation site. This extension will be upgraded to take heavy vehicles, but it is not anticipated that paving will be required. A barrier will be erected between the traffic zone and pedestrian zone on this road, and crossing corridor personnel will be provided at the beginning and end of the school day, if required. Speed limits on this road for construction vehicles will also be posted to minimise any problems with pedestrians. School staff and pupils will be briefed on the nature and risks of vehicle movements to and from the site.

No staff accommodation will be provided at the substation site, other than for a night-watchman.

4.4.6 Equipment

The storage yard for the transmission line construction is expected to be the base for a fleet of vehicles to be used for the construction process. It is anticipated that the following vehicles and equipment will be required:

- One large crane for handling goods within the storage yard;
- Trucks: of various sizes, some fitted with Hiab- or Atlas-type hoists for unloading materials and equipment at each tower site;
- Mobile cranes of 26-30 tonne capacity;
- 'Forest type' large wheeled tractors with winches;
- Cable stringing pullers;
- Pilot line winders;
- Cable stringing tensioners;
- Cable reel carriers;
- Truck/trailer mounted water tanks;
- All purpose four-wheel trailers;
- 4-wheel drive vehicles;

- Compressors with pneumatic equipment such as rock drills; and
- Concrete mixers/

4.4.7 Labour Force

It is not at present known the exact number of staff required for construction of the transmission line. Nonetheless, Project Managers, Supervisors and numerous semi-skilled and unskilled workers (recruited locally) will be required. There will be separate erection crews, and semi-skilled and unskilled workers will be trained by supervisors prior to commencement of construction. Local people will be recruited as unskilled labourers from the villages traversed by the transmission line, where possible.

While in many cases the workers will arrive at site by foot, large vehicles will be provided as necessary to bring workers to the wayleave. Technical staff will be housed in existing accommodation (apartments or hotels). No construction workers' camp will be required. No 'induced impacts' traditionally associated with workers' camps (e.g. growth in prostitution, stretching of social services like schools and health clinics beyond their capacities, transmission of HIV/AIDS) are therefore anticipated.

At the peak of construction activity, it is estimated that 85% of the workforce will be labourers; 5% semi-skilled workers (e.g. equipment operators); 5% highly skilled workers and 5% managers and supervisors.

The recruitment process will be managed by KPLC and its sub-contractors, and contractual commitments will be sought from any labour-only contractors that labourers provided will be employed in line with the provisions of the Employment Act (2007), and the Occupational Safety and Health Act (2007), among others, regarding working hours, workplace conditions, overtime, and form and frequency of pay. In view of the above, KPLC is in the process of formulating a policy that encourages the employment of non-skilled labour from the communities that proposed projects traverse.

4.4.8 Testing and Commissioning

Various tests will be undertaken to ensure that the transmission line performs as per specification. During testing, line ground clearances will be thoroughly checked. Once construction of the transmission line is completed, the soil along the right-of-way will be assessed for problems such as erosion or compaction and corrective action will be taken, as appropriate. Areas of bare soil will be seeded with native cover crops to stabilise the soil, reduce erosion and prevent invasion by undesirable plant species.

Once all circuits have been connected, 'dry' testing will begin. This testing entails confirmation that all connections have been made according to the wiring diagrams. Voltage is then applied to individual circuits to check for correct performance of circuit breakers and correct setting of relays. 'Wet' testing will involve energising the complete system and a final test, prior to full commissioning.

Testing and commissioning will be carried out by two to three inspection engineers and about ten semi-skilled workers.

4.4.9 Operation and Maintenance

Once the transmission lines are constructed there is relatively little ongoing maintenance required. The key activities involve surveillance of the condition of the transmission line and wayleave; emergency maintenance and repairs; and vegetation control.

Vehicular access to most sections of the wayleave will be required to allow supervision and monitoring, and to effect line repairs when needed. Outside agriculture areas or otherwise cleared areas, undesirable vegetation within the wayleaves will be controlled by cutting. Herbicides are not expected to be used. The removal of accumulated growth will continue to

take place in accordance with KPLC's existing wayleave clearance programme, with clearance at least yearly.

During normal operation of the Timboroa/ Makutano Substation, there will be generally two to three operational staff and two to three cleaners and guards. The majority of traffic to and from the substation will be light vehicles, i.e. no regular loads greater than two tonnes, and should be no more than five vehicle movements per day. The transmission system will be almost free from noise, and emissions will be limited to a low hum. This will not be noticeable from within buildings outside the substation site.

The substation will be nearly maintenance-free. Maintenance will be limited to annual cleaning and checking of circuit breaker connections, and will require a team of approximately five engineers and semi-skilled workers, for approximately one week. Changing of transformer oil will not be required.

4.4.10 Decommissioning

It is anticipated that the transmission line will be continuously maintained and repaired, and will be operated for several decades. Because of their long useable life, the circumstances under which they might ultimately be decommissioned are difficult to foresee. Thus, only a general decommission approach can be presented.

The transmission lines would be deconstructed in reverse order from their construction, using similar equipment and techniques. The conductors and shield wires would be lowered to the ground, and all cables would be spooled and removed from the right-of-way salvage. The towers would then be dismantled and removed from the right-of-way salvage. The disposal or otherwise of tower foundations would depend upon the intended future land use. In grazing lands and in areas allowed to revert to forest, the foundations would likely be left in place, and would gradually deteriorate. In other situations (e.g. cultivated farms, land intended for residential or industrial development), foundations might be demolished and removed. Similarly, measures to restore soils would depend upon the intended future use. Access would be required throughout the length of the line for movement of heavy equipment and crews. A process would be needed to remove easements and dispose of land no longer needed.

For the Timboroa/ Makutano Substation, the decision on whether to decommission or upgrade will depend on development of the Kenyan transmission system in the interim, and the system requirements at the time. Under a typical decommissioning process, all steelwork would be lowered to the ground, the cables spooled, and all components including transformers removed for salvage. Transformer oil would be drained and recycled. Access to the substation would be via the existing access road, and no new access route would need to be constructed. Should a decommissioning decision be made, it is anticipated that the substation site and control building would be re-used for industrial, commercial or other compatible purposes. Otherwise, the site would be cleared and levelled in a manner suitable for the most likely future land use. The land would then be disposed of through a process applicable at that time.

4.5 Project Cost

The provisional project cost is estimated at approximately **USD 99.5 million.**

4.6 Project Commissioning

The proposed transmission line is expected to be commissioned from April 2013. This is considered suitable because construction at Olkaria II in Naivasha as well as erection of the transmission line is anticipated to be complete by then, hence completing the interconnection.

4.7 Area Affected by the Project

The area of immediate impact will be the transmission line corridor Right-of-Way (ROW) of 40m width by 178-213Km between Olkaria and Lessos, and 77-103Km between Lessos to Kisumu, depending on the alternative. Tower foundations along the entire line will require a permanent area of approximately 6-8m by 6-8m (36-64m^2) based on a typical 220kV line tower. Along the corridor, appropriate clearance between conductors and vegetation/structures needs to be maintained for the entire life of the transmission line. However, farming and grazing within the corridor is generally permitted.

5 ANALYSIS OF ALTERNATIVES

5.1 Project Alternatives

Three possible options are available for the proposed transmission line as follows:

- Alternative 1 whereby the new transmission line would follow the existing one for most parts;
- Alternative 2 where the new transmission line would create a completely new path;
- Alternative 3, based on utilising the system as it is without undertaking any new works (do nothing)

5.1.1 Impact diagnosis

Based on the above options, a diagnosis of the impacts of foreseen activities is divided into positive and negative impacts as follows:

(a) Alternative 1

This option would involve the new transmission line following the existing one in most places with few changes to the existing transmission line at Olkaria, Naivasha, Elementaita and Kisumu area (Kibos village now included). The existing line, erected in the 1950s, passes from Olkaria through Hell's Gate National Park, and runs adjacent to the road until Naivasha substation. From here, it turns north-west through Kayole and Kabati areas in Naivasha, Elementaita, Gilgil and into Nakuru town. It continues running parallel to the Nakuru-Eldoret highway in most sections, until it branches off to Lessos. From Lessos, the transmission line cuts across the Nandi Escarpment into the Kano plains, then from Mberere centre, turns west and runs parallel to the Nandi Escarpment. It would then approach the Mamboleo substation in Kisumu from the north. The deviation of the proposed transmission line route from the existing line is around Lakes Elementaita and Nakuru, and was done to avoid greater proximity with these sensitive ecosystems.

Corridor sharing with existing facilities is usually encouraged because it minimizes impacts by:

- Reducing the amount of new RoW required ;
- Concentrating linear land uses and reducing the number of new corridors;
- Creating an incremental, rather than a new impact.

(i) Positive impacts

- Already existing transmission line route selected;
- Relatively less costly;
- Reduced wayleave impacts on environment;
- Avoidance of some heavily settled and developed areas, including Olkaria, Naivasha, Nakuru town and Mamboleo centre (Kisumu).

(ii) Negative impacts

- Cumulative impact on specific areas eg. Ol'lessos and Nandi Hills;
- Forest cover 113ha to be affected;
- Increased impact on migratory bird routes between Lakes Naivasha, Elementaita and Nakuru (if route is to pass through Mitimingi);
- Interference with aircraft flight paths at Soysambu (3 airstrips in area);
- Increased impact on previously affected landowners;
- Increased impact on sensitive ecosystems in most areas, through wider wayleaves;
- Number of settlements approximately 530 to be affected;

- Number of tributaries/ rivers crossed is 14.

(b) Alternative 2

This alternative would involve the new transmission line immediately heading north-west from Olkaria, via the Mau Forest, in a more or less straight line towards Nandi Hills, from where it would ascend the Nandi escarpment to Lessos. From Lessos, it would follow the existing 132kV transmission line through Muhoroni onwards to Mamboleo substation in Kisumu.

(i) Positive impacts

- Reduced impact on previously affected landowners;
- Shorter route, therefore less materials used

(ii) Negative impacts

- Increased investment to cover terrain challenges (escarpment);
- Extensive modification in sensitive Mau forest complex (327ha compared to 113ha in Alternative 1);
- Numerous tributaries encountered (48 between Olkaria-Lessos and 29 between Lessos-Kisumu), due to catchment nature of Mau forest complex (compared to 14 between Olkaria-Lessos and 26 between Lessos-Kisumu in Alternative 1);
- Loss of critical flora and fauna (Mau forest complex home to unique flora and fauna);
- Risk of effect on Ogiek community, an indigenous group inhabiting the Mau Forest Complex;
- Greater number of settlements that will require resettlement & compensation – more costly (642 between Olkaria and Lessos; 374 between Lessos and Kisumu).

(c) Alternative 3 (No-action option)

This option is based on utilising the system as it is without undertaking any new works. The current infrastructure has not been able to keep pace with the demand for electricity, and this option would not improve the situation.

(i) Positive impacts

- Less costly to KPLC and its partners

(ii) Negative impacts

- Insufficient power supply to country;
- Less revenue for KPLC

Table 5-1: Summary of Analysis of Alternatives

Alternative	1	2	3 (No-action)
Settlement	530	1016	n/a
River crossings	40	77	n/a
Forest cover	113ha	327ha	n/a
Avifauna	Separates Lake Naivasha from Lakes Elementaita and Nakuru; Cuts through the migratory route	Mau complex is in Important Bird Area (IBA) in Kenya	n/a
Aviation	Transmission line running next to 3 airstrips within Soysambu Conservancy	Transmission line running next to air strip at Keringet	n/a
Indigenous People	n/a	Ogiek in Mau Forest Complex	n/a

5.1.2 Impact Results

Based on the above impact analysis, Alternative 1 is proposed as the best option from an environmental point of view. This is because it does not create adverse environmental impacts on new environments, by following the existing transmission line route in most places, and avoiding extreme proximity to sensitive ecosystems.

Alternative 2 would be associated with heavy investment due to higher settlement in the areas it traverses, that would require compensation and resettlement, as well as the ecological destruction of the Mau Forest Complex. Numerous river crossings (77) would also be encountered, which makes Alternative 2 not a viable option at this time.

Finally, the increased energy demands in Kenya make Alternative 3, the no-action option, not feasible.

5.1.3 Additional Possible Alternatives

This would involve further modification within Alternative 1 to cater for the bird migratory routes and airstrips within the Elementaita area, through maintaining of the proposed transmission line route with the existing one, or underground construction in this section.

6 PUBLIC CONSULTATION

Public consultation is useful for gathering environmental data, understanding likely impacts, determining community and individual preferences, selecting project alternatives and designing viable and sustainable mitigation and compensation plans.

Public consultation in the ESIA process is undertaken during the project design, implementation and initial operation. The aim is to disseminate information to interested and affected parties (stakeholders), solicit their views and consult on sensitive issues.

Inadequate public consultation can result in significant information gaps, which could mislead environmental planners undertaking an environmental assessment. Lack of attention to communication and consultation processes can generate individual, community, or regional opposition to a project. This can ultimately be a cause of substantial delays, increased costs, and unsatisfactory compromise solutions, which could have been avoided through earlier consultation.

Participation is a process through which different stakeholders influence and share their views regarding development initiatives and the decisions and resources that affect them. The effectiveness of resettlement programs is directly related to the degree of continuing involvement of those affected by a project. Comprehensive planning is required to ensure that local government, NGOs, project staff and affected men and women (displaced and host) interact regularly and purposefully during all stages of the Project. The participation of different social groups directly affected by a project is a prerequisite of resettlement planning. The involvement of the Project Affected Persons (PAPs) in the design of the mitigation and/or resettlement plan increases the probability of success.

6.1.1 Objectives of the Public consultation program

The overall goal of the consultation process is to disseminate project information and to incorporate the views of the Project Affected Persons (PAPs) in the design of the mitigation measures, management plan and Resettlement Action Plan.

The specific aims of the consultation process are to:

- Improve Project design and, thereby, minimize conflicts and delays in implementation;
- Facilitate the development of appropriate and acceptable entitlement options;
- Increase long term Project sustainability and ownership;
- Reduce problems of institutional coordination;
- Make the resettlement process transparent; and
- Increase the effectiveness and sustainability of income restoration strategies, and improve coping mechanisms.

An important element in the process of impact assessment is consulting with stakeholders to gather the information needed to complete the assessment.

The main objectives of community consultations were to:

- Provide clear and accurate information about the project to the communities;
- Obtain the main concerns and perceptions of the population and their representatives regarding the project;
- Obtain opinions and suggestions directly from the affected communities on their preferred mitigation measures; and
- Identify local leaders with whom further dialogue can be continued in subsequent stages of the project.

The initial public consultations took place between 13 August 2009 and 15 September 2009, the second round of public consultations between 28 September 2009 and 4 October 2009

and the third between 26 and 31 October 2009. Copies of public consultation forms are presented in Volume II of this report, the Public Consultation and Disclosure Report.

6.2 Earlier Consultation Activities

A Scoping exercise was carried out by KPLC between early June and mid-July 2009, using a desk as well as field study. The objectives of the exercise were:

- To familiarize the team with the project area, that is, the existing transmission lines between Kisumu-Lessos-Olkaria and the proposed alternative alignment of the transmission line in the same area;
- To identify critical environmental/ecological and social/economic/cultural issues that should be addressed in the ESIA study; and
- Delineate and define the study boundaries.

During the site visits, the team also had an opportunity to discuss various issues and concerns with the local people, using a public view questionnaire. This questionnaire initially sought to obtain general information from the public, including respondent name(s), address, telephone contacts, occupation, and residential place in respect to the project site.

The second section of the questionnaire sought to explore the views of the respondents regarding impacts from the proposed project. Areas mentioned included the natural environment; land acquisition; displacement of structures for line corridors and service roads; employment; economic development; socio-economic change; improved access to infrastructure; landscape; soil erosion; solid waste generation; air quality; noise during construction; and public safety, among others. Additional comments were also sought.

The Scoping Study was submitted to the National Environment Management Authority (NEMA) and included presentation of Terms of Reference (ToRs) for approval, as per the requirements of the Kenyan EIAs/EA Regulations. The ToRs were approved on 31 July 2009.

The impacts identified during scoping included:

- *Impacts of Land Acquisition & Resettlement during Planning;*
- *Impacts on the Hell's Gate National Park during Construction and Operation;*
- *Impacts on Forests during Construction and Operation;*
- *Impact on Soil Erosion during Construction and Operation;*
- *Impacts on Landscape during Construction and Operation;*
- *Archaeological, Cultural and Historical Sites during Construction;*
- *Noise/Vibration during Construction and Noise during Operation;*
- *Health and Safety Impact during Construction and Operation;*
- *Impact on Birds during Operation;*
- *Air Pollution during Construction;*
- *Waste Generation during Construction.*

The recommendations made in the Scoping Study are as follows:

- The significant identified issues/impacts should be studied and analysed further to determine their magnitude;
- Appropriate mitigation measures to reduce/prevent impacts identified both for those considered significant and not significant should be identified in the proposed ESIA Study;
- An appropriate monitoring plan for all the adverse impacts identified should be developed. Particularly, special attention shall be paid to the monitoring plan for soil erosion, vegetation clearing, accident & health and social issues such as resettlement if any. For this to be possible, the proposed ESIA Study should establish the existing

baseline conditions for the parameters under investigation, frequency, budget and responsible organisations should be clearly indicated.

6.3 Consultations during ESIA Study Phase

Public consultations for the proposed transmission line were conducted in three rounds, with the first set being held between 13 August 2009 and 15 September 2009, the second round between 28 September 2009 and 4 October 2009, and the third between 26 and 31 October 2009. Appendix 10 outlines dates and venues for the entire consultations. Additionally, a detailed outline of numbers of participants, topics discussed and invitation methods are presented in Volume II of this report.

During the first round of public consultations, 20 key stakeholders were consulted, 25 Government officials, and 45 persons assumed to be within the project influence zone (100 stakeholders in total). During the second round, 495 persons were consulted, and a meeting held with the Soysambu Conservancy management team. 435 persons were consulted in the third round In total, 1030 persons were consulted. The initial consultations provided useful information that assisted in adjustment of the line route to avoid impacts on major investments.

Consultations were held in both English and Kiswahili, at publicly accessible areas (Table 6-1), and based on issues as presented in the Project information Document (PID) in Appendix 6 in the first two rounds of meetings. Notices of meetings were issued one week in advance through letters to local administration (See Appendices 4 & 5) and followed up with telephone calls. An outline of issues discussed during the third round of consultations is presented in Appendix 11.

