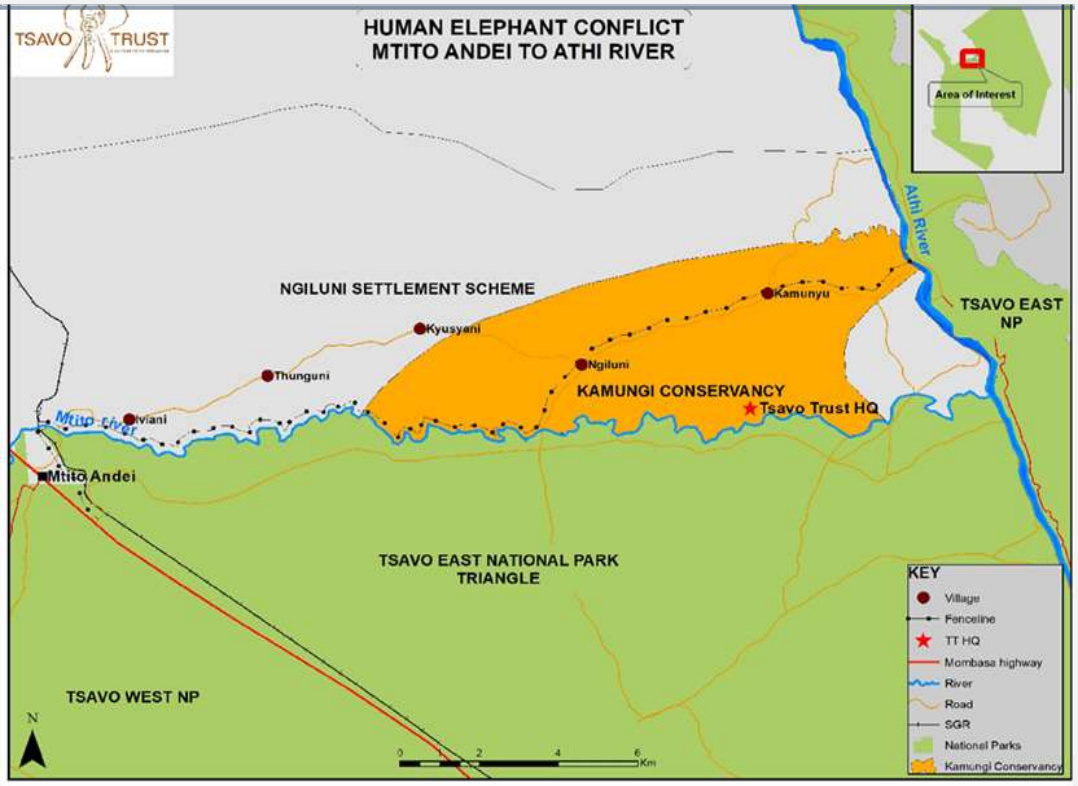
MAY 2020

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT



This Environmental and Social Impact Assessment (ESIA) Study Report is submitted to the National Environment Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination Act 1999 (REV 2015) and the Environmental (Impact Assessment and Audit) Regulations, 2003.

THE PROPOSED KAMUNGI CONSERVANCY ELECTRIC FENCE IN MTITO ANDEI WARD, KIBWEZI EAST SUB-COUNTY, MAKUENI COUNTY.

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CERTIFICATION

KAMUNGI CONSERVANCY: ENVIRONMENTALAND SOCIAL IMPACT ASSESSMENT REPORT.

CLIENT: COUNTY GOVERNMENT OF MAKUENI AND KAMUNGI CONSERVANCY.

ASSIGNMENT: TO CARRY OUT ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT ON THE INSTALLATION OF A TWO STRANDS ELECTRIC FENCE AT KAMUNGI CONSERVANCY.

REPORT PREPARED BY:
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SIGNED:..... DATE: .....

PROPONENT:
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I,……..submit the following Environmental and Social Impact Assessment Report on behalf of the County Government of Makueni. To my knowledge, all information contained in this report is accurate and a truthful representation of all findings as relating to the proposed project.