Locations at which the public meetings were carried out for both the first and second round are presented in the table below:

Table 6-1: Locations for Public Meetings and Consultations

First round (79 people)	Date	Second Round (495 people)	Date	Third Round (435 people)	Date
Kabati area, Naivasha	21.8.09	DCK market centre, Olkaria, Naivasha	28.9.09	Olkaria Sanctuary – South Lake Road, Naivasha	26.10.09
Kayole 'B' area, Naivasha	22.8.09	Olkaria Sanctuary – South Lake Road, Naivasha	28.9.09	Kayole 'B' centre, Naivasha	26.10.09
Mitimingi centre, Elementaita	23.8.09	Kayole 'B' centre, Naivasha	4.10.09	Chief's office, Bagaria, Elementaita	27.10.09
Jogoo centre, Elementaita	23.8.09	Mitimingi centre, Elementaita	29.9.09	Telkom-Ngata-Kirobon centre, Nakuru (Telkom centre)	28.10.09
Karabati centre, Njoro	23.8.09	Jogoo centre, Elementaita	29.9.09	Chief's office, Kamara, Mau Summit	28.10.09
Telkom-Ngata-Kirobon area, Nakuru (Telkom centre)	25.8.09	Telkom-Ngata-Kirobon centre, Nakuru (Telkom centre)	30.9.09	Chief's office, Mau Summit Centre	28.10.09
Jogoo Primary School, Mau Summit	25.8.09	Jogoo Primary School, Mau Summit area	1.10.09	AIC church, Seguton, Timboroa	29.10.09
Market centre, Eldama Ravine,	24.8.09	Chief's office, Timboroa	1.10.09	Chief's office, Mumberes,	29.10.09

First round (79 people)	Date	Second Round (495 people)	Date	Third Round (435 people)	Date
Koibatek				Koibatek District	
Lessos centre	29.8.09	Lessos centre	2.10.09	AIC church, Lessos centre	29.10.09
Nandi Hills town centre	29.8.09	Nandi Hills town centre	2.10.09	Chairman's compound, Taito Location, Nandi E. District	30.10.09
DC's office, Kisumu	28.8.09	Kibos village, Miwani Location	3.10.09	Kibos village, Miwani Location	30.10.09
		Mamboleo centre, Kisumu	3.10.09	Mamboleo centre, Kisumu	31.10.09

6.4 Applicable Laws, Regulations and Policies to Public Engagement

The Environmental Management and Coordination Act (1999) as well as the Environmental Impact Assessment and Audit Regulations (2003) set out the minimum requirements for stakeholder consultation and engagement. Additionally, the project must also address the consultation and engagement requirements of the international finance institutions, especially JBIC. Further details of the legal and regulatory requirements that apply to the project are provided in Chapter 2 of this report.

6.5 Public Consultation Method

The public consultation method used is described in Section 1.6 of this report, and included the dissemination of information using a Public Information Document (PID) prepared for the study, focus group discussions, public meetings, and guided interviews.

6.6 Stakeholder Engagement

The public consultation and disclosure programme was designed and implemented so as to foster community awareness of the proposed project, and to provide opportunities for community input and involvement. Careful attention was made to the various national and international principles/policies/guidelines (as previously noted) as they relate to consultation.

6.7 Stakeholders Analysis

6.7.1 Description of Stakeholders

The consultation programme was developed and implemented taking into account the various areas of influence. Based on these recognized areas of influence, Table 6-2 below outlines the stakeholder groups that were consulted.

Table 6-2: Identified Stakeholder Groups

Stakeholders	Consultation Activities
General Public	This involved making documentation available to all interested parties. These stakeholders were supplied with the Public Information Document (PID), and encouraged to voice their concerns either verbally, or through telephone and mail, at their convenience.
Government Agencies	Meetings were held with various government agencies and Ministries
Local Communities	Contact was made with District government officials, including District Commissioners, District Officers, Chiefs, Sub-Chiefs and Village elders, to inform them of the project
Project Affected Persons	PAPs include those that own property, live and/or are involved in economic activities (typically farming) within the transmission line corridor and associated activities. Vulnerable groups are considered under this group, and include women, the elderly, children (particularly orphans), the poor, and people with disabilities.
Institutional Stakeholders	These include those institutions that are situated within the transmission right-of-way / wayleave.

6.8 Stakeholders Consulted

6.8.1 Public Consultation Rounds

Public consultations for the proposed transmission line were conducted in three rounds, with the first set being held between 13 August 2009 and 15 September 2009, the second round between 28 September 2009 and 4 October 2009, and the third round to be confirmed.

6.8.2 Initial Consultations (13 August to 15 September 2009)

Initial consultations with the project proponent and key stakeholders related to the project are important to provide a comprehensive background during the subsequent project activities.

The representatives of the Project Proponent contacted during the initial consultations included:

- KPLC SHE Manager;
- KPLC Environment and Social Specialist;
- KPLC Socio-economist;
- KPLC Transmission Engineer;
- KPLC Civil Engineer & Lead EIA Expert;
- KPLC Chief Wayleaves Officer;

Detailed contacts of the above experts as well as minutes of already held meetings are included in Appendix 3. A recurring issue arising from consultations held at the initial stage was the expected accuracy of public consultations, yet the confirmed trace of the proposed line has not yet been confirmed. This would also affect the decision on whether a Resettlement Action Plan (RAP) is necessary.

(a) Institutional Stakeholders

Consultative Meetings at district and local levels included discussions with district and regional officers, specialists, key informants and other knowledgeable people. These consultations were conducted as either:

- Direct, Personal Interviews With Selected Informants, or
- Focus Group Meetings with authorities and technical personnel (e.g. District Planners, agricultural extension services, NEMA officers, DCs, Dos, Chiefs, Sub/Assistant Chiefs, village elders and Irrigation Engineers).

Typically, the Agenda for these consultations was:

- Presentation of the proposed project;
- Defining the institutional framework;
- Discussing recent experience in the Region / District with respect to compensation eligibility criteria and entitlement packages;
- Obtaining from the authorities their environmental and socio-economic concerns and perceptions regarding the proposed irrigation schemes; and
- Discuss the role of the authorities in public information dissemination, monitoring and management plan.

(b) Potential Project Affected Persons (PAPS) and Project Beneficiaries

Dissemination of Project information among communities within the project area is an important aspect of the public participation process and they should be appropriately informed about what is planned. Copies of questionnaires and signature sheets of PAPs consulted for the proposed transmission line are presented in Volume II of this Report.

6.8.3 Second Round of Public Consultations (28 September to 4 October 2009)

The second round of public consultations consisted primarily of public meetings. In addition, a meeting was held with the Soysambu Conservancy management team on 29 September 2009. Copies of the minutes to these meetings as well as copies of original signed forms are included in Volume II of this report.

Public meetings were held in the following areas:

- DCK Market Centre, Olkaria, Naivasha (28 September 2009);
- Olkaria Sanctuary, Naivasha (28 September 2009);
- Kayole 'B' centre, Naivasha (4 October 2009);
- Miti Mingi centre, Elementaita (29 September 2009);
- Jogoo centre, Elementaita (29 September 2009);
- Telkom-Ngata-Kirobon area, Nakuru (30 September 2009);
- Mau Summit area (1 October 2009);
- Timboroa (1 October 2009);
- Lessos centre, Wareng District (2 October 2009);
- Nandi Hills town centre (2 October 2009);
- Kibos village, Miwani Location (3 October 2009); and
- Mamboleo centre, Kisumu District (3 October 2009).

6.8.4 Third Round of Public Consultations (26 to 31 October 2009)

The third round of public consultations consisted primarily of public meetings. Copies of the minutes to these meetings as well as copies of original signed forms are included in Volume II of this report.

Public meetings were held in the following areas:

- Olkaria Sanctuary, Naivasha (26 October 2009);
- Kayole 'B' centre, Naivasha (26 October 2009);

- Bagaria centre, Elementaita (27 October 2009);
- Telkom-Ngata-Kirobon area, Nakuru (28 October 2009);
- Kamara Location, Mau Summit (28 October 2009);
- Mau Summit – Chief's office (28 October 2009);
- Seguton, Timboroa (29 October 2009);
- Mumberes, Koibatek District (29 October 2009);
- Lessos centre, Wareng District (29 October 2009);
- Taito Location, Nandi E. District (30 October 2009);
- Kibos village, Miwani Location (30 October 2009); and
- Mamboleo centre, Kisumu District (31 October 2009).

6.9 Results of the Consultation

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

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

6.9.1 Initial Public Consultations

(a) Issues of High Significance

- Need for comprehensive public consultations;
- Avoid cumulative impact of wayleaves on same people;
- Handle resettlement issues sensitively;
- Concern of possible resettlement;
- Consideration of social cost when resettlement is inevitable;
- Relocation of a village (Kabati) in Naivasha;
- Mandatory and fair compensation for property and trees to PAPs;
- Consideration of vulnerable groups during compensation and resettlement;
- Major impacts on investments – flower farms in Naivasha (copy of affected area of Homegrown off South Lake Road as well as email from Panda Flowers is included in Appendix 7);
- Loss of sensitive ecological habitats;
- Bird migratory routes in Elementaita area;
- Existing airstrips in Elementaita area;
- Effect of transmission lines on sensitive habitats such as Lakes Naivasha, Nakuru, Elementaita, National Parks, and animal sanctuaries/conservancies;
- Consider risk of landslides at Maji Mazuri, as experienced 3-4 years ago.

(b) Issues of Medium Significance

- Employment of locals during construction of the transmission line;
- Soil runoff during construction of towers on steep slopes;
- Risk of landslides during construction on steep slopes;
- Vegetation removal effect on water catchment areas;
- Cutting of trees within wayleave;
- Destruction of buildings within wayleave;
- Need to minimise impacts during construction, including scheduled working hours, reduction of noise, water pollution, solid waste management, and health & safety measures.

- Consider alternative sources of livelihood for PAPs;

(c) Issues of Low Significance

- Involve other public sectors to minimize social impacts;
- Communicable diseases & HIV/AIDs during construction;

Following the first round of public consultations, it was noted that in some areas, including Olkaria, Naivasha and Mamboleo centre, there was high level of investment and settlement. This level of settlement and investment would be expected to be very costly for KPLC in terms of resettlement and compensation. Following discussions between the GIBB Africa and KPLC teams, as well as a site visit on 19 September 2009, further realignment was made of the proposed transmission line as follows:

- To run further inward along South Lake road, so as to avoid huge investment in flower farms and accompanying infrastructure, including Homegrown, Sher Karuturi, among others;
- To run further east of the proposed transmission line after Naivasha town so as to avoid Kabati estate (Guest Inn), GK Naivasha medium prison, and Flower Business Park (including Panda flowers);
- To deviate south at Kibos River and connect to Mamboleo substation south of the Mamboleo shopping centre, so as to avoid heavy settlement.

The above realignment influenced the centres in which the second round of public meetings was held.

A summary of comments from each group of stakeholders is presented in Volume II of this report.

6.9.2 Second Round of Public Consultations

(a) Issues of High Significance

- Consider replacing existing 132kV line with proposed 220kV one, instead of constructing a completely new line;
- Confirmation required on exact transmission line route;
- Need for comprehensive public consultations;
- Inadequate electricity supply;
- Community sensitization prior to project commencement;
- Consider psychological effects/trauma in compensation planning;
- Transparent wayleave acquisition procedure;
- Resettlement and adequate compensation;
- Relocation of line at Kayole 'B' in Naivasha to avoid densely settled area;
- Lessos – specific proposals for compensation and resettlement packages by the local community.
- 2-3 acres of forest land required for the new Timboroa / Makutano sub station;
- Bird fatalities – Elementaita area.

(b) Issues of Medium Significance

- Need for employment opportunities;
- Safety / health concerns associated with new line;
- Risk of fire from existing transmission lines during rain and lightning (insulation required in some areas);
- High demand on land by other infrastructure developments, including roads, oil pipeline, fibre optic cable;
- Change name of proposed sub station to Makutano, or move it to Timboroa if name is to remain the same.

(c) Issues of Low Significance

- High cost of domestic electricity;
- Confirmation on project commencement duration and dates;
- Security provision / employment from community.

A summary of comments from the stakeholders is presented in Volume II of this report.

During this round of consultations, many proposals were additionally made from the public concerning expected Community Social Responsibility (CSR) by KPLC. These requests are also summarised in Volume II of this report.

6.9.3 Third Round of Public Consultations

(a) Issues of High Significance

- 1999- David Komina (mrefu) struck by sparks from existing transmission line during heavy rains;
- Emphasis on community sensitization & education prior to transmission line construction;
- Don't rush compensation process;
- Concern on compensation discrepancies with past projects, eg. Kenya Pipeline;
- Worry about possible areas for resettlement;
- Suggestion to follow existing road, instead of acquiring new land;
- Consider sharing wayleaves with existing infrastructure to reduce land requirements;
- Unique community in Kibos, might not integrate well with neighbouring communities, hence worry on resettlement (Muslims & rest of area Christian).

(b) Issues of Medium Significance

- Good existing relationship between KPLC, KenGen & community;
- Training for community about electricity;
- Unhappy about unannounced lopping of trees during wayleave maintenance;
- Question on insurance if accident takes place from transmission line;
- Some areas have negative experience of no compensation with recent road expansion & pipeline projects;
- Employment opportunities during transmission line construction?
- Land currently under existing transmission line considered useless.

(c) Issues of Low Significance

- Concern about project commencement date & duration;
- Clarification on land ownership documents considered for compensation;
- KPLC requested to maintain safety signage on existing towers;
- Beware of corruption during compensation.

A summary of comments from the stakeholders is presented in Volume II of this report.

During this round of consultations, additional proposals were also made from the public concerning expected Community Social Responsibility (CSR) by KPLC.

6.10 Recommendations for Future Public Consultations

Findings from the public consultations presented in this report fulfil the legal and regulatory requirements of the project planning phase. These findings are more elaborately presented in the Public Consultation and Disclosure Plan that accompanies this report (Volume II).

Future public consultations should be guided by the above plan as it makes proposals and recommendations for consultation activities to be carried out during the construction, operation and implementation phases of the proposed transmission line project.

7 ASSESSMENT OF POTENTIAL IMPACTS & PROPOSED MITIGATION MEASURES

7.1 Feasibility Study & Preliminary EIA, 2003

The Feasibility Study and Preliminary Environmental Impact Assessment for the Olkaria-Lessos-Kisumu Transmission Line was carried out in April 2003 by ETC East Africa Ltd. Included in the study was a review of the environmental policy, institutional and legal framework in Kenya, a description of the project, a description of the existing environment of the project area, an analysis of environmental impacts and alternatives, and a mitigation plan.

Three transmission lines and two substations were assessed in the feasibility study, namely Kamburu-Meru, Olkaria-Lessos and Lessos-Kisumu. Additionally, the Naivasha and Lanet substations were assessed for purposes of rehabilitation.

The preliminary Environmental Impact Assessment identified the following positive impacts:

- Creation of employment opportunities for the local community;
- Improved access roads associated with the project implementation;
- Promotion and acceleration of business opportunities in the area;
- Modernisation and expansion of transmission infrastructure that will address the increasing demand for power; and
- Augment the current 220kV linkages and improve voltage control, stability and system reliability.

The negative impacts included:

- Clearing and trampling of vegetation;
- Excavation of soils and other geological formations;
- Loss of habitat and biodiversity;
- Disturbance of floral and faunal communities;
- Loss of land and property;
- Management of labour camps;
- Visual intrusion;
- Impacts on indigenous people – the Ogiek in the Mau Forest Complex; and
- Loss or damage to archaeological sites and cultural property.

7.2 Scoping Report, 2009

The scoping study for the transmission lines was carried out by KPLC at desk level as well as through a field study from 9 June 2009 to define the scope and structure of the study. The field study for the scoping exercise was conducted on 22-24 June, 5 July, 17-19 July and 21 July 2009.

The Scoping Study was submitted to the National Environment Management Authority (NEMA) and included presentation of Terms of Reference (ToRs) for approval, as per the requirements of the Kenyan EIAs/EA Regulations. The ToRs were approved on 31 July 2009.

The impacts identified during scoping include:

- Impacts on land acquisition and resettlement during planning;
- Impacts on the Hell's Gate National Park during construction and operation;
- Impacts on forests during construction and operation;

- Impact on soil erosion during construction and operation;
- Impacts on landscape during construction and operation;
- Archaeological, cultural and historical sites during construction;
- Noise/ vibration during construction and noise during operation;
- Health and safety impact during construction and operation;
- Impact on birds during operation;
- Air pollution during construction; and
- Waste generation during construction.

7.3 Definition and Classification of Environmental Impacts

An environmental impact is any change to the existing condition of the environment caused by human activity or an external influence. Impacts may be:

- Positive (beneficial) or negative (adverse);
- Direct or indirect, long-term or short-term in duration, and wide-spread or local in the extent of their effect.

Impacts are termed cumulative when they add incrementally to existing impacts. In the case of the proposed KPLC Olkaria-Lessos-Kisumu transmission line project, potential environmental impacts would arise during the construction and operation phases of the project and at both stages positive and negative impacts would occur.

7.3.1 Impact Significance

The purpose of this ESIA study report is to identify the significant impacts related to the project or activity under consideration and then to determine the appropriate means to avoid or mitigate those which are negative.

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

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

7.3.2 Impact Matrix

An impact matrix is a simple but effective tool for identifying the possible impacts of project activities on the environment and this has been done for the proposed KPLC Olkaria-Lessos-Kisumu transmission line project (see Table 7-1).

Here, the activities proposed to be carried out during the construction and post-construction or operational phases are arrayed against a selection of environmental factors that are deemed relevant, or which may be affected indirectly as a result of project activities.

The construction phase activities have been sub-divided into the two key areas of activity comprising:

- Procurement, Manufacturing and Transportation; and
- Construction Activities.

The impact matrix should not be misinterpreted to mean that all the identified impacts would occur during implementation of the project. However, the matrix does serve to identify the potential impacts and significant concerns and this leads to the next step of the EIA process, mitigation, which considers the appropriate measures to remove or ameliorate the adverse impacts that have been identified. At this stage measures to enhance the positive aspects of the development can also be devised.

7.3.3 Impact Description and Mitigation

The following sections discuss the major project activities and the potentially significant impacts related to those activities. For ease of discussion and presentation, the corresponding impact mitigation measures are presented after the discussion of each impact. A summary of the impacts is given afterwards in Table 7-2.

Table 7-1: Environmental impact identification matrix for KPLC Olkaria-Lessos-Kisumu Transmission Line Project

+ Positive interaction or impact; - Negative interaction or impact; ++ Major impact; -- Minor impact		ENVIRONMENTAL FACTORS																		
		Visual and Aesthetic Impacts	Land take	National Parks and Conservancies	Impacts on Forests	Impacts on Wetland Ecosystems	Impacts on Avifauna	Impacts on Aviation	Archaeological, Cultural & Historical sites	Public Health	Social Impacts	Occupational Health & Safety impacts	Soil Erosion Impact from vegetation clearance	Earth & construction material sourcing	Hazardous materials	Waste Management	Air & Dust Emissions	Fuel & Chemical Storage on Site	Traffic Congestion/ Road Wear & Tear	Labour Force Management
PROJECT ACTIVITIES	**DESIGN**																			
	Transmission line design	--	--	-	--	--	--	--	-			-								
	Substations	--	--		-			-			--	-	--	--	-	-	-	-	-	+
	Site survey	-	-	-	-	-			-		-		-							
	Route clearance		-	-	--	--			-		--		--	--		-	-		-	-
	Wayleave acquisition		--	-	--	-			-		--	-	-							
	CONSTRUCTION																			
	Civil works/ foundations	-	--	-	--	--			-		--	-	--	-		-	-		-	+
	Tower erection	--	--	-	--	--	--	--	-		-	-	--			-	-	-	-	+
	Conductor stringing			-	--	-	--	--			-	-				-	-		-	+
	Tensioning and sagging	--		-	--	-	--	--			-	-	-			-	-	-	-	+
	OPERATION																			
	Testing & commissioning		-		-					--	-	-			-		-	-	-	+
	Surveillance		--	-	-	-		-	-	-	-	-	-				-		-	+
	Emergency maintenance & repairs		--	-	--	--	-	--	-	--	--	-	-	-	-	-	-	-	-	+
	Vegetation control	--	--	-	--		-		-		--	-	--				-		-	+

+ Positive interaction or impact; - Negative interaction or impact; ++ Major impact; -- Minor impact		ENVIRONMENTAL FACTORS																		
		Visual and Aesthetic Impacts	Land take	National Parks and Conservancies	Impacts on Forests	Impacts on Wetland Ecosystems	Impacts on Avifauna	Impacts on Aviation	Archaeological, Cultural & Historical sites	Public Health	Social Impacts	Occupational Health & Safety impacts	Soil Erosion Impact from vegetation clearance	Earth & construction material sourcing	Hazardous materials	Waste Management	Air & Dust Emissions	Fuel & Chemical Storage on Site	Traffic Congestion/ Road Wear & Tear	Labour Force Management
	Annual cleaning & checking of circuit breaker connections - substations		-		-			-				-			¦	-	-	-	-	+
PROJECT ACTIVITIES	**DECOMMISSIONING**																			
	Lower conductors & shield wires	--	--	-	--	--	+ +	--	-		--	-	-		-	-	-	-	-	+
	Spool cables & remove from RoW	--	--	-	--	--	+	-	-		--	-	-			-	-	-	-	+
	Dismantle towers	--	--	-	--	-	+	-	-		-	-	-			-	-	-	-	+
	Dispose of tower foundations	-		-	--	-	+		-		-	-	-	-		-	-	-	-	+
	Soil restoration	++	+	+	+ +	+			+		+	-	++	++			-			+
	Revegetation	++	+	+	+ +	+ +	+		+		+		++	+			-			+

7.4 Summary of Potential Impacts

An overview of the project design components has been presented in Chapter 4.

The summary of the main potential impacts of the proposed project is listed in Table 7-2 below and analysed into different categories based on the stakeholders' views and perceptions as well as the consultant's previous experience in undertaking EIAs of construction projects.

Table 7-2: Summary of potential impacts

Environmental and Social Impact	Positive / Negative	Direct / Indirect	Temporary / Permanent	Major / Minor	Occurrence	
					Construction	Operation
Improved quality of life.	Positive	Indirect	Permanent/ Temporary	Major	✓	✓
Labour force management	Positive	Direct	Temporary	Minor	✓	-
Increased revenue for KPLC through electricity provision	Positive	Direct.	Permanent	Major	-	✓
Visual and Aesthetic Impacts	Negative	Direct	Permanent	Major	✓	✓
Land Take	Negative	Direct	Permanent	Major	✓	✓
National Parks & Conservancies	Negative	Indirect	Permanent	Minor	✓	✓
Impacts on Forests	Negative	Direct	Permanent	Major	✓	✓
Impacts on Wetland Ecosystems	Negative	Direct	Permanent	Major	✓	✓
Impacts on Avifauna	Negative	Direct	Permanent	Major	✓	✓

Environmental and Social Impact	Positive / Negative	Direct / Indirect	Temporary / Permanent	Major / Minor	Occurrence	
					Construction	Operation
Impacts on Aviation	Negative	Direct	Permanent	Major	✓	✓
Archaeological, Cultural & Historical Sites	Negative	Indirect	Permanent	Minor	✓	-
Public Health	Negative	Direct	Permanent	Major	-	✓
Social Impacts	Negative	Direct	Permanent	Major	✓	-
Occupational Health & Safety Impacts	Negative	Direct	Permanent	Minor.	✓	✓
Soil Erosion Impacts from vegetation clearance	Negative	Direct	Permanent	Major	✓	✓
Earth & construction material sourcing	Negative	Direct	Temporary	Major	✓	-
Hazardous materials	Negative	Direct	Temporary	Minor	✓	✓
Waste management	Negative	Direct	Temporary	Minor	✓	✓
Air, noise & dust emissions	Negative	Direct	Permanent	Minor	✓	✓
Fuel & chemical storage on site	Negative	Direct	Permanent	Minor	✓	✓
Traffic congestion/ road wear & tear	Negative	Direct	Temporary	Minor	✓	-

7.5 Key Project Impacts

The following key project impacts have been identified based on comments received by project stakeholders. Each of the impacts is dealt with, in turn, in the following subsections. Additionally, impacts of a more routine nature that are common to large construction projects, and for which effective mitigation measures are well known, are dealt with directly in the Environmental and Social Management and Monitoring Plan provided in the next chapter:

- Improved quality of life;
- Creation of employment;
- Increased revenue for KPLC through electricity provision;
- Visual and Aesthetic Impacts;
- Land take;
- Impacts on National Parks and Conservancies;
- Impacts on Forests;
- Impacts on Wetland Ecosystems;
- Soil Erosion Impact from Vegetation Clearance;
- Impacts of Construction Material Sourcing (eg. Quarrying);
- Impacts on Fauna and Avifauna;

- Impacts on Aviation;
- Impacts on Archaeological, cultural and historical sites;
- Impacts on Public Health;
- Social Impacts;
- Occupational Health & Safety Impacts;
- Hazardous Materials;
- Waste Management;
- Air and Dust Emissions;
- Noise;
- Impacts of Fuel and Chemical Storage on Site;
- Traffic Congestion/ Road Wear and Tear;
- Labour Force Management;
- Contractor Code of Conduct;
- Environmental and Social Monitoring.

7.6 Improved Quality of Life

Improvement of the quality of life of the local community is anticipated to arise from improved local socio-economy. This is anticipated from:

- Increased growth of business opportunities influenced by the Construction workforce mainly anticipated to promote the following types of businesses:
  - Local retail businesses;
  - Taxi / Boda Boda Operators
- Health, Environment and Safety Responsibilities of the project that would promote improved health, environment and safety issues of the project in relation to various stakeholders;
- Implementation of grievance resolution mechanisms by KPLC;
- Implementation of community social responsibility and development initiatives by KPLC, as corporate citizens, or a "good neighbour," underscoring the project's willingness to generate positive development benefits in the wider project community within the project areas.

7.7 Creation of Employment

The proposed project will create job opportunities immediately during construction of the proposed transmission line, and eventually due to availability of electricity for activities such as welding, photocopying, etc. During construction, it is expected that construction labour be sourced from communities through which the transmission line project will traverse, as further mentioned in Section 7.27.

7.8 Increased Revenue for KPLC through Electricity Provision

The current national distribution reaches only about 18% of the population, which has caused the Government to call for increased power generation and review of the distribution network. Power supply to the national grid would be expected to increase with the proposed transmission line project, reducing the unreliability and instability of the the present grid infrastructure. Power outages would also reduce. KPLC would then be able to obtain new clients, accompanied by increased revenue.

7.9 Visual and Aesthetic Impacts

The overall aesthetic effect of a transmission line is likely to be negative to most people, especially where proposed lines would cross natural landscapes. The tall steel lattice structures may seem out of proportion and not compatible with rural and agricultural landscapes or wetlands. Some people may find transmission lines bordering their property particularly disruptive to scenic views. Some people however, do not notice transmission lines or do not find them objectionable from an aesthetic perspective. To some, the lines or other utilities may be viewed as part of the infrastructure necessary to sustain our everyday lives and activities. To others, new transmission lines may be viewed in a positive light because it represents economic development.

Aesthetic impacts depend on:

- The physical relationship of the viewer and the transmission line (distance and sight line);
- The activity of the viewer (living in the area, driving through or sightseeing) ;
- The background, or context, of the transmission line, such as whether the line stands out or blends in.

A transmission line can affect aesthetics by:

- Removing a resource, such as clearing fences that provide visual relief in a flat landscape;
- Degrading the surrounding environment (intruding on the view of a landscape);
- Enhancing a resource (evoking an image of economic strength in a developing business or industrial area).

7.9.1 Landmarks near the project area

The proposed transmission line is set in the varied landscape that stretches from Olkaria, Naivasha, Elementaita region, and Nakuru on the Rift Valley floor, to the Nandi escarpment, moving on to the Kano Plains and the Lake Victoria basin. A landscape survey was carried out to analyse the magnitude and significance of the proposed transmission line on the landscape.

During the survey of the existing line route, it was noted that from Olkaria to Kisumu, the area is dotted with varied landscape vocabulary and landmarks, including:

- Nearby Mount Longonot;
- Olkaria geothermal springs and stations;
- Lake Naivasha;
- Lake Elementaita;
- Lake Nakuru;
- Western scarp of the Rift Valley, including Lessos and Nandi Hills areas;
- Kano Plains,
- Lake Victoria;
- Settlements dispersed along the entire proposed transmission line route.

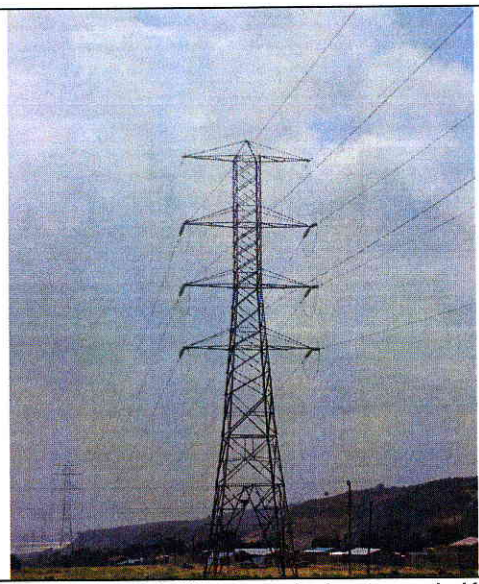
7.9.2 Tower Design

In any design composition, the repetitive element (motif) plays a big role in the overall scheme. From the extensive photo survey carried out, it was noted that the design composition of the existing towers is too busy, with many lattice members, gigantic and overbearing. It would be be possible to make the towers thinner but achieve the necessary structural integrity, clearances, and also reduce the visual impact.

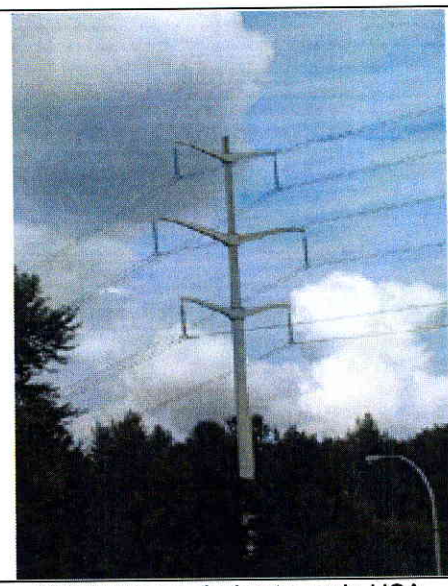
Examples are presented below of the existing towers found in Kenya, and those available elsewhere, for example, USA and China. The towers from USA and China are less busy,

thinner and less intimidating. They visually disappear and blend with the landscape when placed at far distances.

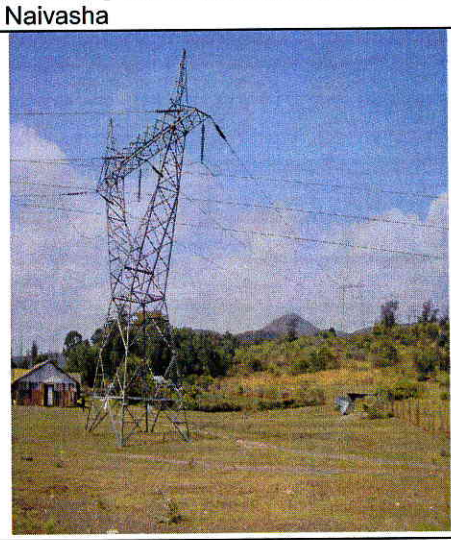
Fig 7-1: Typical tower designs



View of existing 132kV transmission tower in Kabati area, Naivasha



View of 230kV transmission tower in USA



View of existing 132kV transmission tower adjacent to DCK market, Olkaria, Naivasha

View of 220kV transmission tower in China

7.9.3 Scale/ Proportion

At 120 ft (36 m) height, the lattice-type tower completely dwarfs a human being of average height (1.75m). The elevation of a typical tower, as expected for the proposed transmission line, is presented visually in relation to other every-day objects:

Fig 7-2: Typical Lattice-type elevation of tower in relation to human, trees, saloon car and bus

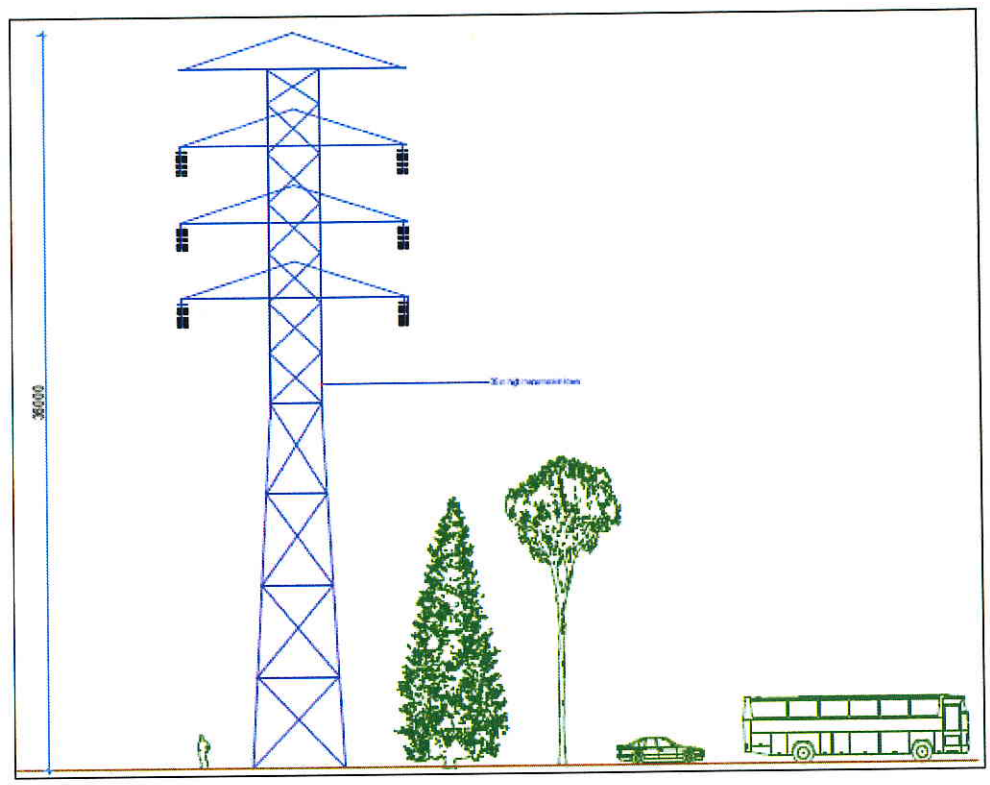
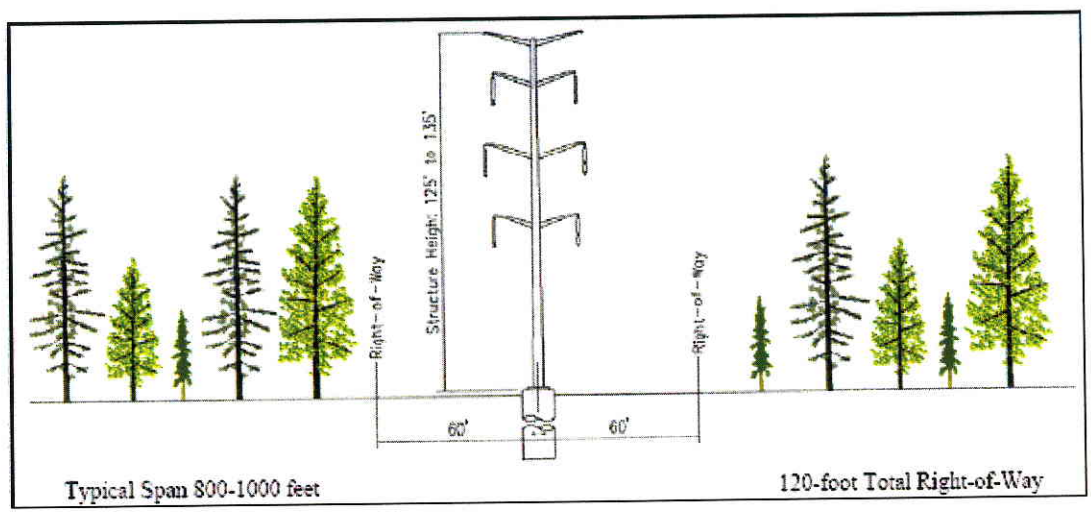
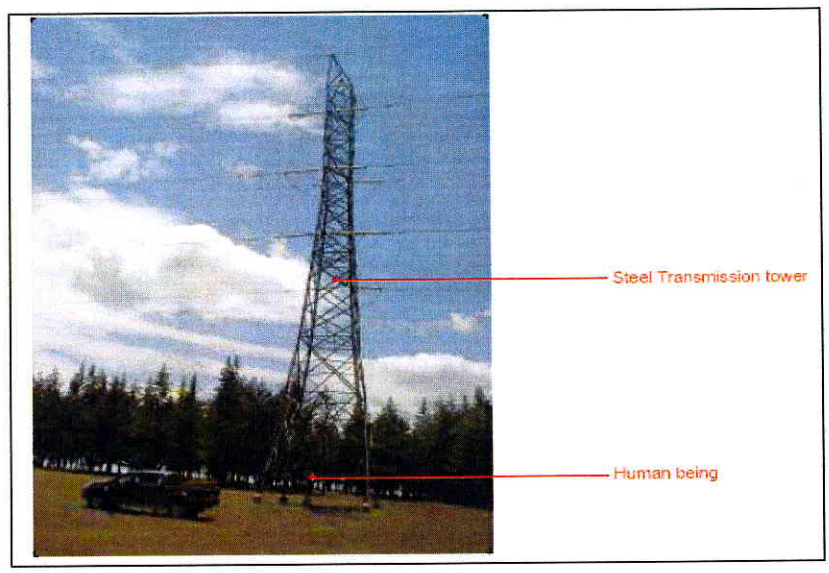


Fig 7-3: Visual impact of typical aesthetic-type tower in a forest



The photograph below additionally confirms the relative height of one of the towers along the existing 132kV line at the proposed Timboroa/ Makutano sub station site, as taken with one of the GIBB team members.