SIGNED:..... DATE: .....

Disclaimer:
This environmental and social impact assessment study report is based on information made available by the client to the consultants and findings from field assessment.

ACRONYMS AND ABBREVIATIONS

ACC	Assistant County Commissioner
AIDS	Acquired Immune Deficiency Syndrome
BoQ	Bill of Quantities
BOD	Biological oxygen demand
CGoM	County Government of Makueni
CSR	Corporate Social Responsibility
EA	Environmental Audit
EFA	Environmental Flow Analysis
EIA	Environment Impact Assessment
ESIA	Environment and Social Impact Assessment
EMCA	Environmental Management Coordination Act
EMP	Environmental Management Plan
EMS	Environmental Management System
ERS	Economic Recovery Strategies
ESMP	Environmental and Social Management Plan
EHS	Environmental Health and Safety
HEC	Human Elephant Conflict
HWC	Human Wildlife Conflict
KWS	Kenya Wildlife Services
KPLC	Kenya Power and Lighting Company
KC	Kamungi Conservancy
MoH	Ministry of Health
NEMA	National Environment Management Authority
NAPEP	National Poverty Eradication Plan
NLC	National Land Commission
OSHA	Occupation Safety and Health Act
OHS	Occupation Health and Safety
PHO	Public Health Officer
PPE	Personal Protection Equipment
PAYE	Pay As You Earn
PCC	Public Complaint Committee
SACCO	Savings And Credit Cooperative
TT	Tsavo Trust
TOR	Terms Of Reference
TENP	Tsavo East National Park
WSSD	World Summit for Sustainable Development
WRA	Water Resources Authority
WHO	World Health Organization
WTP	Water Treatment Plant

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EXECUTIVE SUMMARY

The Environmental and Social Impact Assessment findings presented in this report provide a critical examination of issues considered important in fulfilling the requirements of a clean, sustainable and healthy environment. This report is primarily aimed at establishing the environmental and social impacts of the proposed installation of a two strand 20Km Long electric fence along Mtito River in Kamungi Conservancy to help prevent wildlife interactions with humans especially the elephants that are rampant in destroying community farm lands. Human-wildlife conflicts present one of the greatest challenges to wildlife management in Kenya today. Conflict arises due to the close proximity between people and wildlife, and more pronounced in areas where agricultural activities and high human populations invariably that lead people to encroachment in wildlife territory.

Human-wildlife conflict is also a land-use problem, and occurs because of incompatibility land use types and interests sharing a common boundary e.g. State owned national reserve neighbouring a crop producing private lands – all of them legitimate undertakings. Conflicts also arise from differing behaviour, goals, value needs, expectations, and ideologies between parties (Omondi, 1994). Kelso (1962) notes that land use conflicts occur because land resources are limited while wants are limitless. The increasing competition for use of scarce land has resulted in conflict management becoming a major issue. Effective conflict management requires adequate understanding of conflict history, causes and how it affects the parties involved. Human-elephant conflict epitomizes human-wildlife conflict, and is defined by the IUCN/SSC African Specialist Group as "any human-elephant interaction, which results in negative effects on human-social, economic or cultural life, on elephant conservation or on the environment"

It is in this light that the proponent through consultations with relevant stakeholders proposed for the installation of an electric fence. The fence will be electrified using solar power energy from two power energizers. Wooden posts will be used to support the power cables which will prevent the animals specifically the elephants from crossing the river to the people's farm lands. The fence will be put in a manner so as to allow the public access the water in the river as well as their livestock with ease. The ESIA team made wide consultations, interviews and field visits to the project area and offices of relevant stakeholders. The views and concerns of all relevant stakeholders were noted and considered when writing this study report.

Objectives of the study

The objective of the EIA is to enhance project sustainability through appropriate intervention in project development. The specific aim of the project report is to identify all impacts, beneficial or detrimental, which can result from the project implementation and operation, and provide mitigation measures in view of the Terms of Reference. The scope of the present study was to:

- Describe nature of the project, location and rationale;
- Describe the pertinent policies, legislation, regulations and standards governing environmental quality at national and international levels;
- Identify potential positive and/or negative environmental impacts and of the project;
- Propose environmental mitigation plan to minimize those negative impacts;
- Develop an environmental monitoring plan.