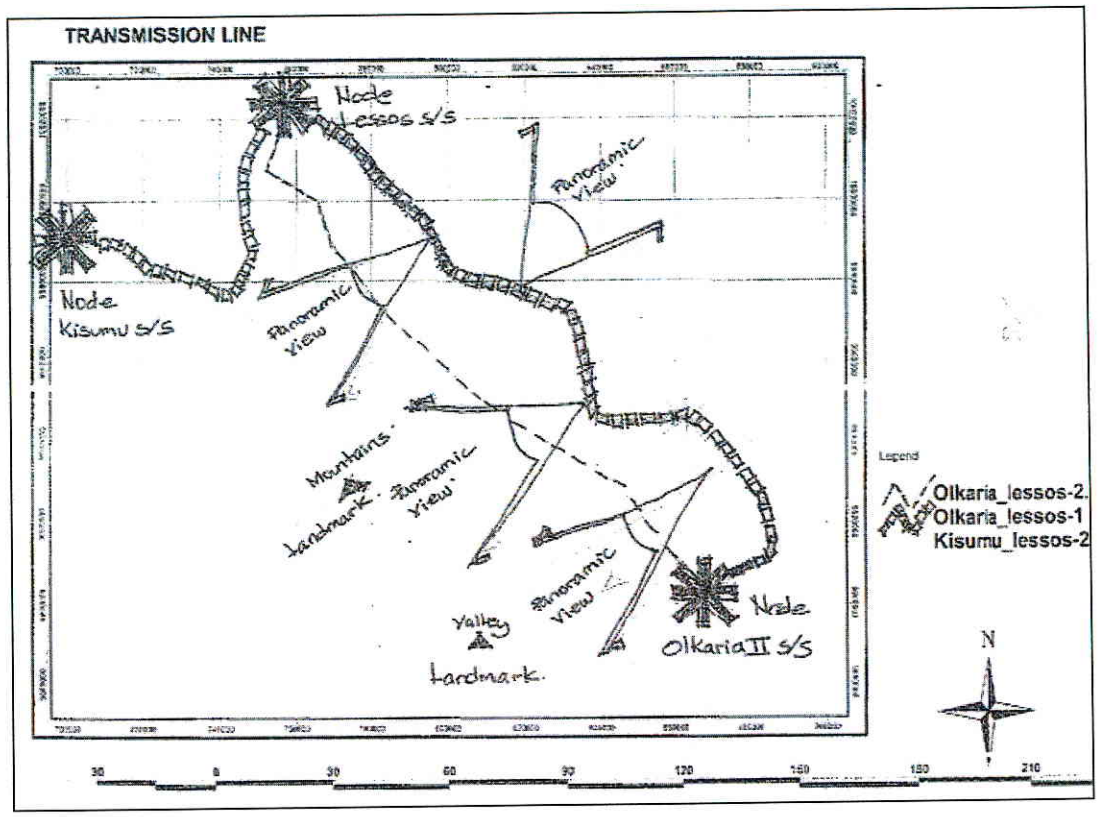
Fig 7-4: Elevation of tower in relation to human



7.9.4 Contextual Analysis

It is expected that the introduction of the proposed transmission line will have a great visual impact on the landscape, especially on the Rift Valley floor, in areas such as Lakes Naivasha, Elementaita and Nakuru, which place a high value on the aesthetic / wilderness environment. The figure below presents the overall contextual analysis of the proposed transmission line with views towards the transmission line at the points indicated, vis-à-vis the surrounding landscape:

Fig 7-5: Project Contextual Analysis



It was considered important to further analyze the varying visual impacts of the proposed transmission line on various contexts. The proposed line is expected to traverse the following general contexts:

- Shrub land;
- Residential settings;
- Agricultural land;
- Forest land
- Wilderness;
- Hills and ridges;
- Derelict land, eg. quarry land;
- Transport infrastructure, eg. Roads, railway; and
- Substations.

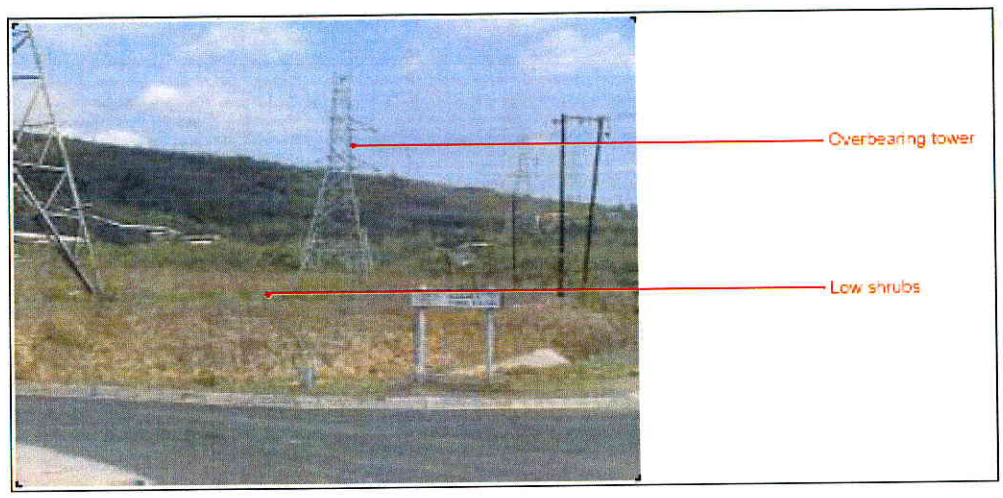
Six target areas of tourist and scenic value were also given special attention, and included:

- Lake Naivasha;
- Lake Elementaita;
- Lake Nakuru;
- Mau Escarpment;
- Nandi Escarpment; and
- Nandi Hills.

(a) Shrub land

In this area, the metallic grey towers stand out against the light green shrub background, visually making the towers intruders in the landscape. This is the case in areas such as Olkaria, as depicted in the figure below:

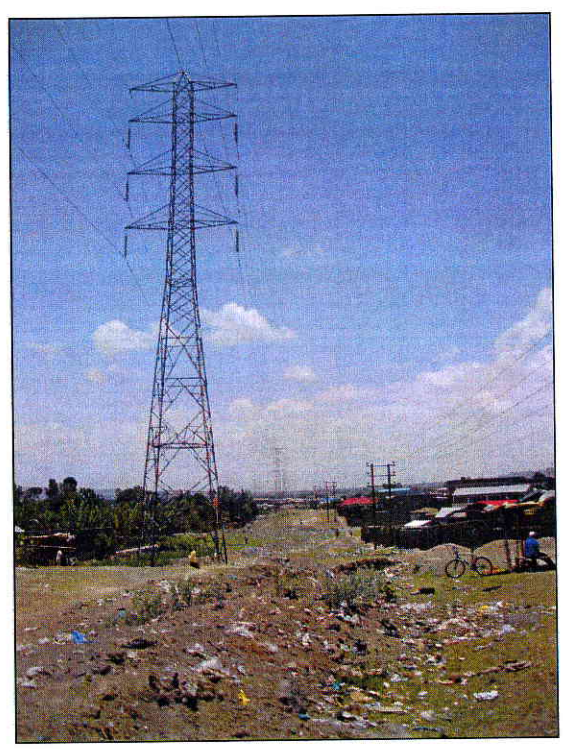
Fig 7-6: Visual impact of transmission line and towers on shrub land



(b) Residential settings

In the residential areas, the fabric is mostly urban, with the architecture being mostly single-storey / double-storey masonry structures. In these settings, the towers are still massive and overbearing, because an average two-storey house attains a maximum height of approximately 7m. This is expected to be the case in the urban areas traversed along the proposed transmission line route. The figure below was taken in Nakuru town:

Fig 7-7: Visual impact of transmission line and towers on residential settings



(c) Agricultural land

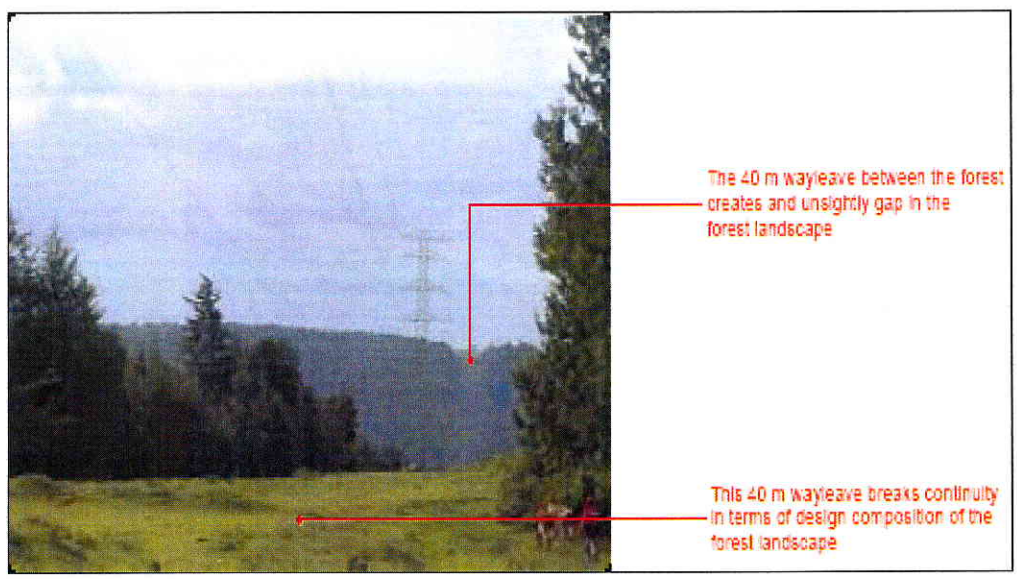
In this area, the metallic grey towers stand out against the green background, visually making the towers intruders in the landscape. This is the case in areas such as Nandi Hills, as depicted in the figure below:

Fig 7-8: Visual impact of transmission line and towers on agricultural land

(d) Forest land

As in shrub and agricultural land, the metallic grey towers also stand out against the green background, visually making the towers intruders in the landscape. This is the case in areas such as Timboroa forest, as depicted in the figure below. From the field studies conducted, it was noted that the visual effect of the transmission line and towers is most devastating on forest land.

Fig 7-9: Visual impact of transmission line and towers on forest land – Timboroa



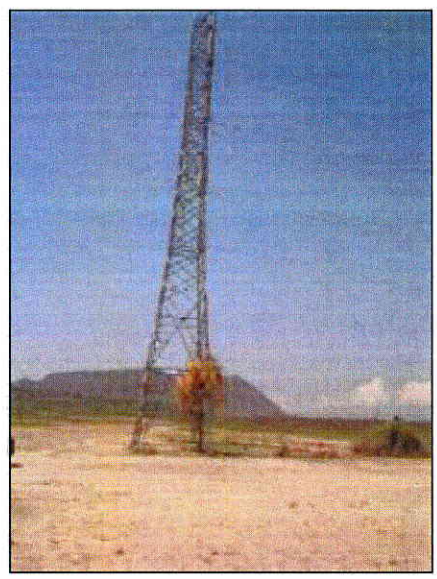
Below is an additional photograph, taken within Kibabet Tea Estate in Nandi Hills, in the forest lot within the larger tea estate:

Fig 7-10: Visual impact of transmission line and towers on forest land – Nandi Hills

(e) Wilderness

The areas surrounding Lakes Naivasha, Elementaita and Nakuru are considered scenic sites, and valued for their wilderness. Due to the general topography of the regions, few natural features in this area protrude above the general landscape. In the case of Elementaita region, for example, the beautiful 'sleeping giant' shaped hill is obstructed in some cases by transmission towers, as depicted below:

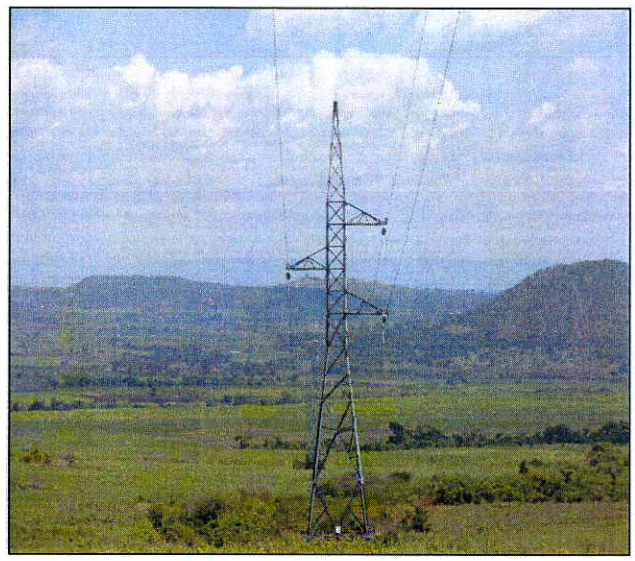
Fig 7-11: Visual impact of transmission line and towers on wilderness landscape



(f) Hills and Ridges

Areas within the proposed transmission line route such as the Mau Escarpment, Nandi Escarpment and the Nandi Hills, are also considered for their scenic value. In these areas, the existing transmission line and towers also intrude visually as seen below from Nandi Hills. It is expected that the level of visual intrusion will increase in these areas, if mitigation measures suggested elsewhere in this report are not incorporated during the proposed project.

Fig 7-12: Visual impact of transmission line and towers on hills and ridges

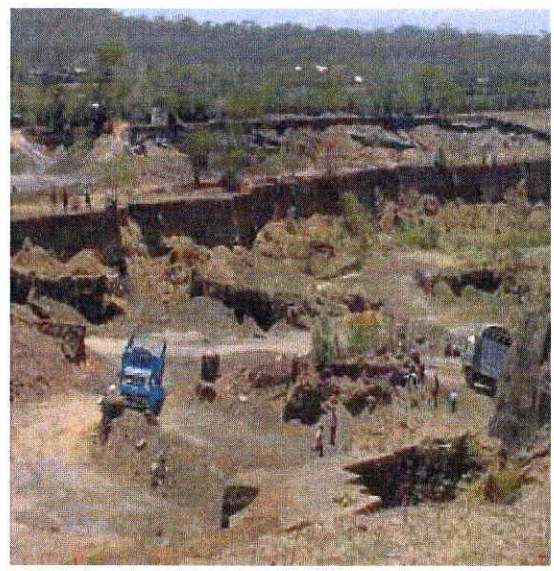


(g) Derelict land, eg. Quarry land

A variety of areas considered derelict were encountered during the field studies. These unpleasant parcels of the landscape are generally under-utilized, and as part of initial reclamation plans, services including power lines could be passed here.

Fig 7-13: Derelict land sites

Quarry site at Naivasha G.K. prison

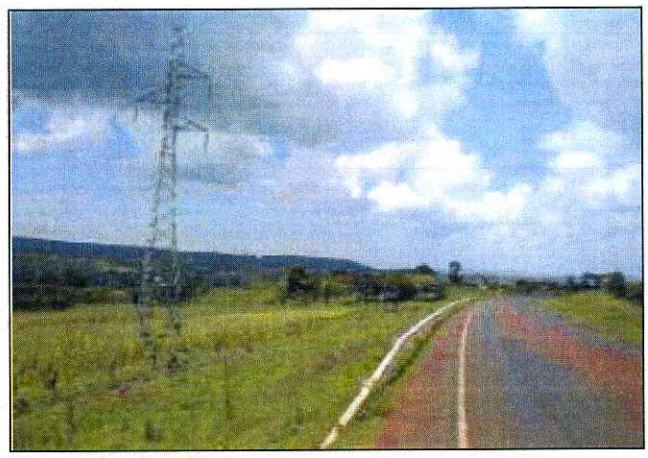


Sand harvesting site behind L. Nakuru National Park

(h) Transport Infrastructure, eg. Roads, Railway

In cases where the existing transmission line was running parallel to the road, it was noted that in cases where the tower was close to the road, it obstructed/ curtailed the scenic and attractive views of the mountains and valleys beyond. Siting of infrastructure is conventionally 'lumped' together for convenience, maintenance and safety purposes. Nonetheless, caution should be exercised when siting the proposed towers to reduce the visual impact of these structures on the surrounding environment.

Fig 7-14: Existing transmission line running parallel to main road A104 after the Njoro turn-off



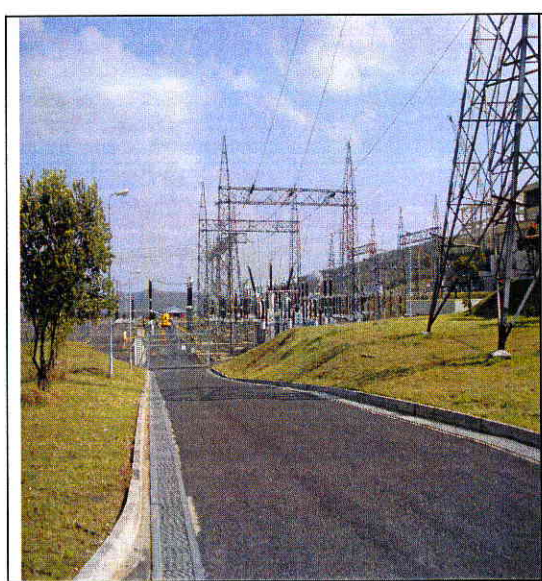
(i) Substations

Existing substations along the proposed transmission line include:

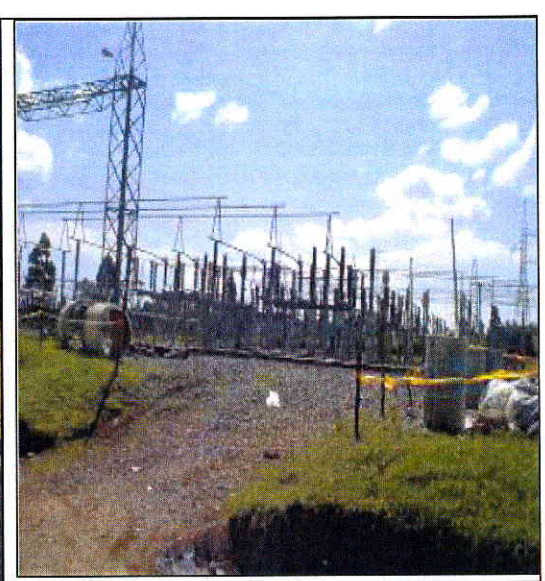
- Olkaria;
- Lessos;
- Mamboleo, Kisumu.

The proposed transmission line is expected to take off and terminate at the sub stations. Each of these substations occupies substantial land. Additionally, these substations have a very large component of hard landscape, including paving slabs, ballast, and hardened ground. The steel poles and transformers further kill the natural landscape. With these areas, an important mitigation will include heavy planting along the perimeter, to screen off the internal hard landscape. A view of the existing sub stations is presented in the figure below:

Fig 7-15: View of existing sub stations along the proposed transmission line route



View of Olkaria II substation



View of Lessos substation

View of Mamboleo substation, Kisumu

7.10 Land Take

Land affected by the construction and operation of the proposed transmission line falls into the following categories:

- Transmission Lines:
  - Right-of-Way
  - Wayleave;
  - Temporary land take for construction purposes;

- Sub-stations:
  - Permanent land acquisition;
  - Temporary land take for construction purposes.

7.10.1 Transmission Lines

(a) Right-of-Way (RoW)

The Right-of-Way is the land required for a maintenance track under the line and the location of the towers. This corridor is 5m (2.5m on either side of the centreline) in width which suffices for both the access path and the four legs of towers.

KPLC will determine whether land falling within the 5m wide Rights-of-Way will remain the property of its current owners (land titles would then not be transferred) or whether it should be fully transferred to KPLC. This land must be accessible at all times by KPLC for maintenance purposes. Whether land titles are transferred or not, land falling in the Right-of-Way is deemed not to have any residual value for its current owner, and should, therefore, be compensated in full to its present owners. This is a sentiment that was also strongly expressed by landowners in Ol'Lessos, during the public consultations.

(b) Wayleave

The Wayleave is recognised as the safety corridor outside of which negative impacts from transmission lines are assumed to be negligible. The width of the corridor depends on the line voltage. The Kenyan standard is a 40m wide corridor for a 220kV transmission line.

Titles for wayleave land will not be transferred from its present owners; this land will remain their property. This land is, however, subject to the following restrictions:

- No construction is allowed in the corridor; and
- All vegetation is to be kept below 6ft height (1.8m).

In the wayleave outside of the 5m right-of-way, cultivation or other uses of land may continue provided the above-mentioned restrictions are complied with by the owner and the occupants of the land. KPLC is also required to provide the land owners with 3-days notice prior to maintenance works.

7.10.2 Sub stations

The following existing substations form part of the proposed project:

- Olkaria;
- Lessos; and
- Mamboleo (Kisumu).

Land has been allocated within the exisiting sub-stations for the expansion of the bays for this project.

7.10.3 Land Take for Construction Purposes

During construction, some areas may have to be temporarily occupied by the contractors in charge of the transmission lines construction, for storage of materials. As previously mentioned, no Contractors' camp will be set up for this particular project. Instead, unskilled labour will be sourced from areas in which the transmission line will traverse. Skilled labour, which is anticipated to be small in size, will be absorbed by the nearest urban/ settlement areas. Owners and occupants will be compensated against the loss of crops if any, and will receive rent from the contractors for temporary occupation. There will be no transfer of rights in this case. Damaged crops will be compensated if any change occurs.

7.10.4 Perceived Loss of Economic Value of Land

Over most of its length, the new transmission line will follow an existing KPLC-operated transmission line. KPLC's standards require that a 5m strip separate the two corridors. In most situations, it is not anticipated that access to this strip should be hindered, as on both sides of it is land that is not taken permanently, but only encumbered by restrictions on building and higher crops. However, it is possible that in a limited number of specific field configurations (particularly if a residential structure is located in this strip), access may be hindered or a loss in value may be experienced. In line with usual practice on similar projects (transmission lines, pipelines, etc), these cases will be considered on a case-by-case basis for potential compensation.

Concerns were raised during the public consultations that despite the wayleave titles remaining with the present owners, the restrictions placed on use of these sections of land literally renders them useless. It is recommended that KPLC sensitize the community on alternative uses of wayleaves, and design themes to reduce the effect of land take by the transmission line project.

7.10.5 Proposed Mitigation Measures for Land Take

The following measures will be used to minimize the land take impacts of the transmission line project:

- Community sensitization by KPLC on alternative land uses of wayleaves, and design themes to reduce the effect of land take by the transmission line project;
- KPLC to follow Wayleave Rules and provide 3-day notice prior to wayleave maintenance works;

- KPLC will be required to enter into an agreement / arrangement with the Kenya Forest Services regarding wayleave acquisition and alternative afforestation/ reforestation;
- Compensation against loss and damage to crops when land temporarily acquired for construction purposes;
- Consider replacing existing 132kV line with new 220kV line, instead of a new parallel line.

7.11 Impacts on National Parks and Conservancies

The presence of the line is expected to reduce aesthetic values for ecotourism and recreation in Hell's Gate National Park and adjacent ranches, and Soysambu Conservancy. In most parts, the proposed transmission line will not create an overly new visual element in the landscape, as it is adjacent to an existing line. It will, however, incrementally increase the level of intrusion present.

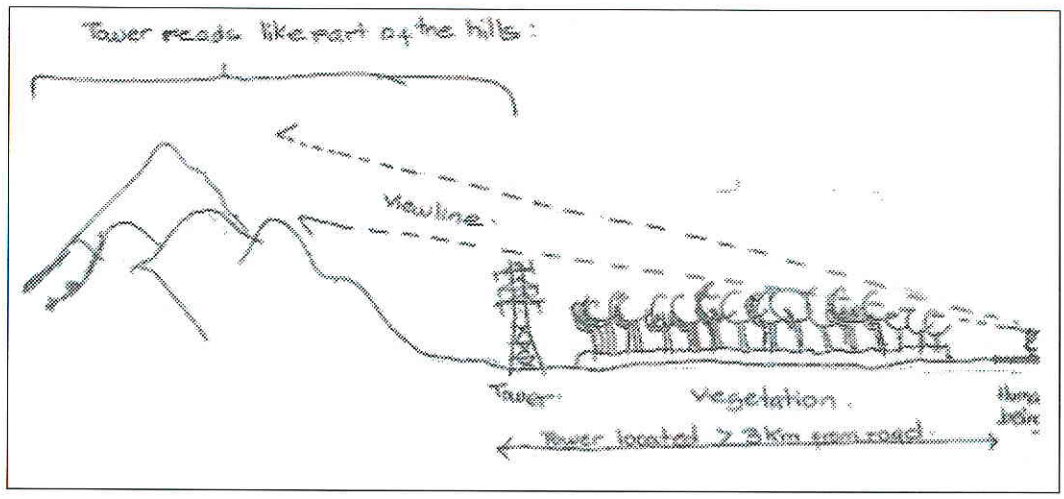
Apart from Hell's Gate National Park, Lake Elementaita and Lake Nakuru regions, the transmission corridor is quite distant from existing tourism/eco-tourism features, hence adverse effects on these features are not anticipated.

7.11.1 Proposed Mitigation Measures for the National Parks and Conservancies

The following mitigative measures and design elements will also be used to minimise the aesthetics effects of the transmission line project:

- Review the visual intrusiveness of the current tower design, and consider engaging local industrial designers to generate a functional, aesthetic and environmentally friendly tower design;
- Where possible, straight line runs are maximised so that the need for angle towers, which have a more negative visual impact due to their heavier construction, is minimised;
- Where possible, the proposed transmission route will be located adjacent to already existing high-impact visual features, such as forests or cliffs (See Fig 7-16 below);
- Where possible, the transmission route is located immediately adjacent to, and parallel to, an existing 132kV line. This limits effects to an already disturbed area, rather than creating a new, discrete second corridor and impact zone;
- Where two lines are parallel, new towers will be constructed adjacent to existing towers, when possible, to minimise visual 'clutter';
- Existing tracks will be used for construction and maintenance operations as much as possible;
- All temporary construction works, such as borrow pits and contractor's yards will be restored upon completion.

Fig 7-16: Location of transmission towers adjacent to natural obstacles, to reduce the visual impacts



7.12 Impacts on Forests

The loss of forested habitat increases the number of common (edge) plants and animals that can encroach into what were the forest interiors. This encroachment can have impacts on the number, health, and survival of interior forest species, many of which are rare.

Opening the forest floor up to sunlight makes it susceptible to the introduction of exotic plant species which may be inadvertently brought in by construction activities. The disturbance caused by construction can encourage these aggressive, invasive species to proliferate. Exotic species, once introduced, have few local natural controls on their reproduction and easily spread. Their spread can alter the ecology of a forest as they out-compete native species for sunlight and nutrients, further reducing suitable habitat and food sources for local wildlife.

A transmission line ROW can fragment a larger forest block into smaller tracts. Fragmentation makes interior forest species more vulnerable to predators, parasites, competition from edge species, and catastrophic events. The continued fragmentation of a forest can cause a permanent reduction in species diversity and suitable habitat. A cleared ROW increases access into a forest which may lead to trespassing, vandalism and deforestation.

Upon determination of the exact wayleave, accurate estimates will be possible of affected sections of gazetted forests. These are expected to include the gazetted forests of:

- Nakuru Lake Forest;
- Londiani Forest;
- Mt. Londiani Forest;
- Timboroa Forest;
- N. Tinderet Forest.

It is estimated that 113ha of forest land will be impacted by Alternative 1, and 327ha by Alternative 2 (See Appendix 9.4). The location of the proposed line within gazetted forests has been raised as a concern with respect to loss of vegetation and habitat for forest wildlife within the wayleave, especially in light of JBIC's Guidelines for Confirmation of Environmental & Social Considerations, and the World Bank's Natural Habitats Safeguard Policy (OP 4.04).

Specific concerns that have been identified include:

- The permanent loss of forested land that will reduce the available habitat for forest dwelling animal species and reduce the forest's capacity to sequester carbon;
- The approximate doubling of the width of the existing cleared corridor may create a barrier to movement of forest species between the forest lands on either side of the cleared corridor;
- The line introduces a physical hazard to birds and climbing animals (applies to entire length of the line);
- If road access is improved in the vicinity of the above forests, it may result in an increased level of intrusion by people, illegal timber harvesting, and bushmeat hunting; and
- Increased visual impacts created by cutting through the forest by the transmission lines.

7.12.1 Forest Fires

If underlying growth is left unchecked, or slash from routine maintenance is left to accumulate within the Right-of-Way (RoW) boundaries, sufficient fuel can accumulate that may promote forest firest.

(a) Recommended measures to prevent and control risk of forest fire include:

- Monitoring Right-of-Way vegetation according to fire risk;
- Removing blowdown and other high-hazard fuel accumulations;
- Time thinning, slashing and other maintenance activities avoid forest fire seasons;
- Disposal of maintenance slash in an environementally acceptable manner, e.g. composting of vegetation;
- Planting and managing fire resistant species (e.g. hardwoods) within, and adjacent to rights-of-way;
- Establishing a network of fuel breaks of less flammable materials or cleared land to slow progress of fires and allow fire fighting access.

7.12.2 KPLC Afforestation Project

KPLC established a tree nursery in 2000, situated along the Eldoret-Nairobi highway, in Sugunanga Area, after CPC, near the bridge. The nursery was started with the aim of raising *Eucalyptus spp*. tree seedlings for planting in Government forest lands to beef up future supply of electricity transmission poles for the company's use. Despite the current negative publicity associated with the *Eucalyptus* spp, the Kenya Forest Services (KFS) acknowledge that it is a fast-growing tree that is of ecological and economic benefit. Additionally, indigenous tree seedlings are given out freely by KPLC to interested farms as a social corporate responsibility, and to enhance growing of trees within the region. On average, approximately 130,000 seedlings have so far been donated annually to farmers.

In March 2000, the then Forest Department of the Government of Kenya (now Kenya Forest Services) entered into agreement with KPLC for allocation of 304.3 hectares of land for planting of eucalyptus trees within the forest blocks of Timboroa, Cengalo, Nabkoi and Kapseret. Planting is already taking place at Timboroa, and further planting is expected to commence at Kapseret by the end of 2009.

7.12.3 Proposed Mitigation Measures for the gazetted forests

Mitigation measures that will be undertaken to limit the impact of the proposed transmission line in the above forests include:

- KPLC should estimate the Total Economic Value of lost forest resource (from 113ha of forest resource) and allocate equivalent monies to support initiatives by KFS and in the local community, eg. Enhancement planting which will compensate for loss of forest resource and associated benefit stream to stakeholders and communities;

- KPLC required to apply for wayleave authorisation to KFS (procedure outlined in Section 2.2.3)
- Development of a consultative process that includes all relevant stakeholders in the acquisition, compensation, disposal and regeneration activities;
- The proposed transmission line will be routed immediately adjacent to the existing 132kV line to minimise fragmentation effects on the forest (see Fig 7-17 below);
- Revegetation of disturbed areas with native plant species;
- Introduce low shrubs and bushes within the wayleave to reduce the unpleasant band of discontinuity in the forest landscape (see Fig 7-18 below);
- Wayleave width will be limited to 35m;
- Clearing will be limited in selected areas along the wayleave so that the resulting corridor does not pose a barrier to the movement of 'forest interior' wildlife species between the forested areas on either side of the cleared corridor;
- Scheduling of activities to avoid breeding and nesting seasons for any critically endangered or endangered wildlife species;
- Regular surveillance by KFS of wayleaves within forest areas during as well as after construction of the proposed transmission line;
- Increase reforestation projects, such as those already being carried out by KPLC in Timboroa and Kapseret forest reserves;
- Prohibition of project workers from hunting bushmeat, possessing firearms, snares and other hunting equipment, and sufficient wages to reduce need to supplement purchased food with bushmeat and non-timber forest products (NTFPs); and
- Restricted access to wayleave within forest areas.

Fig 7-17: Reducing the size of the transmission line corridors

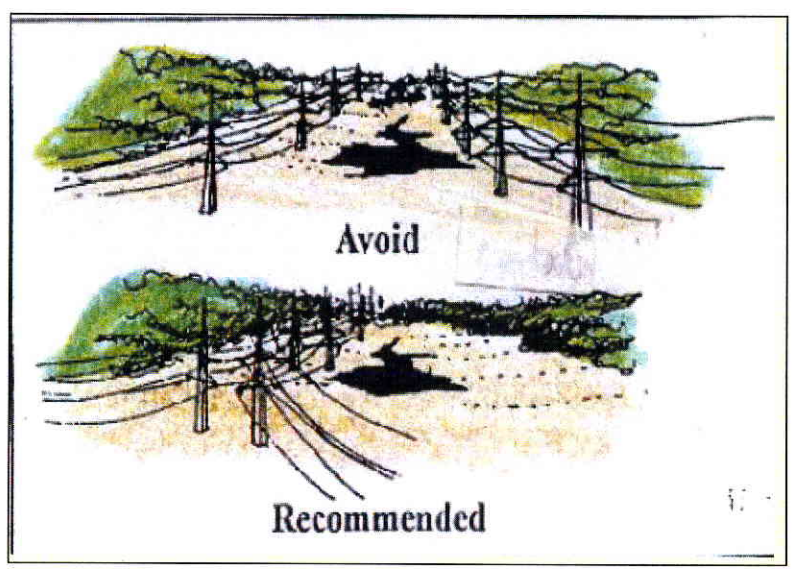
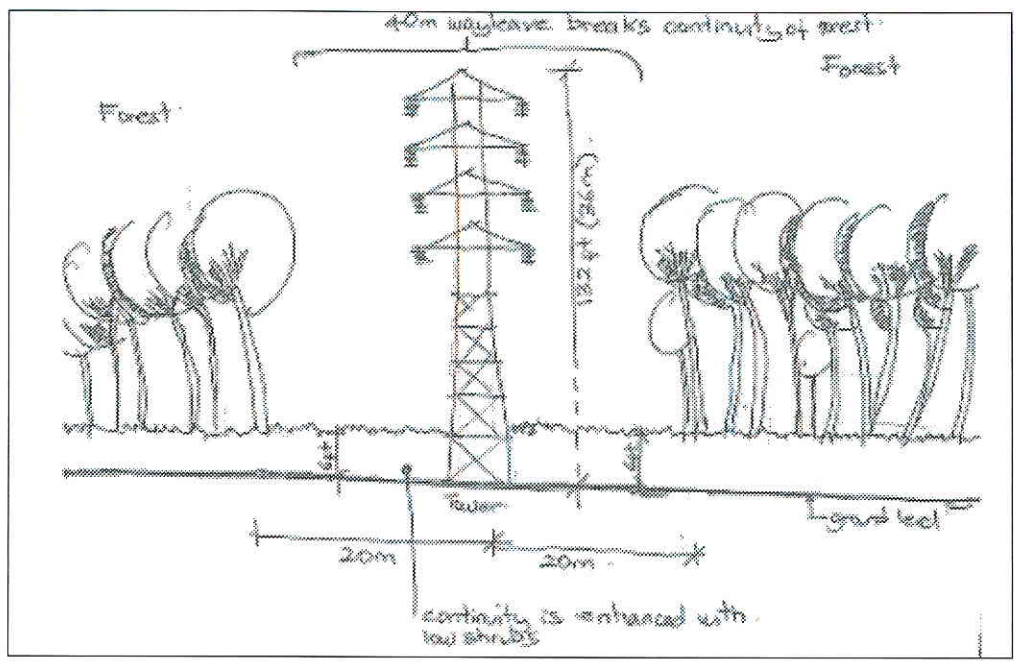


Fig 7-18: Harmonising vegetation and transmission line landscape



7.13 Impacts on Wetland Ecosystems

Wetlands occur in many different forms and serve vital functions including storing runoff, regenerating groundwater, filtering sediments and pollutants, and providing habitat for aquatic species and wildlife. The construction and maintenance of transmission lines can damage wetlands in the following ways:

- Heavy machinery can crush wetland vegetation and wetland soils;
- Wetland soils, especially very peaty soils can be easily compacted, increasing runoff, blocking flows, and greatly reducing the wetland's water holding capacity;
- The construction of access roads can change the quantity or direction of water flow, causing permanent damage to wetland soils and vegetation;
- Construction and maintenance equipment that crosses wetlands can stir up sediments, endangering fish and other aquatic life;
- Transmission lines can be collision obstacles for flamingoes, cranes, waterfowl and other large water birds;
- Clearing forested wetlands can expose the wetland to invasive and shrubby plants, thus removing habitat for species in the forest interior;
- Vehicles and construction equipment can introduce exotic plant species. With few natural controls, these species may out-compete high-quality native vegetation, destroying valuable wildlife habitat.

Disturbed wetland soils are not easily repaired. Severe soil disturbances may permanently alter wetland hydrology. A secondary affect of disturbance is the opportunistic spread of invasive weedy species. These invasive species provide little food and habitat for wildlife.

Power transmission lines and associated access roads and facilities may require construction of corridors crossing aquatic habitats that may disrupt watercourses and wetlands, and require the removal of riparian vegetation. It is further anticipated that any large-scale earthworks might cause suspended solids to be mobilised into the water column. Identified wetland ecosystems to be possibly affected by the proposed project include Lakes Naivasha, Elementaita and Nakuru, 40 river crossings along Alternative 1b and 77 river crossings along

Alternative 2. Additionally, Alternative 1 passes Makutano and Equator Stations, to rejoin and cross the main road close to Lake Narasha. Care willb e needed in constructing the new line through the 'pinch-point' between the existing line and the lake, to avoid its pollution by soil particles, oils/grease, etc.

7.13.1 Proposed Mitigation Measures for the wetland ecosystems

Proposed mitigation measures to minimise temporary disturbance of the wetlands, and avoid permanent intrusion into the wetland area include:

- The proposed transmission line will use existing road corridors for construction and operational access wherever possible, thereby avoiding critical aquatic habitats;
- The proposed alignment will be modified from the existing line route in order to avoid ecologically sensitive areas;
- Fine tuning of tower locations in consultation with local communities;
- Footings of towers will be built to address wet season conditions; and
- Use of specialized construction techniques where necessary;
- Spanning towers across the wetland.

7.14 Soil Erosion Impact from Vegetation Clearance

Vegetation clearance and foundation works would expose soils in the affected areas and leave them vulnerable to erosion by heavy rainfall and surface run-off. This was noted to be the situation in the quarry areas adjacent to the South Lake Road in Naivasha, the hilly sections in Maji Mazuri area near Makutano/ Eldama Ravine, and Nandi Escarpment.