Terms of Reference (TOR) for the ESIA Process

The scope of the assessment covered excavation works, development works of the proposed development which include ground preparation, masonry, and erection of electric fence components, as well as other utilities required.

The consultant on behalf of the proponent conducted the study by incorporating the following terms of reference:-

- Review of the preliminary designs to assess any impact of installation and operation on the environment;
- Carry out a comprehensive assessment ensuring all environmental concerns and views of all parties/persons likely to be affected by the project are taken into consideration;
- A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project;
- The objective of the project;
- The technology, procedures and processes to be used, in the implementation of the project;
- The materials to be used in the development and implementation of the project;
- The products, by-products and waste to be generated by the project;
- A description of the potentially affected environment;
- The environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated;
- To recommend a specific environmentally sound and affordable waste management system.
- Analysis of alternatives including project site, design and technologies;
- An environmental management plan.

The output of this assessment is a comprehensive Environmental Impact Assessment project report for the purposes of applying for NEMA approval and issuance of a license for the proposed development.

ESIA Methodology

The study was carried out at desk level and also through a detailed and structured field study. The process included: collection of baseline data to describe the status of the project site before project implementation; data analysis and evaluation; public participation to identify the concerns of persons likely to be affected by the project; and preparation of an ESIA study report encompassing the details specified in the Legal Notice No. 101 of 13th June 2003 which deals with the Environmental Impact Assessment/Audit Regulations.

Policy, Legal and Regulatory Framework

The Environmental Management and Co-ordination Act (2015 Revised), is the legislation that governs ESIA studies in Kenya. This project falls under the Second Schedule of EMCA 2015, which lists the type of projects that are required to undergo ESIA studies. Other key national laws that govern the management of environmental resources in the country have been discussed in this report.

Project Main Project Components

The "Elephant exclusion zone" fencing is a very simple but effective way off keeping elephant out of specific areas, in this case community small scale farmland. This type of cost-effective fence is basically two live wires separated by 1.5 feet and one earth wire that runs along the ground (dug underground or pegged in at intervals). The 2 live wires are nailed to trees being attached using a W-insulator to stop shorting. Where there are no trees, then posts can be used. The 2-strand fence is set approximately 5 to 6 foot off the ground and attached to trees wherever possible rather than fence posts. This system is environmentally friendly and insignificant impact as there are few fence posts (possibly one or two where there are no trees), the wire soon oxidizes and is not visible easily, and provided the fence is maintained and power upheld it does work well as an elephant barrier. Livestock and people can easily move under the fence so free movement is not impaired at all. It has been tried and tested in various conservation areas such as Lewa Wildlife Conservancy and MT. Kenya Forest, to name just two examples.

Project Cost

Table 1: *Anticipated Project Cost*

BUDGET:
1 US$ = Ksh. 100
20 kilometers fencing

Item Description	Quantity	Unit Cost $	Cost $
Treated long Gate posts 7" x 8" x 20' – 10 posts p/km	200 posts	50	10,000
Treated fence posts 6" to 7" x 9' – 40 posts p/km	800 posts	22	17,600
Double galvanized 12.5-gauge x 50kg fencing wire – 3 rolls p/km	60 rolls	130	7,800
Super strainer insulators – 25 p/km	500 pcs	35	17,500
W-insulators – 60 p/km	1,200 pcs	11	13,200
H/D.P.E ½" pipe x 50m p/km	1,000m	8	8,000
Stafix Energizer X8 model	2	980	1,960
Solar panel, 200 Watt	4	300	1,200
Solar charge controller	2	160	320
Solar battery	4	300	1,200
Solar steel fabricated stand	2	200	400
Energizer steel fabricated box	2	200	400
Cables etc	2 sets	150	300
Total materials			**79,880**
Total transport			**2,800**
Labour and food rations 15%			**12,000**
Tsavo Trust administration costs 5%			**5,000**
GRAND TOTAL for 10 kilometers			**$ 99,680**
Cost per meter = US$ 5			

Summary of Findings

A number of positive and negative anticipated impacts to the environmental and social wellbeing were identified.

Project Impacts

The project is geared towards enhancing social and economic benefits through Human Elephant Conflict (HEC) Mitigation, Clean Water Access, Increased Resilience, and Capacity Building in the area between Mtito Andei east to Athi River, in collaboration with Kamungi Conservancy (KC) and Makueni County Gov't (MCG).

Potential Positive impact

The expected positive impacts from the project include;

- ✓ Incorporation of environmental, health and safety concerns.
- ✓ Reduced human-wildlife conflict specifically the elephants.
- ✓ Increased conservation.
- ✓ Increased productivity and food security.

- ✓ Better watershed protection.
- ✓ Climate change mitigation and adaptation.
- ✓ Improved security
- ✓ Improved social order
- ✓ Reduced cases of pulmonary diseases.
- ✓ Social-economic impacts: peace, less damage to property and infrastructure; better relations with the conservancy management.

Impacts during Operation Phase

1. Skills transfer to local –The project will promote skills transfer not only during the development phase but also during the operation phase of the project as locals will get employed.
2. Increase in population - The project will lead to an increase in the local population in the area as some people come to work or seek employment. The increase in local population will increase the market for local products. There will also be an increase to the number of elephants in the conservancy due to minimal interactions with humans.
3. Increase in local economic activities - The presence of the conservancy and its associated activities will increase local economic activities.
4. Promotion of Eco-Tourism - Tourism already plays a considerable role in all nature reserves and in particular is often magnets for tourism. Travel motivations which can support the decision to visit a natural or national park include cleaner air, cleaner water, getting away from a polluted environment and experiencing nature.

Negative Project Impacts and Mitigation Measures (Biophysical and Socio-Economic)

The potential negative impacts likely to be triggered by the development includes;-

- ✓ Loss of vegetation from clearing of vegetation and habitat destruction by animals: Limiting clearing area, trees planting.
- ✓ Soil erosion from loss of vegetation, compaction and machines/vehicles: Using manual labour as much as possible, drainage, and backfilling.
- ✓ Solid wastes from vegetation clearing, pitting, materials used and human activity: Backfilling, proper wastes collection and disposal, community policing against dumping.
- ✓ Restriction of wildlife movement by fence resulting in trampling, habitat destruction, and overgrazing, increased populations: Securing migratory corridors.

- ✓ Increased human activity near conservancy edge impacting on wildlife: Community education and mobilization.
- ✓ Visual intrusion from artificial structure: Using colors of poles and materials that blend well with the surrounding environment, use of trees as poles.
- ✓ Air pollution from fumes and dust: Use of serviceable vehicles and equipment, and proper wastes disposal.
- ✓ Noise from vehicles, machines, man: Use of serviceable equipment, education, and not working at night.
- ✓ Human wastes: Toilets (mobile and pit); liaison with adjacent communities.
- ✓ Increased accidents from electric fence: Community education and warning signs.
- ✓ Offsite impacts: Procuring materials from known sustainable sources

CHAPTER ONE
1.0 INTRODUCTION

1.1 General Background

Kamungi Conservancy is a community conservancy located on the northern boundary of Tsavo East National Park between Mtito Andei to the West and the Athi River coursing alongside the Yatta Plateau to the East. Tsavo Trust has worked with the local Kamba communities since 2013 to establish the Kamungi Conservancy, and to create a vital buffer to the northern boundary of Tsavo East National Park to which Kamungi Conservancy borders. Establishment of a buffer is important as this region serves as an entry point into the Park for poachers, charcoal burners and hard wood extraction as well as illegal grazing of livestock within the Protected Area.

Kamungi Conservancy works closely with the KWS through Tsavo Trust to secure and monitor wildlife and assist in law enforcement through trained Kamungi Conservancy scouts. The Conservancy also works to reduce Human Wildlife Conflict, educate the community, to secure and diversify livelihoods. Tsavo Trust also plans to facilitate an increase ecotourism in this area, reduce poverty through employment, education, healthcare, water projects, and agricultural best practice.