7.14.1 Mitigation Measures

- The Contractor should ensure the recovery of exposed soils with grass and other ground cover as soon as possible;
- The Project Management should ensure monitoring of areas of exposed soil during periods of heavy rainfall throughout the construction phase of the project to ensure that any incidents of erosion are quickly controlled;
- The Contractor should ensure that construction related impacts like erosion and cut slope destabilization should be addressed through landscaping and grassing, carting away and proper disposal of construction wastes in the various site works;
- The Contractor should ensure that recommended compaction of spoil areas is undertaken and effective drainage of spoil sites in order to avoid land instability in form of soil subsidence, slip and mass movement;
- The Contractor should ensure Landscaping of the completed site;
- The Contractor should ensure planting and irrigation of cut and fill slopes as well as installation of erosion control and drainage devices that comply with the requirements of the Factories (Building Operations and Works of Engineering Construction) Rules 1984;
- Areas compacted by vehicles during site preparation and construction should be scarified (ripped) by the Contractor in order to allow penetration of plant roots and the re-growth of natural vegetation;
- The Contractor should ensure that all wastewater is drained into approved drainage facilities;
- On steep slopes, coir netting will need to be pegged over the ground in addition to grass planting;
- Any ripping or ploughing of compacted soils must be done across slope to avoid creating erosion channels.

7.15 Impacts of Construction Material Sourcing (eg quarrying)

Earth materials needed for construction (e.g. concrete, sand, aggregate) is anticipated to be obtained from quarry and mining operations. Conscious or unwitting purchase of these materials from unlicensed operations indirectly supports, encourages and promotes environmental degradation at the illegal quarry sites and causes medium to long-term negative impacts at source, including landslides.

Natural resource depletion may occur if not rationally done through activities such as quarrying, mining and timber logging.

7.15.1 Mitigation Measures

- Construction contract should stipulate that the Contractor sources materials from an approved site;
- The tender documents should specify required standards and certification for procurement of all materials and appliances;
- The sources of all construction materials should be from approved sources; for example, hardstone for building should be obtained from bona fide commercial quarries.

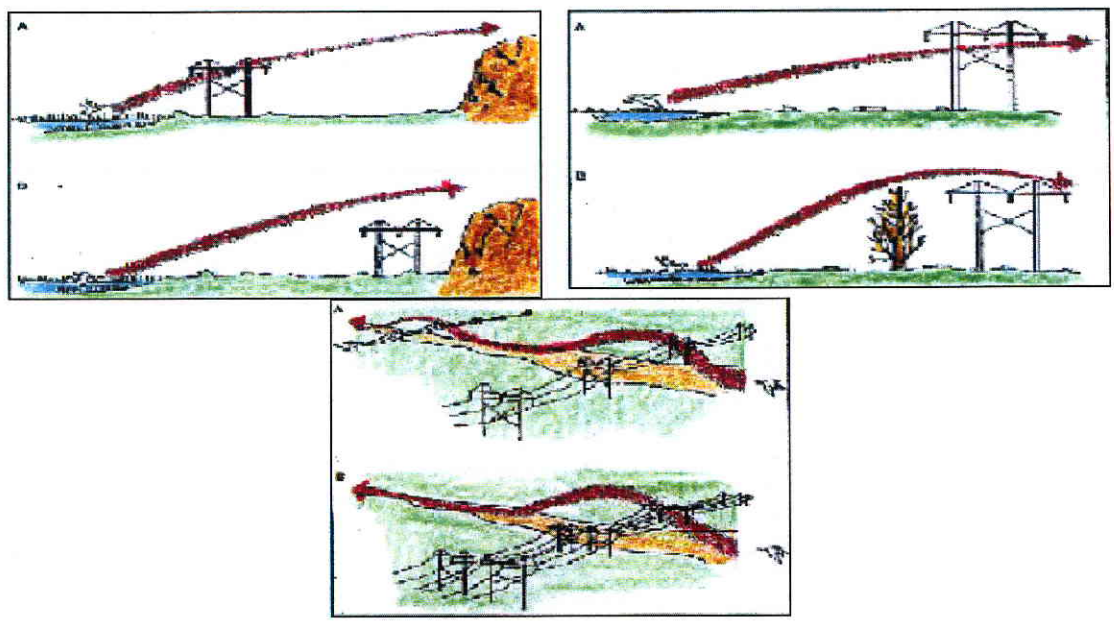
7.16 Impacts on Fauna and Avifauna

Risk of electrocution by large climbing animals, such as vervet monkeys or bats are not expected as the spacing of the conductors and the length of the insulators exceeds the reach of the climbing species and wingspan of bats present in the forested area. A reach of at least 1m – with the animal touching both the insulators and conductors at the same time- would be required to achieve a short circuit between the conductor and tower. No species known in the forests in the project area, or elsewhere in the study area, has a reach this long.

The proposed transmission line is expected to be located as far away as possible to any significant bird breeding or staging areas, and migratory bird routes will be considered during planning and construction (see Section 3.3.3), such as where the proposed transmission line is expected to deviate from the route of the existing transmission line, around Lake Elementaita region.

Possible alternatives for the proposed transmission line include constructing an underground transmission line within the Elementaita area due to bird migratory routes present here, or following the existing transmission line the entire way, as discussed in Alternative 1a. Universally, placing high-voltage transmission lines underground is not uncommon but can cost two to ten times more than building an overhead line. While this practice may reduce aesthetic and bird mortality impacts, it may increase others such as soil disturbance and underground leaks.

Fig 7-19: Location of transmission towers to prevent birds from colliding with conductors

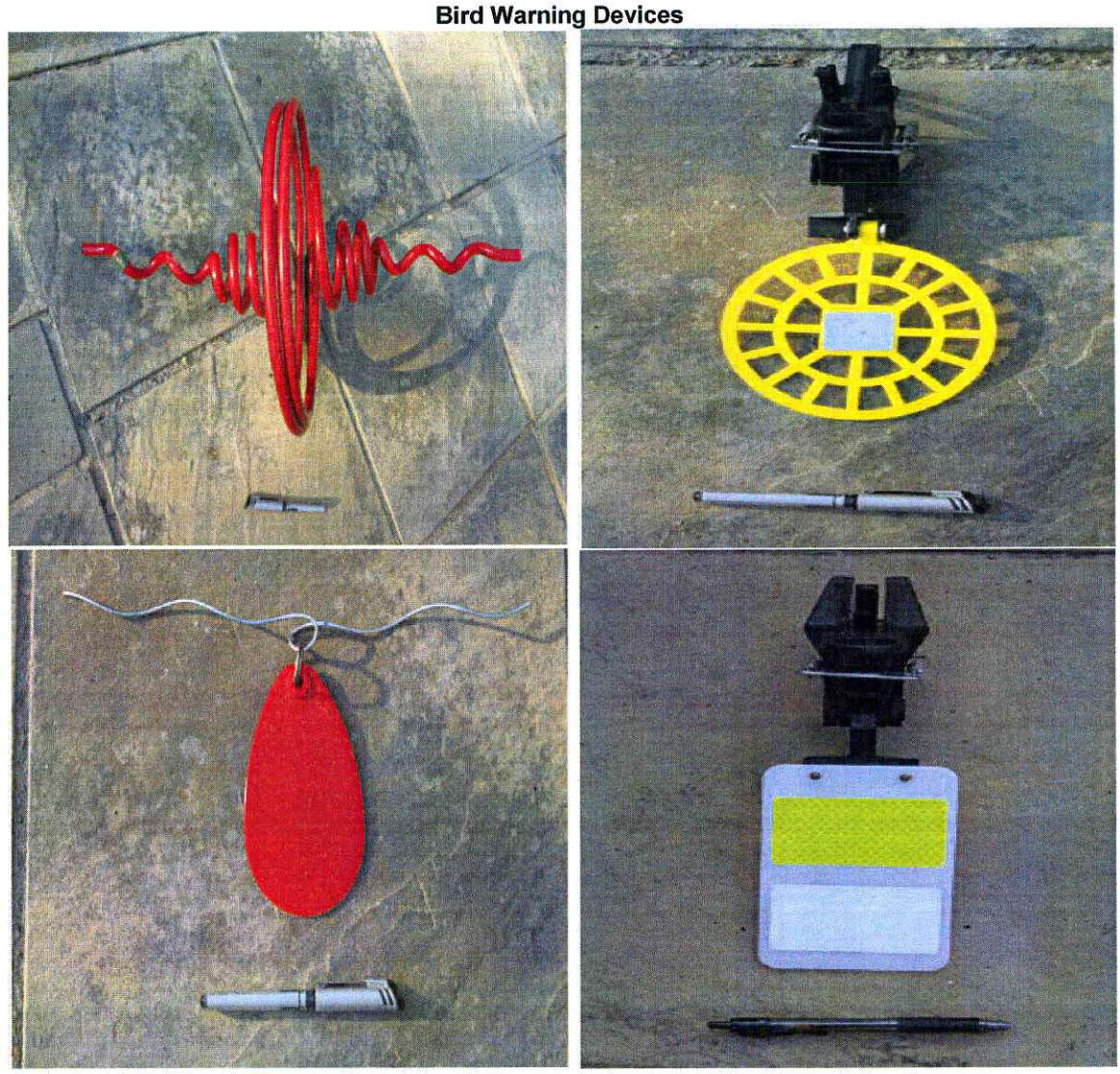


7.16.1 Proposed Mitigation Measures for Avifauna

The following measures are proposed to mitigate negative impacts on avifauna:

- Identify locations as far away as possible from any significant bird breeding or staging areas;
- Consider migratory bird routes when planning the route of the proposed transmission line;
- Use existing towers for new lines (upgrade);
- Construct new transmission line adjacent to existing one;
- Construct underground transmission line where expected to cross bird migratory routes;
- Dress existing and proposed transmission lines with conspicuous bird warning devices, where necessary, such as areas where bird migratory routes cannot be avoided;
- Locate the proposed transmission line adjacent to prevailing natural obstacles such as trees or cliffs to prevent collision by birds with conductors;
- Use of bird warning devices on transmission lines and insulating certain components on the towers to make them 'bird friendly'. Figure 7-20 presents a sample of the variety of bird warning devices currently available.

Fig 7-20: Variety of bird warning devices available



7.17 Impacts on Aviation

The combination of the height of transmission towers (120feet/ 36m) and the electricity carried by transmission lines can pose potential risk through collisions and electrocutions. During consultations, it was established that the Soysambu Conservancy area has three airstrips, including Naishi Airstrip, which belongs to Kenya Wildlife Services (KWS). Alternative 2 of the proposed transmission line would pass very near to one of these airstrips, also frequently used for gliding. These should be considered during construction of the proposed transmission line so that it is routed through low risk areas and away from the aircraft flight paths. Final approval will be subject to an aerial inspection of the proposed transmission line route by KCAA staff.

7.17.1 Proposed Mitigation Measures for Aviation

- Consider Kenyan Civil Aviation Authority (KCAA) guidelines and procedures regarding impact of height and visibility of towers on aircraft safety;

- Dress existing and proposed transmission lines with consipicuous aviation warning devices, where necessary, such as areas where aircraft flight paths cannot be avoided; and
- Follow KCAA authorisation procedure, which includes aerial inspection along entire proposed transmission line route and especially in Soysambu Conservancy, which has three airstrips (including one proposed for upgrading to international standard).

7.18 Impacts on Archaeological, Cultural & Historic Sites

The Lake Naivasha-Lake Nakuru basin has been well surveyed since the late 1970s and more is known about the archaeology of the area than any other part of Kenya. The sites of archaeological interest are presented in Table 3-1, and Appendix 9.

Where the transmission line is anticipated to pass through a homestead, and the arrangement of the homes is affected, an effort should be made to ensure there is no split in the housed. Research has shown that there is a special arrangement of houses in a homestead within each of the Kenyan communities. Affecting this arrangement could have adverse effects on the socio-cultural status of the family.

Within the Lake Victoria region, possibility of the power line passing through major cultural sites is nil. Indeed, most of the areas the line is proposed to pass through (except Kibos Village and Mamboleo centre) are sparsely populated, and mainly composed of sugar plantations. This is therefore not foreseen as a major challenge. The Lwanda Magere site is also quite distant from the proposed power line.

There are no known archaeological sites that the transmission line will pass through.

7.18.1 Proposed Mitigation Measures for Archaeological, Cultural and Historic Sites

The key mitigation for the above sites will include:

- Diversions of the Right-of-Way for the proposed transmission line, to minimize the impacts on these sites, if discovered;
- Selective tower placement to span archaeological site;
- Establishment of procedures for chance find and protection of archaeological sites, and contact with the National Museums of Kenya (NMK).

7.19 Impacts on Public Health

This section examines concerns for public health related to HIV/AIDS and other communicable and Sexually Transmitted Diseases (STDs), and exposure to electric and magnetic fields (EMFs).

(a) HIV / AIDS

HIV/AIDS has been declared a national disaster. It has been observed that construction works and projects are a conduit for transmission of the disease through sexual interactions between project staff and local communities.

The EPC Contractor will bus workers to active construction sites each day from the nearest urban centres, such as Naivasha, Nakuru, Eldoret, Lessos, and Kisumu. No camps will be used that might attract a concentration of prostitutes. The EPC Contractor will, as part of each worker's initial orientation and ongoing education, provide public education information about HIV/AIDS transmission and preventative measures. Condoms will be made available to project workers at no cost.

(b) Electric and Magnetic Fields (EMFs)

(i) Background

Health concerns over exposure to EMF are often raised when a new transmission line is proposed. Exposure to electric and magnetic fields caused by transmission lines has been studied since the late 1970s. These fields occur whenever electricity is used. The magnetic field is created when electric current flows through any device including the electric wiring in a home. Every day we are exposed to many common sources of EMF from vacuum cleaners, microwaves, computers, and fluorescent lights.

The research to date has uncovered only weak and inconsistent associations between exposures and human health. To date the research has not been able to establish a cause and effect relationship between exposure to magnetic fields and human disease, nor a plausible biological mechanism by which exposure to EMF could cause disease. The magnetic fields produced by electricity do not have the energy necessary to break chemical bonds and cause DNA mutations.

(ii) Applicable Regulatory Guidance on EMF Health Effects

The International Commission on Non-Ionising Radiation Protection (ICNIRP, 1990; 1998) has published interim guidelines on limits of exposure to 50.60 Hz electric and magnetic fields. The guidelines are based on analyses of the most recent scientific literatures an on earlier review articles published by the World Health Organisation (WHO, 1993). The WHO concluded that no biological effects could be expected for magnetic fields smaller than 50,000 mG. The ICNIRP (1998) guidelines state that occupational exposure continuing throughout the working day should be limited to below 4,167 mG for magnetic fields and below 8.33 kV/m for electric fields. The guidelines also state that exposure for members of the general public should be limited to 833 mG for magnetic fields and 4.16 kV/m for electric fields. In addition, general public magnetic field exposure between 1,000 and 10,000 mG should be limited to a few hours per day.

In the United States, some States have adopted guidelines based on maintaining the *status quo* for EMF exposure. Several States have adopted as guidelines the electric and magnetic field levels that have historically been present at ground level in transmission line corridors. However, none of these guidelines have been based on the conclusion that particular levels of EMF pose a risk to human health, and none have been developed using careful scientific methodologies.

(iii) Electric and Magnetic Fields for Olkaria-Lessos-Kisumu Project

Prior to final design, the Contractor will calculate the EMF levels generated by the various components of the project. Design changes will be made to ensure levels for the proposed project will be well below the range suggested by guidelines and also well within the range of EMF generated by other common sources.

(iv) Mitigation and Monitoring Activities

Magnetic fields can be measured with a gauss meter. The size of the magnetic field cannot be predicted from the line voltage but is related to the current flow. A 69 kV line can have a higher magnetic field than a 115 kV line. Magnetic fields quickly dissipate with distance from the transmission line.

A common method to reduce EMF is to bring the lines closer together. This causes the fields created by each of the three conductors to interfere with each other and produce a reduced total magnetic field. Magnetic fields generated by double-circuit lines are less than those generated by single-circuit lines because the magnetic fields interact and produce a lower total magnetic field. In addition, double circuit poles are often taller resulting in less of a magnetic field at ground level.

The electrical transmission line will be designed and constructed to ensure that EMF levels are well below accepted guidelines for occupational and human health exposure limits. KPLC policy for keeping residences etc. out of wayleaves will also minimise exposure of the general public to EMFs. EMF levels are not expected to change with time, so further monitoring is not planned.

Electric utility workers typically have a higher exposure to EMF than the general public due to working inproximity to electric power lines. Occupational EMF exposure should be prevented or minimized through the preparation and implementation of an EMF safety program including the following components:

- Identification of potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities;
- Training of workers in the identification of occupational EMF levels and hazards;
- Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers;
- Implementation of action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by international organizations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP), and the Institute of Electrical and Electronics Engineers (IEEE). Personal exposure monitoring equipment should be set to warn of exposure levels that are below occupational exposure reference levels (e.g. 50 percent). Action plans to address occupational exposure may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials.

7.20 Social Impacts

(a) Project Affected Persons (PAPs)

(i) Physically Displaced People

Physically Displaced People are people whose residence has to be displaced because it is located within the Project land acquisition area. It is yet to be determined the exact number of households and people who will have to be physically displaced as a result of the Project.

However, it is anticipated that most potentially physically displaced people live in densely settled areas including:

Olkaria, and Kayole areas in Naivasha;
Njoro, Molo and Rongai Districts in the larger Nakuru District;
Lessos, especially near the existing substation;
Kibos and Mamboleo area in Kisumu.

In some places where physically displaced households have a large enough land area, it is anticipated that they will relocate their residence to the remaining part of their plot – 'self-relocation'. This will however be unlikely in suburb areas within the areas mentioned above, due to the small nature of land plots.

Additionally, comments from the public consultations include installing the new line apart from the old one so that the displacement 'shock' is spread within the community, not just concentrated on a few people, hence totally displacing their lives. In Lessos, it is a possibility for the future that the entire town might be forced to shift if the transmission lines converging at the substation continue to increase, accompanied by their demands for land. Consideration should also be made of other infrastructural demands on the same people, including existing transmission lines, oil pipelines, and fibre optic cables.

(ii) Economically Displaced People

Economically Displaced People are defined here as people whose livelihoods are affected by the Project land acquisition to such an extent that even if they are not physically displaced they will have to move to regain similar economic opportunities. In an agricultural setting, this is usually the case because people are affected by the acquisition of a significant proportion of the land they farm that leaves the remainder unsustainable. For example, within the Naivasha area, the flower farms will be adversely affected, but further along the transmission line, areas including Nandi Hills, with the tea farms, will only be affected marginally, as tea and food crops can still be grown while complying with the 6foot height restriction. The sugar cane growing belt will also be significantly affected, due to the risk of fire associated with harvesting of the crop.

(iii) Total Number of Affected Households

This has not been established at this stage, but is planned for in subsequent socio-economic studies, and a possible Resettlement Action Plan (RAP), following this ESIA.