Tsavo Trust provides the stewardship role for capacity building, fundraising potential and commitment to ensure that the members of Kamungi Conservancy enjoy and realize better forms of livelihood in what is a challenging and harsh environment.

Tsavo Trust is Kenyan registered not-for-profit conservation organization governed by a Kenyan Board of Directors, headquartered in Kamungi Conservancy, Makueni County.

- Tsavo Trust works in collaboration with County Government of Makueni – Water, Environment, Sanitation and Climate Change (WESCC) Office, who have endorsed this concept paper.
- Tsavo Trust works to a valid MoU with the Kenya Wildlife Service (KWS).
- Tsavo Trust partners with Kamungi Conservancy through a stewardship role. Kamungi Conservancy is a registered Community Based Organisation (CBO) with membership to Kenya Wildlife Conservancies Association (KWCA) located in the project area.
- Tsavo Trust works closely with the area Senior Chief, from the Office of the President.

The intended project involves activities with impacts to the ecological environment, culture and socio-economic set-up of the area. Therefore, the proponent (Kamungi Conservancy in collaboration

with the County Government of Makueni) as a major stakeholder in environment conservation needs to undertake the environmental management responsibilities through conducting an environmental and social impact assessment for the proposed project to assess and address the anticipated environmental concerns emanating from the project implementation, operation, and future decommissioning phases.

1.2 Terms of Reference

The environmental consultants as stipulated under the Environmental Management and Coordination Act was commissioned by the proponent to undertake an environmental impact assessment for the proposed development of an electric fence to assess the environmental and social impacts that may result from electing a 20Km long two strand electric fence along Mtito River in Mtito-Andei ward in Kibwezi East Sub-county. The ESIA report forms the baseline for objective evaluation of how activities and processes involved during implementation, operational and decommissioning phases will impact on the general social and natural environment and whether the activities will conform to the approved environmental management standards and sound environmental management practices with the main objective of promoting safe and healthy environment at all phases of the project.

The Term of Reference (TOR) within which the mandate of the experts is stipulated provides a basis upon which the eventual project report can be evaluated.

1.3 ESIA Guiding Principles

The guiding principles for Environmental Impact Assessment are:

- It requires that all environmental concerns be accounted for in all development activities;
- It also encourages public participation in all stages of proposed project development. It increases the ownership and sustainability.
- It also recognizes the role of social and cultural principles traditionally used in the management of the environment and natural resources; International cooperation in the use and wise management of shared resources; Intra-generation and inter-generation equality; Polluter-pays principle; and the precautionary principle.

1.4 Objectives, Scope and Methodology

The general objective of the ESIA is to assess all activities involved in the development of the proposed facilities, the subsequent operation and decommissioning processes; and the arising environmental impacts according to the requirements of the Environmental Management and Co-ordination Act 2015, and in accordance with the stipulations of Legal Notice No. 101, the Environmental (Impact assessment and Audit) Regulations, 2003 and the Local Authority by-laws.

Development of the proposed facilities essentially requires an environmental management system. The responsibility to the environment, wildlife and the other projects and of the community in the area is tremendous. During the development phase, the project activities will generate temporary and/or permanent impacts, which include solid waste generation, air and noise pollution etc. During the operation phase, the project could generate several long-term impacts, either beneficial or detrimental e.g. interference with the cultural set-up of the area, improvement of the socio-economic set up of the area, development of essential infrastructure, etc.

The objective of the ESIA is to enhance project sustainability through appropriate intervention in project development. The specific aim of the project report is to identify all impacts, beneficial or detrimental, which can result from the project implementation and operation, and provide mitigation measures in view of the Terms of Reference.

1.4.1 Objectives of Environmental and Social Impact Assessment (ESIA)

The overall objective of carrying out an Environmental and Social Impact Assessment is to determine the likely impacts of a given project on the environment, propose possible mitigation measures and monitoring.