(b) Principles for Compensation and Resettlement

In the event of compensation and resettlement, the following key principles should be noted:

- Resettlement and compensation of PAPs will be carried out in compliance with Kenyan legislation, JBIC guidelines, IFC's Performance Standard 5 and World Bank OP 4.12;
- All physically or economically displaced people will be offered an option between either a full resettlement package, including the provision of replacement residential land and a house, or cash compensation;
- Past experience in Kenya has shown that cash compensation, although very sought after by many household heads, could be detrimental in the medium term, to other household members, particularly the females and children; the Project will make every effort to promote resettlement rather than cash compensation;
- A majority of PAPs derive their livelihood from agriculture. Where farmers are physically or economically displaced, they will be offered a resettlement option including the provision of agricultural land of potential equivalent to that of the land they have lost;
- KPLC will assist PAPs in restoring their affected livelihoods, and will provide transitional assistance, as necessary, as long as livelihoods are not restored to their previous level;
- The resettlement implementation and outcomes will be monitored and evaluated as part of a transparent process; and
- PAPs and host communities will be informed and consulted during the whole course of development, implementation and evaluation of the resettlement process.

7.20.2 Resettlement and Compensation

The details of Resettlement and Compensation activities to be carried out are still to be finalised following confirmation of PAPs, detailed socio-economic assessment, the exact wayleave, and a Resettlement Action Plan (RAP). Overall, the compensation and resettlement measures will be designed to ensure compliance with the laws and regulations of Kenya and international requirements like JBIC, to ensure that PAPs are better off or, at least, no worse off as a result of the project. KPLC's Resettlement Unit (KRU) will be charged with overseeing resettlement and compensation where it occurs.

Comments were received during the public consultations, however, that the process of resettlement and compensation has not always been fair/ transparent in the past. This should not be the case with this project. Additionally, counselling was recommended for PAPs, due to the trauma of resettlement.

7.20.3 KPLC Community Social Responsibility (CSR)

KPLC endeavours to carry out business in a socially and environmentally responsible manner. Towards this end, the company sets aside one percent of its after-tax profit each year to support corporate social responsibility (CSR) initiatives as one way of giving back to communities. These initiatives include:

- Education;
- The Environment;
- Health;
- Sports;
- Arts and culture;
- The Disadvantaged;
- Post-election violence;
- Community support.

Suggestions were presented during the public consultations on possible CSR opportunities for KPLC within areas that the proposed transmission line is expected to traverse. These requests will be considered against the background of the above initiatives.

On the proposed transmission line route, CSR programs are recommended in Lessos area due to the density of electrical infrastructure converging at the substation. This has left the community feeling bereft and almost landless despite owning the land. It is a possibility that the centre might be shifted in the future if additional transmission lines land and take off from the substation in the area.

7.21 Occupational Health and Safety

Risk of accidents and incidents will be heightened with the construction activities. Construction workers will be in direct contact with heavy machinery and equipment. Apart from the regular training on health and safety (KPLC SHE Policy), staff working along the transmission line should be sensitised on work within the varying ecological and social areas traversed.

- Health, safety and security are important aspects through all the stages of the proposed project. Occupational health and safety hazards specific to electric power transmission and distribution projects primarily include:

  - Live power lines;
  - Working at height;
  - Community Health and Safety.

(a) Live Power Lines

Workers may be exposed to occupational hazards from contact with live power lines during construction, maintenance and operation activities. Prevention and control measures associated with live power lines include:

- Only allowing trained and certified workers to install, maintain, or repair electrical equipment;
- Deactivating and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines;
- Ensuring that live-wire work is conducted by trained workers with strict adherence to specific safety and insulation standards. Qualified or trained employees working on transmission or distribution systems should be able to achieve the following:
  - Distinguish live parts from other parts of the electrical system;
  - Determine the voltage of live parts;

    - Understand the minimum approach distances outlined for specifiv live line voltages;
    - Ensure proper use of special safety equipment and procedures when working near or on exposed energized parts of an electrical system
- Workers should not approach an exposed energized or conductive part even if properly trained unless:
    - The worker is properly insulated from the energized part with gloves or other approved insulation; or,
    - The energized part is properly insulated from the worker and any other conductive object; or,
    - The worker is properly isolated and insulated from any other conductive object (live-line work).
- Where maintenance and operation is required within minimum setback distances, specific training, safety measures, personal safety devices, and other precautions should be defined in a health and safety plan;
- Workers not directly associated with power transmission and distribution activities who are operating around power lines or power substations should adhere to local legislation, standards and guidelines relating to minimum approach distances for excavations, tools, vehicles, pruning, and other activities;
- Minimum hot stick distances may only be reduced provided that the distance remaining is greater than the distance between the energized part and a grounded surface.

(b) Working at height on poles and structures

Workers may be exposed to occupational hazards when working at elevation during construction, maintenance, and operation activities. Prevention and control measures for working at height include:

- Testing structures for integrity prior to undertaking work;
- Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others;
- Establishment of criteria for use of 100 percent fall protection (typically when working over 2 metres above the working surface, but sometimes extended to 7 metres, depending on the activity). The fall protection system should be appropriate for the tower structure and necessary movements, including ascent, descent, and moving from point to point;
- Installation of fixtures on tower components to facilitate the use of fall protection systems;
- Provision of an adequate work-positioning device system for workers. Connectors on positioning systems should be compatible with the tower components to which they are attached;
- Hoisting equipmen should be properly rated and maintained and hoist operators properly trained;
- Safety belts should be of not less than 16 millimeters (mm) (5.8 inch) two-in-one nylon or material of equivalent strength. Rope safety belts should be replaced before signs of aging or fraying of fibers become evident;
- When operating power tools at height, workers should use a second (backup) safety strap;
- Signs and other obstructions should be removed from poles or structures prior to undertaking work;
- An approved tool bag should be used for raising or lowering tools or materials to workers on structures.

(c) Community Health and Safety

Community health and safety impacts during the construction/ operation and decommissioning of transmission and distribution power lines are common, and include dust, noise, and

vibration from construction vehicle transit. The operation of live power distributionlines and substations may generate the following impacts:

- Electrocution;
- Electromagnetic interference;
- Noise and ozone;
- Tower vandalism;
- Aircraft navigation safety

(i) Electrocution

Hazards most directly related to power transmission and distribution lines and facilities occur as a result of electrocution from direct contact with high-voltage electricity or from contact with tools, vehicles, ladders, or other devices that are in contact with high-voltage electricity. Recommended techniques to prevent these hazards include:

- Use of signs, barriers (e.g. use of steel posts surrounding transmission towers, particularly in urban areas) and education/ public outreach to prevent public contact with potentially dangerous equipment
- Grounding conducting objects (e.g. fences or other metallic structures) installed near power lines to prevent shock.

(ii) Electromagnetic interference

The corona of overhead transmission line conductors and high-frequency currents of overhead transmission lines may result in the creation of radio noise. Typically, transmission line rights-of-way and conductor bundles are created to ensure radio reception at the outside limits remains normal. However, periods of rain, sleet or freezing rain sharply increases the streaming corona on conducts and may affect radio reception in residential areas near transmission lines.

(iii) Noise and ozone

Noise in the form of buzzing or humming can often be heard around transformers or high voltage power lines producing corona. Ozone, a colorless gas with a pungent odor, may also be produced. Neither the noise nor ozone produced by power distribution lines or transformers carries any known health risks.

The acoustic noise produced by transmission lines is greater with high voltage power lines (400-800 kV). Noise from transmission lines reaches it maximum during periods of precipitation, including rain, sleet, snow or hail, or as the result of fog. The sound of rain typically masks the increase in noise produced by the transmission lines, but during other forms of precipitation (e.g. snow and sleet) and fog, the noise from overhead power lines can be troubling to nearby residents.

Measures to mitigate this impact may be addressed during project planning stages to locate rights-of-way away from human receptors, to the extent possible. The lines will also be transposed at least three times to mitigate this effect.

(iv) Tower vandalism

In some areas along the existing transmission line, it was emphasised by KPLC staff during the public consultations that vandalism of towers is a common occurrence, and compromises the structural integrity of the towers. This then increases the risk of accidents by electrocution.

Proposed mitigation measures include:

- Community sensitization on the need to keep the towers untouched, due to the associated risks;
- Use of single unit towers instead of currently used lattice composite towers;

- KPLC to consider bolting and welding assembled tower parts;
- Engaging the community in policing of the towers.

(v) Air Navigation Safety

Power transmission towers, if located near an airport or known flight paths, can impact aircraft safety directly through collision or indirectly through radar interference. Aircraft collision impacts may be mitigated by:

- Avoiding the siting of transmission lines and towers close to airports and outside of known flight path envelopes;
- Consultation with regulatory air traffic authorities prior to installation;
- Adherence to regional or national air traffic safety regulations; and
- Use of buried lines when installation is required in flight sensitive areas.

7.21.2 General Occupational Health and Safety Mitigation Measures

- The Contractor should ensure registration of all the construction works by the Director, Directorate of Occupational Health and Safety Services (DOHSS) in compliance with the Buildings and Works of Construction Engineering Rules, 1984;;
- The Contractor should contract a qualified Health and Safety advisor to conduct training and monitoring of construction works;
- The Contractor must ensure establishment of a Health and Safety Committee for the project as per the Health and Safety Committee Rules 2004 of the OSHA Act that outline the following:
    - Composition of the committee to include safety representatives from management and workers;
    - Provision for a competent person appointed from the management staff to be designated as Secretary to the Committee;
    - Undertaking of basic training course in occupational health and safety by every member of the Health and Safety Committee within a period of six months from date of appointment or election and thereafter further training from time to time;
    - Conducting Health and Safety audit of the workplace to be carried out at least once in every period of twelve months by a registered health and safety advisor.
- The Contractor should ensure provision of appropriate Personal Protective Equipment for staff such as:
    - Earmuffs for ear protection;
    - Helmets for head protection;
    - Dust masks for dust protection for all project works;
    - Goggles with good visibility for eye protection;
    - Overalls and dust coats to protect the skin;
    - High-visibility retro-reflective fluorescent yellow-green, fluorescent orange-red/fluorescent red jackets with 360° visibility;
    - Safety Shoes for protection of the feet;
    - Safety belts for working at heights;
    - Gloves of different types according to specific works in relation to:
        - Puncture resistance;
        - Sharps resistance;
        - Cut resistance;
        - Flexibility;
        - Abrasion resistance;
        - Grip.

- KPLC should ensure that the contractor complies with all standard and legally required health and safety regulations as promulgated by Occupational Safety and Health Act (Part XI: section 96) as pertains to construction activities;
- The Contractor should provide a standard First Aid kit on site. Recommendations for Employees exceeding fifty (50) [as per the first Aid Rules section 2 (c)] and Fourth Schedule of the Factories (Building Operations and Works of Engineering Construction) Rules 1984 part III regarding contents of first aid boxes that should comprise the following:

    - Copy of first aid leaflet (L.D. 250/1) issued by the Labour Department specified in Section 2 (b) and (c) of the First Aid Rules of 1977 of the OSHA Act;
    - Not less than 24 of small sterilized unmedicated dressings for injured fingers;
    - Not less than 12 of large sterilized unmedicated dressings for injured hands or feet;
    - Not less than 12 of large sterilized unmedicated dressings for injured parts;
    - Not less than 36 of adhesive wound dressings of a suitable type and assorted sizes;
    - Not less than 8 of triangular bandages of unbleached calico (longest side of which measures not less than 130m and each of the other sides not less than 91 cm;
    - Sufficient supply of adhesive plaster;
    - Sufficient supply of absorbent sterilized cotton wool (in 14 gram packets);
    - Sufficient supply of factory eye drops, BPC;
    - Not less than 8 of sterilized eye pads in separate seal packets;
    - A rubber or pressure bandage;
    - Sufficient supply of safety pins.

- All works which may pose a hazard to humans and domestic animals are to be protected, fenced, demarcated or cordoned off as instructed by KPLC. If appropriate, symbolic warning signs must be erected;
- For fire and safety the Contractor, should ensure the following:

    - Place portable fire extinguishers at suitable locations, according to the activities in the construction programme in conformity to Factories and other places of work (Fire Risk Reduction) Rules, 2007 comprising of the following types:

        - Water extinguishers for Class A fires of ordinary combustible materials such as paper, wood, cardboard and most plastics;
        - Carbon dioxide extinguishers for extinguishing of Class B and C fires [(Class B: flammable/combustible liquids such as gasoline, kerosene, grease and oil. Class C: Electrical equipment such as appliances, wiring, circuit breakers and outlets)];
        - Dry powder extinguishers for extinguishing of Class A, B and C fires.

    - Maintaining of a Material Safety Data Sheet (MSDS) from the manufacturer for flammable gases and flammable combustible liquids indicating their flammable ranges in % per volume;
    - Development of fire emergency procedures and pinning-up in a place where all workers can access them;
    - Training all staff on fire safety policy and procedures;
    - Allocating a fire assembly point;
    - Complying with the Factories and Other Places of Work (Fire risk reduction) Rules of 2007;
    - Ensure safety warnings are prominently displayed on site, such as "No smoking", "No naked flames";
    - Provide and enforce the use of personal protective equipment (PPE);
    - Maintain an incident/accident register, in accordance with the Occupational Safety and Health Act 2007 and report incidences to KPLC and the Directorate of Occupational Health and Safety (DOHSS);

- KPLC should ensure that the Contractor is instructed in the use of all materials that may have negative environmental (including health) effects;
- KPLC should ensure that if any material or substance is used that is at any point in the future deemed to be deleterious to health, then it must be replaced with an acceptable alternative;
- The Contractor has to adhere to safety regulations outlined in the Local Government Adoptive by-laws, and the Building Operations and Works of Engineering Construction (The Occupational Safety and Health Act 2007);
- The Contractor should ensure the following:
    - Appropriate training for Machine handling;
    - Provision of 2-way Communication radios for site personnel to avoid shouting on work sites;
    - Establishment of Shift system for site personnel, to avoid effects of vibrations on staff health as a result of long exposure times to construction machinery emitting vibrations.
- KPLC should ensure strict safety management through close attention to design, work procedures, materials and equipment.

7.22 Hazardous Materials

Hazardous materials in this sector include insulating oils/ gases (eg. Polychlorinated Biphenyls [PCB] and sulphur hexafluoride [SF6], and fuels (See Appendix 11)

7.22.1 Insulating Oils and Fuels

Highly-refined, mineral insulating oils are used to cool transformers and provide electrical insulation between live components. They are typically found in the largest quantities at electrical substations and maintenance shops. Sulfur Hexafluoride (SF6) may also be used as a gas insulator for electrical switching equipment and in cables, tubular transmission linees, and transformers. SF6 may be used as an alternative to insulating oils. However, the use of SF6, a greenhouse gas with a significantly higher global warming potential (GWP) than CO_2 should be minimized.

Liquid petroleum fuels for vehicles and other equipment may also be used and stored at transmission and distribution projects. Polychlorinated Biphenyls (PCB) were widely used as a dielectric fluid to provide electrical insulation, although their use has been largely discontinued due to potential harmful effects on human health and the environment. KPLC no longer uses PCBs in their transformers.

Spilled chemicals can contaminate soil as well as pollute water resources. Hazardous and flammable substances (e.g. diesel oil, paints, thinner, solvents, etc.) when improperly stored and handled on the site become potential health hazards for construction workers. It is anticipated that refueling and maintenance of large vehicles will take place on the construction site and that, correspondingly, there will be storage of fuel and lubricants on the site.

During the construction period for proposed transmission line project, oil spills may result from construction site equipment and storage.

7.22.2 Mitigation Measures

- The Contractor should ensure that the employees on site are aware of the company procedures for dealing with spills and leaks from oil storage tanks for the construction machinery though induction and safety training;
- Incase of spillage the contractor should isolate the source of oil spill and contain the spillage using sandbags, sawdust, absorbent material and/or other materials approved by KPLC;

- All vehicles and equipment should be kept in good working order, serviced regularly and stored in an area approved by KPLC;
- The Contractor should also provide security to guard against vandalism when the site is unattended. This includes:

    - Appropriate training for the handling and use of fuels and hazardous material as necessary. This includes providing spill response and contingency plans;
    - Taking extreme care when transferring chemicals and fuels from storage vessels to equipment and machinery on an impervious sealed area which is kerbed and graded to prevent run-off. Chemical and fuel transfer areas should be drained away from the perimeter bund to a containment pit. The design should provide for the safe and efficient movement of vehicles;
    - Storage of all chemicals within the bunded areas clearly labelled detailing the nature and quantity of chemicals within individual containers;
    - Immediate cleaning of chemical or fuel spills. The spilt liquid and clean-up material should be removed, treated and transported to an appropriate site licensed for its disposal;
    - The contractor should assemble and clearly list the relevant emergency telephone contact numbers for staff, and brief staff on the required procedures.

7.23 Waste Management

Solid wastes anticipated to be produced during site preparation, electromechanical and civil works include spoil from excavations, scrap metal, mortar, wood, paper, masonry chips and left over food stuff. Effects of mismanaged wastes include:

- Public nuisance due to littering or smell from rotting;
- Creation of breeding grounds for vermin like rats and roaches;
- Contamination of soils and water courses.

Construction material waste will include:

- Earthworks;
- Soil debris;
- Waste paper;
- Cuttings from vegetation;
- Pent oil and greases;
- Redundant sections of pre-stressed concrete;
- Waste paper; and
- Excavated soil.

(a) Mitigation Measures

- The Contractor should adhere to the site waste management plan;
- KPLC and Contractor should ensure that spoil from excavations is arranged according to the various soil layers. This soil can then be returned during landscaping and rehabilitation, in the correct order which they were removed that is top soil last;
- The Contractor should separate hazardous from non-hazardous wastes. Hazardous wastes include waste contaminated with petroleum product and chlorine. Waste should then be handled, collected, transported and disposed according to the *Environmental Management and Co-ordination (Waste Management) Regulations of 2006* (See Appendix 11);
- KPLC should ensure that waste is recycled and re-used where possible. Recycling bins for glass, metal, newspaper, plastic bottles and other recyclable site solid wastes should be provided onsite and/or for site curbside collection. Waste that cannot be re-used on site should be transported to the correct yard to be specified by KPLC;

- For waste handling the Contractor should provide litter collection facilities such as bins;
- The contractor should comply with the requirements of the OSHA Act 2007 and Building Rules on storage of construction materials;
- Final disposal of the site waste should be done at a location that shall be approved by KPLC in accordance with the waste management plan after consultation with the local authority;
- KPLC should ensure that several high quality waste management facilities are put in place, including waste storage structures, engineered hazardous and non-hazardous solid waste landfills, and a hazardous waste-capable incinerator as per specifications of Third Schedule of the Waste Management Regulations of 2006;
- The tender documents should specify proper solid waste handling as provided in the waste management plan during site preparation phase of construction prior to project works commencing in identifying optimal waste re-use options and licensed disposal areas. This should strictly be adhered to by the Contractor;
- The Contractor should not burn wastes on site or dump in an open pit;
- KPLC should ensure that the contractor provides proper handling and storage procedures for hazardous wastes e.g. fuel oil should be stored in areas with concrete floor and forecourt as well as containment to handle spills;
- KPLC should ensure that excavation activities that normally contribute to severed vegetation roots, compaction of surrounding soils, as well as siltation of area waters and subsequent dumping of spoil are properly managed such that land which is not required for buildings is left undisturbed.