The Constitution of Kenya requires that environmental concerns are integrated in all economic Development which calls for environmental integration in the project life cycle in order to:

- Protect and manage the environment for sustainable development;
- Integration of environmental management and economic decisions at early planning stages;
- Predict the consequences of a proposed project in terms of environmental, social, economic and cultural settings and propose mitigation measures;
- Compare available alternatives for a particular project and determine the optimal mix of environmental and economic costs and benefits; and
- Involve public, proponents, private and government agencies in assessment and review of the proposed project in an open, transparent and participatory approach.

1.4.2 Scope and content of project assessment

The project assessment investigates and analyzes the anticipated environmental impacts of the proposed drilling of the borehole in line with the Environmental Impact Assessment and Audit 2003 regulations. Consequently, the report provides the following:

- Nature of project;
- The location of the project including the physical area that may be affected by the project's activities;

- The activities that shall be undertaken during the project installation, operation and decommissioning of the project;
- The materials to be used, products and by-product including waste to be generated by the project and the methods of disposal;
- The potential environmental impacts of the project and mitigation measures to be taken during and after the implementation of the project;
- An action plan for prevention and management of possible accidents during the project cycle;
- A plan to ensure the health and safety of the workers and the neighbouring communities;
- The economic and social cultural impacts to local community and the nation in general.

To achieve all this, a systematic approach was followed by the consultant that includes the general steps outlined below:

- Environmental screening;
- Environmental scoping which provided the key environmental issues;
- Desktop studies;
- Interviews with the Project Proponent;
- Physical inspection of the site and surrounding areas;
- EIA Public participation; and
- Reporting including the preparation of an Environmental Management Plan.

All these aspects were considered accordingly. This report also seeks to ensure that all the potential environmental impacts are identified and that workable mitigation measures are adopted. The report also seeks to ensure compliance with the provision of the EMCA (Rev 2015), and Environmental (Impact Assessment and Audit) Regulations 2003 as well as other regulations.

The report emphasizes the duties of the proponent and contractor during the installation phase as well as the operation phase of this project.

1.4.3 Methodology

The assessment team used both primary and secondary data collection. Primary data was collected through site visits and public consultations. While at the site, the consultant used key informant interviews, semi structured interviews, observations and focus group discussions. Secondary data was obtained through literature review.

❖ **Literature Review**

Information obtained through literature review enabled us to know:

- Field information available;

- Data gaps to be filled;
- Social, environment, community and land ownership criteria likely to influence the sitting and operation of the project; and
- Relevant laws and regulations.

❖ **Site Visits**

The project site was visited in order to:

- Develop a better understanding of the project area;
- Consult the local people about the proposed project and document their views;
- Carry out geological surveys; and
- Assess project impacts.

❖ **Public Consultations**

Consultation was also undertaken as part of the ESIA in order to obtain the views of members of the immediate community and interested and affected groups within the site's immediate area of influence. The consultation was done with randomly selected people in the neighbourhood of the proposed site and involved use of a semi-structured interviews.

❖ **Fieldwork/Assessment**

This included a reconnaissance survey of the project area, assessment of existing occupational activities of the neighbours, existing type of land ownership, any existing infrastructure including water supply, sewerage system, power and telephone lines, road network, emergency response facilities, and the general proponent's site set up. Alternatives to the various components of the project such as, design, water pipeline transmission route, relocation of the site and No-option alternative were assessed. Further, identification of mitigation measures and enhancement measures, assessment of the significant impacts and comparison with alternatives was carried out in detail.

❖ **Environmental Management Planning**

Following identification of the nature and scale of potential impacts of the proposals, the ability of these impacts to be reduced or eliminated was considered. This involved the development of suitable mitigation measures which included recommendation of design and technology or additional protection measures. The preparation of an environmental plan to implement mitigation measures and monitoring recommendations has also been undertaken as part of the project report.