7.24 Air and Dust Emissions

Air pollution arises from excavation and movement of earth materials, exposure of bare soil to wind, exhaust from engines and burning of solid waste on site. This impact is temporary for the duration of the construction period. The impact is expected to be minimal within the main conservation areas (Rift Valley floor) but may be significant in the human occupied areas. Sections with murram roads are also expected to have higher dust emissions into the atmosphere.

Air emissions from construction machinery, including dust, is regarded as a nuisance when it reduces visibility, soils private property, is aesthetically displeasing or affects palatability of grazing. This is expected during construction works. Dust will be generated from construction earthworks, transportation activities and aggregate mixing. Air and dust emissions are likely to arise from the following construction activities:

- Movement of heavy equipment for trenching and transport of building materials;
- Trenching activities including storage of excavated materials (no blasting will be conducted);
- Movement of personnel / vehicles;
- Backfilling.

In case of welding, the mechanical equipment, trucks, and electric generator sets for the welding machines will produce pollutants such as dust; carbon monoxide (CO); nitrogen dioxide (NO_x); and sulfur dioxide (SO_2) from fuel combustion.

The CO, NO_x, and SO_2 will be dispersed in the atmosphere. The residential development construction operation will be carried out mostly in the open space, and the dispersion of the emissions from the heavy equipment is not expected to pose any serious environmental problem to the atmosphere. Motor vehicle emission standards are outlined in the First Schedule of NEMA Air Quality Regulations (See Appendix 12).

(a) Mitigation Measures

- The contractor should provide dust masks to all personnel on work site;
- KPLC has to ensure that periodic water spraying is carried out to suppress dust during excavations and backfilling;
- KPLC has to ensure that dust generating activities (excavation, handling and transport of soils) are not undertaken during times of strong winds;
- KPLC has to ensure that earthwork operations are suspended wherever visible dust is affecting adjoining activities;
- KPLC has to ensure enforcement by the contractor in the provision of vehicles delivering soil materials with covers to reduce spills and windblown dust;
- Any complaints received by the Contractor regarding dust should be recorded and communicated to KPLC;
- KPLC has to ensure that dust emissions are kept at a minimum especially in areas with human settlements;
- KPLC should ensure that all construction machinery are maintained and serviced in accordance with the contractor's specifications, manufacturer's standards and the NEMA *Fossil Fuel Emission Regulations 2006*;
- Contractor staff should conduct regular monitoring on the efficacy of the methods used to minimise dust emissions and give recommendations thereof.

7.25 Noise

Noise pollution is expected to be low as no blasting is expected. Expected sources of noise pollution include vehicles and machinery. The acoustic noise produced by transmission lines is greater with high voltage power lines, reaching its maximum during periods of precipitation, including rain, sleet, snow or hail, or as the result of fog. The sound of rain typically masks the increase in noise produced by the transmission lines, but during other forms of precipitation (e.g. snow and sleet) and fog, the noise from overhead power lines can be troubling to nearby residents.

Measures to mitigate this impact may be addressed during project planning stages to locate rights-of-way away from human receptors, to the extent possible.

Noise emissions are likely to arise from the following construction activities:

- Movement of heavy equipment for trenching and transport of building materials;
- Trenching activities including storage of excavated materials (no blasting will be conducted);
- Movement of personnel / vehicles.

Maximum permissible noise levels are outlined in the Second Schedule of NEMA Noise Control Regulations (See Appendix 12).

(a) Mitigation Measures

- KPLC should ensure that all works are conducted during the day;
- KPLC should ensure that noise and vibration levels are kept within acceptable limits preferably as stipulated within the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009;

7.26 Impacts of Fuel and Chemical Storage on Site

Spilled chemicals can contaminate soil as well as pollute inshore waters and hazardous and flammable substances (e.g. diesel oil, paints, thinner, solvents, etc.) when improperly stored and handled on the site become potential health hazards for construction workers. It is anticipated that the number of vehicles to be used will be minimal.

During the construction period for the Olkaria-Lessos-Kisumu transmission line, oil spills may result from fuelling project cars.

7.26.1 Mitigation Measures

- The Contractor should ensure that the employees on site are aware of the company procedures for dealing with spills and leaks from oil storage tanks for the construction machinery though induction and safety training;
- Incase of spillage the contractor should isolate the source of oil spill and contain the spillage using sandbags, sawdust, absorbent material and/or other materials approved by KPLC;
- KPLC and the contractor should ensure that there is always a supply of absorbent material such as saw dust on site during construction, readily available to absorb/breakdown spill from machinery or oil storage;
- All vehicles and equipment should be kept in good working order, serviced regularly and stored in an area approved by KPLC;
- The Contractor should ensure that filling areas, Oil storage drums / products storage areas have a smooth impermeable (concrete or thick plastic covered in gravel) floor. The floor should be bunded and sloped towards a sump to contain any spillages of substances in accordance with *The Kenya Bureau of Standards (KEBS) KS 1969: 2006 The Petroleum Industry -The installation of underground storage tanks, pumps/dispensers and pipe work at service stations and consumer installations - Code of Practice;*

7.27 Traffic Congestion/ Road Wear and Tear

Traffic congestion is anticipated from site related traffic from contractor vehicles, particularly along the Naivasha-Nakuru-Eldoret-Kisumu Highway. This may interfere with socio-economic activities which rely heavily on the transport network affected by the construction activities as well as negatively impact on the current road condition.

(a) Mitigation Measures

- KPLC and Contractor should choose traffic routes to reduce the impact in the neighbourhood avoiding, as far as practical any sensitive areas;
- The Contractor should ensure due regard of drivers to traffic regulations and insist at all times that courtesy be shown to other road users;
- Where traffic is anticipated, the Contractor in close consultation with KPLC should ensure:
    - Effecting of traffic controls to avoid congestion and truck accidents on the project access roads;
    - Choice of traffic routes depending on delivery and dispatch to reduce the congestion impact in the neighbourhood;
    - Due regard of drivers to traffic regulations which should be insisted upon at all times, with courtesy shown to other road users;
    - Employment of a road safety co-ordinator to oversee implementation of the traffic controls;

- Regular maintenance of delivery and dispatch trucks.

7.28 Labour Force Management

It is envisaged that personnel for operations will be drawn from KPLC's overall labour pool. If supplementary staff is needed, it is anticipated that they will be recruited locally through an open recruitment procedure and will receive appropriate training. KPLC is committed to complying with good employment standards and providing decent working conditions for its staff. Currently, a local employment policy is being formulated to cater for the above. KPLC will also undertake to comply with all relevant national legislation and international standards, which are applicable to its operations.

7.29 Contractor Code of Conduct

The Contractor should submit method statements covering the procedures for the main activities which could generate emergency situations through accidents or neglect of responsibilities. In addition, each contractor should be required to submit their own EMP, which should be reviewed / approved by KPLC and then appended to the contract. The Contractor EMPs should be based on the master EMP in the ESIA report (Chapter 8), focussed on the issues of relevance to the individual contractors.

These situations include, but are not limited to:

- Accidents at the work place;
- Accidental fires;
- Accidental leaks and spillages;
- Vehicle and plant accidents.

These conditions focus on safety of operations but do not provide for environmental awareness creation.

(a) Mitigation measures

- The contractor should undertake an initial environmental awareness training session prior to any work commencing on site, where the target audience is all project personnel. The training should include but not be limited to the following:
    - Basic awareness and understanding of the key environmental features of the work site and environs;
    - Understanding the importance of and reasons why the environment must be protected;
    - Ways to minimise identified environmental impacts;
    - Relevant requirements of the Environmental Management Plan (EMP) and Waste Management plan (WMP) provided in this report;
    - Health risks pertinent to the site, including prevention of communicable diseases;
    - Prevention and handling of fire.
- An Environmental consultant should conduct environmental awareness training in liaison with the Contractor and KPLC;
- KPLC and the contractor has to ensure that site staff found to be involved in incidences of theft or pose other security risks to the local community are to be dismissed and reported to the authorities.

7.30 Environmental & Social Monitoring

Environmental and social monitoring programs should be implemented to address all activities that have been identified to have potentially significant impacts on the environment during normal operations and upset conditions. Environmetnal and social monitoring activities should also be based on direct or indirect indicators of emissions, effluents, and resource use applicable to the particular project. Monitoring frequency should be sufficient ro provide representative data for the parameter being monitored.

Monitoring should be conducted by trained individuals following monitoring and record-keeping procedures and using properly calibrated and maintained equipment. Monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken.

To ensure the performance, efficiency, and effectiveness of environmental mitigation measures programs, it is necessary that these activities be monitored. Monitoring programs will be necessary for noise, air quality, and dust during the construction phase.

Compliance monitoring during construction should be the responsibility of the contractor to be supervised by a Project Environmental scientist. Environmental monitoring of significant impacts during the operation of the project should be among the responsibilities of KPLC Management, which should have the overall responsibility to ensure that the adverse impacts from the project are maintained to acceptable levels and corrective measures are undertaken when required.

Environmental monitoring during construction should be conducted twice (2) a year for the entire project by a Project Environmental Scientist in order to ascertain the level of compliance of the works to the developed Environmental and Social Management (ESMP) and Monitoring (ESMoP) Plans.

8 ENVIRONMENT & SOCIAL MANAGEMENT (ESMP) & MONITORING (ESMoP) PLANS

The Environmental and Social Management (ESMP) and Monitoring (ESMoP) Plans are prepared to show how site specific concerns and mitigation measures are addressed through the engineering, procurement and construction phases of the Project.

To ensure that the negative environmental impacts can be controlled and mitigated effectively, a stringent and scientific management and monitoring plan has been prepared. The ESMP proposes to utilize existing structures with KPLC management, including Safety, Health & Environment (SHE) departments, and the KPLC Resettlement Unit (KRU), to be responsible for ensuring that the overall environmental and social targets are achieved and that the environmental responsibilities and obligations of the ESIA are satisfied during the life of the transmission line project. The Project Manager shall conduct quarterly audits to ensure that the system for implementation of the ESMP and ESMoP is operating effectively.

8.1 Environmental and Social Management (ESMP) & Monitoring (ESMoP) Plans

Tables 8-1 and 8-2 set out the potential impacts associated with construction of the proposed transmission line, along with the location of occurrence, management and mitigation measures, monitoring requirements, and responsibility.

At completion of construction, ownership of the transmission line will be transferred to KPLC. KPLC will be responsible to implement environmental management measures associated with operation of the transmission line. If necessary, KPLC will acquire technical assistance and training in environmental management practices for operation of the proposed transmission line, to strengthen its capabilities in this area.

8.2 Auditing of the ESMP & ESMoP

The Project Manager shall conduct quarterly audits to ensure that the system for implementation of the ESMP and ESMoP is operating effectively. The audit shall check that a procedure is in place to ensure that:

- The ESMP and ESMoP being used is the up to date version;
- Variations to the ESMP and ESMoP and non-compliance and corrective action are documented;
- Appropriate environmental training of personnel is undertaken;
- Emergency procedures are in place and effectively communicated to personnel;
- A register of major incidents (spills, injuries, complaints, legal transgressions, spot fines and penalties etc) is in place and other documentation related to the ESMP and ESMoP;
- Ensure that appropriate corrective and preventive action is taken by the Contractor once instructions have been issued.

8.2.1 Responsibilities

In order to ensure the sound development and effective implementation of the ESMP and ESMoP, it will be necessary to identify and define the responsibilities and authority of the various persons and organisations that will be involved in the project. The following entities should be involved in the implementation of this ESMP and ESMoP:

- The project management team / KPLC;
- Project manager;
- Contractor;
- The local administration; and
- NEMA.

(a) Project Management team / Kenya Power & Lighting Co. Ltd. (KPLC)

It will be the responsibility of KPLC to oversee or appoint a qualified and competent team to oversee the construction phases of the proposed Olkaria-Lessos-Kisumu transmission line project. During the operation phases of the transmission line, KPLC would manage the project.

(b) The Project Manager (PM)

The Project manager will be required to oversee the construction programme and construction activities performed by the Contractor, in compliance with the ESMP and ESMoP.

The project management should co-ordinate all aspects of the environment during project implementation and operations. This should include following the construction to monitor, review and verify the implementation of the project's ESMP and ESMoP.

(c) The Contractor

The contractor should be required to comply with the requirements of the EIA, the EMP within this report and other relevant legislations.

(d) The Local Administration

The relevant local administrators should be called upon where necessary during project implementation to provide the necessary advisory services and support to the project implementers.

(e) NEMA

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

This chapter outlines ways in which environmental aspects can be managed and monitored during the implementation of the transmission line project.

TABLE 8-1: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN					
Environmental Issue	**Location**	**Management & Mitigation Measures**	**Responsibility**	**Time Frame**	**Estimated Costs**
Visual and Aesthetic Impacts					
Presence of the transmission line reduces aesthetic values for ecotourism and recreation	Scenic Rift Valley Basin	• KPLC should review visual intrusiveness of current tower design; • Existing or planned tourism facilities not expected to be significantly affected.	During construction, KPLC to report on status of tourist facilities in regular compliance reporting	Project planning phase & construction period	No additional cost. Based on sound engineering practice
Tower design too busy, with many lattice members, gigantic and overbearing	Scenic Rift Valley Basin	• KPLC should review visual intrusiveness of current tower design, and consider engaging local industrial designers to generate a functional, aesthetic and environmentally friendly tower design	KPLC project management	Project planning phase	No additional cost. Based on sound engineering practice
Visibility of towers & conductors	Entire transmission line project	• Straight-line runs maximised to reduce the need for angle towers; • Locate new towers adjacent to already existing high-impact visual features, such as forests or cliffs; • Where possible, locate the new line adjacent to existing power lines; • Locate new towers adjacent to existing towers to minimise visual 'clutter'; • Existing tracks will be used for construction & maintenance as much as possible; • Where a transmission line runs across a ridge, locate the access track off or across the line to avoid accentuating the route;	KPLC project management	Construction phase	No additional cost. Based on sound engineering practice

TABLE 8-1: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN					
Environmental Issue	**Location**	**Management & Mitigation Measures**	**Responsibility**	**Time Frame**	**Estimated Costs**
		• All temporary construction works, such as borrow pits & contractor's yards, will be restored upon completion.			
Land Take					
Land affected by the construction and operation of the proposed transmission line	Entire transmission line project; existing substations	• KPLC to follow existing transmission line for most of the way; • Existing substations to be expanded	KPLC project management	Project planning phase & construction period	No additional cost. Based on sound engineering practice
Wayleave Acquisition & maintenance	Entire transmission line project	• KPLC to follow Wayleave Rules, including provision of 3-day notice prior to maintenance works; • Community sensitization on alternative land uses.	KPLC project management	Project planning phase & construction period	Based on current land valuation and negotiation results with existing land owners
Impacts on National Parks and Conservancies					
Reduced aesthetic values for ecotourism and recreation	Hell's Gate National Park, Lake Nakuru National Park, Soysambu Conservancy	• KPLC should review the visual intrusiveness of the current tower design, and consider engaging local industrial designers to generate a functional, aesthetic and environmentally friendly tower design; • Where possible, straight line runs are maximised so that the need for angle towers, which have a more negative visual impact due to their heavier construction, is minimised; • Where possible, the proposed transmission route will be located adjacent to already	KPLC to implement design and location procedures prescribed in the framework	Project planning phase & construction period	No additional cost. Based on sound engineering practice

TABLE 8-1: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN					
Environmental Issue	**Location**	**Management & Mitigation Measures**	**Responsibility**	**Time Frame**	**Estimated Costs**
		existing high-impact visual features, such as forests or cliffs; • Where possible, the transmission route is located immediately adjacent to, and parallel to, an existing 132kV line. This limits effects to an already disturbed area, rather than creating a new, discrete second corridor and impact zone • Where two lines are parallel, new towers will be constructed adjacent to existing towers, when possible, to minimise visual 'clutter'; • Restore borrow pits and contractor's yards upon completion.			
Impacts on Forests					
Incompatible land use in a designated reserve	Nakuru Lake Forest, Londiani Forest, Mt. Londiani Forest, Timboroa Forest, and N. Tinderet Forest	• Wayleave within these areas will be limited to 35m, versus 40m in other areas; • KPLC will estimate Total Economic Value of lost forest resource, and will allocate equivalent monies to support initiatives by KFS, eg. Community initiatives, & enhancement planting, which will compensate for loss of forest resource and associated benefit stream.	KPLC to inspect clearing in forest areas to confirm work confined to 35m wayleave. KPLC to update status of enhancement planting & other mitigation/compensation measures in regular compliance reporting, eg. existing KPLC Timboroa and Kapseret reforestation projects.	Project planning, construction and operation phases	To be determined in conjunction with KFS during wayleave acquisition
Permanent loss of	Nakuru Lake	• KPLC will estimate the Total	KPLC to update status of	Project	To be

TABLE 8-1: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN					
Environmental Issue	**Location**	**Management & Mitigation Measures**	**Responsibility**	**Time Frame**	**Estimated Costs**
forest land will reduce the available habitat for vegetation and wildlife, and reduce the forests' function as carbon sinks	Forest, Londiani Forest, Mt. Londiani Forest, Timboroa Forest, and N. Tinderet Forest	Economic Value of lost forest resource (from 113 ha of forest resource), and will allocate equivalent monies to support initiatives by KFS, eg. enhancement planting; • After construction, flora & fauna surveys should be undertaken by KPLC to ascertain biodiversity.	regeneration plan in regular compliance reporting.	planning, construction and operation phases	determined in conjunction with KFS during wayleave acquisition
The resulting cleared corridor may pose a barrier to movement of 'forest interior' wildlife species between the forested areas on either side of the transmission line	Nakuru Lake Forest, Londiani Forest, Mt. Londiani Forest, Timboroa Forest, and N. Tinderet Forest	• The 220kV line will be routed immediately adjacent to the existing 132kV line to minimise fragmentation effects. KPLC will ensure cross line corridors between either side of the transmission line are established by minimising clearing and selective planting of suitable vegetation	Current status of 'cross line corridors' will be determined by KPLC and KFS.	Project planning, construction and operation phases	To be determined in conjunction with KFS & KWS
Improvements to access required for construction may increase grazing, bushmeat hunting & illegal felling of timber	Nakuru Lake Forest, Londiani Forest, Mt. Londiani Forest, Timboroa Forest, and N. Tinderet Forest	• Access has been improved in recent years, by KPLC upgrading the existing right-of-way.No further specific mitigations are necessary	KPLC, in collaboration with KFS, to report on status of access and any issues arising, in regular compliance reporting	Project construction & operation phases	No additional costs
Forest fires, if underlying growth is left unchecked, or slash from routine maintenance accumulates in RoW	Nakuru Lake Forest, Londiani Forest, Mt. Londiani Forest, Timboroa Forest, and N. Tinderet Forest	• Monitoring RoW vegetation according to fire risk; • Removing blowdown & high-hazard fuel accumulations; • Thinning, slashing & other maintenance to avoid forest fire seasons; • Planting and managing fire	KPLC, in collaboration with KFS, to report on status of access and any issues arising, in regular compliance reporting	Project construction & operation phases	To be determined in conjunction with KFS