CHAPTER TWO
2.0 PROJECT JUSTIFICATION AND ITS DESCRIPTION

2.1 Project Justification

The principle objective of the ESIA study was to carry out a systematic examination of the baseline environmental situation within the project area in order to determine whether or not the proposed project requires the development and how it will impact on the environment. The specific objectives of the proposed project include, but are not limited to, the following:

- To determine the compatibility of the proposed project with the neighboring land uses and evaluate local environmental conditions.
- To identify and evaluate the significant environmental impacts of the proposed project.
- To assess the environmental and social impacts that may result from electing a 20 Km long two strand electric fence along Mtito River in Mtito-Andei ward in Kibwezi East Sub-county.
- To carry out extensive public and other stakeholder consultation on the proposed project.
- Assess risks and hazards associated with the project activities.
- To assess the alternative to designs, sources of energy and sources of materials.
- To provide an Environmental Social Monitoring & Management Plan and propose mitigation measures to any possible adverse environmental, ecological and social Impacts.

For several years, small-scale agriculture has taken place east of Mtito Andei town and along the seasonal river also called the Mtito River. This river course is the boundary between Tsavo East National Park (TENP) to the south (area known as the “Triangle”) and local community small-scale farmlands to the north in an area today known as Kamungi Conservancy (a part of Ngiluni Settlement Scheme – and also part of what was formerly known as Ngai Ndethya National Reserve) and other communities that lie outside Kamungi Conservancy but still border TENP and frequently experience Human Elephant Conflict (HEC).There are many cases of HWC and a negative perception towards wildlife as a whole. Other animals involved in this human animal conflict in the project area includes Zebras, Baboons, Leopard, Hyenas, Lions. The following photographs shows some of the damages done to residents properties.

Fig 1.Elephant destructive nature on private property

Fig 2. Fresh Elephant Excrement at a farm

Fig 3 Zebras rooming outside the conservancy

Fig 4 Damage done to a resident farm by Zebras

Fig 5 Goat attacked by Hyenas

This has however changed in a positive way since Kamungi Conservancy was established in 2015. Though elephant crop raiding has increased, Kamungi's anti-poaching patrols assistance by Tsavo

Trust has availed employment, water projects and better healthcare to mention just a few that has, over time changed community perceptions and tolerance towards wildlife.

HWC remains one of the greatest challenges that Kamungi Conservancy members (1,500) face on a near daily basis. In the first 6 months of 2017 alone, there was an average of 28 Human Wildlife Conflict (HWC) cases every month and over 70% of these were cases of elephant conflict. At the same time, there are members of these communities that are known to poach wildlife, including elephant, within the National Park, just across the unfenced Mtito River. Other communities that border the Tsavo Triangle west of Kamungi towards Mtito Andei town, have a constant fear of crop raiding elephants as this occurs regularly if not daily and there is real urgent need to mitigate this conflict. These communities of Kyusyani and Nthunguni villages are keen to become members of an expansion phase of Kamungi Conservancy over time. Engaging with them in support of this HWC situation could be an excellent way to "bring them on board" in other conservation matters such as illegal natural resource extraction from the TENP Triangle area, something that has been taking place for many years and ongoing. It is therefore felt that if the HWC concerns of the adjoining community can be addressed with the development of a cost-effective fence to keep elephant from crop raiding, then the illegal activities of some local community members such as poaching, charcoal burning, and logging can be addressed in a better way by the Kenya Wildlife Service (KWS), Kamungi Conservancy and Tsavo Trust who are tackling these issues daily. In short a "scratch each other back scenario".

In regard to that, Kamungi Conservancy in partnership with the Government of Makueni County are proposing to elect a two strand electric fence along Mtito river to help keep away wildlife specifically elephants that are rampant in destructing community farm lands. The fence will be electrified using solar power energy from two power energizers. Wooden posts will be used to support the power cables where necessary and utilizing which will prevent the animals from crossing the river to the people's farm lands. The fence will be put in a manner so as to allow the public access the water in the river as well as their livestock with ease. It is also important to note that community members residing inside the conservancy will not be evacuated but will have their own barricades where they will be provide with a two strands electric fence. However they will be required to pay a certain percentage in addation.

2. Project description

2.2.1 Electric Fencing

During the study scoping stage, electric fencing was identified as the most effective barrier to manage problem animals in the area especially the elephants. The "Elephant exclusion zone" fencing is a very simple but effective way of keeping elephant out of specific areas, in this case community small scale farmland. This type of cost-effective fence is basically two live wires separated by 1.5 feet and one earth wire that runs along the ground (dug underground or pegged in at intervals). The 2 live wires are nailed to trees being attached using a W-insulator to stop shorting. Where there are no trees, then posts can be used. The 2-strand fence is set approximately 5 to 6 foot off the ground and attached to trees wherever possible rather than fence posts. This system is environmentally friendly and insignificant impact as there are few fence posts (possibly one or two where there are no trees), the wire soon oxidizes and is not visible easily, and provided the fence is maintained and power upheld it does work well as an elephant barrier. Livestock and people can easily move under the fence so free movement is not impaired at all. It has been tried and tested in various conservation areas such as Lewa Wildlife Conservancy and Mt. Kenya reserve.

2.2.2 Planning

This has already started and has included the undertaking of this Environmental and social Impact Assessment. Already, a scoping exercise has been undertaken and it involved extensive consultations with the conservancy adjacent communities and key stakeholders. The ESIA process has also involved various meetings and discussions that have been held to try and identify the best wildlife barriers to mitigate human-wildlife conflicts, and it is from this process that the electric fence, its design and alignment were chosen.

In choosing the design of the electric fence, the key problem animals were considered with respect to their sizes, intelligence. In our case, the elephants were the Key interest. The geographical factors and location of site to be fenced were also considered.

Project sustainability was one of the critical issues considered in the planning phase. In this regard, the planning stage has ensured that project sustainability is guaranteed through community participation from the very beginning. The scooping exercise and other initial meeting held between communities determined that the wildlife barriers were actually required and indeed requested by the conservancy adjacent communities as the best way to mitigate

human wildlife conflicts. The scooping exercise determined that the electric fence was indeed the preferred barrier.

The electric fences are thus community driven, and the proposed project will involve the community in the implementationand maintenance (operation) phases. Already, most communities have fence committees in place and monies have also been contributed from among the conservancy adjacent communities.

The project sustainability is also guaranteed due to the high socio-economic benefits that will accrue to the conservancy adjacent communities. Key will be poverty alleviation through minimization of crops and infrastructure destruction by animals. The fences will also restore social order and improve small holder agriculture production, food security, and general security, reduced incidences of pulmonary diseases, and improved incomes and livelihoods. Additionally, the sustainability is assured due to the commitment of the communities to maintain the fences. In this regard, it is proposed to form a Kamungi Conservancy Fence Trust Fund to manage the proposed electric fence and also to give room for other players, especially donors to come on board to ensure that the whole perimeter fence in erected. The Trust Fund will have both a Management and Technical Committee and will involve the KWS, NEMA, donors, and local communities.

2.3 Development Phase

This will be the main phase of the project and will include the actual erection of the fence. The design of this fence is that it will comprise of two strands of wire. The fence is designed to allow ingress of larger wildlife from the settlement side by breaking the W- insulators, but to prevent egress of wildlife from the rangeland. Key activities will include:-

2.3.1 Clearing of the fence alignment

This will start with the surveying of the alignment by the conservancy management. The fence alignment will be on the boundary between the conservancy and the community. The clearing will thus be on the conservancy side. The conservancy management together with the County Government of Makueni will determine how the cleared vegetation will be disposed.

2.3.2 Pitting and erecting fence posts

This type of cost-effective fence is basically two live wires separated by 1.5 feet and one earth wire that runs along the ground (dug underground or pegged in at intervals). The 2 live wires are

nailed to trees being attached using a W-insulator to stop shorting. Where there are no trees, then posts can be used. The 2-strand fence is set approximately 5 to 6 foot off the ground and attached to trees wherever possible rather than fence posts.

This system is environmentally friendly and insignificant impact as there are few fence posts (possibly one or two where there are no trees), the wire soon oxidizes and is not visible easily, and provided the fence is maintained and power upheld it does work well as an elephant barrier. Livestock and people can easily move under the fence so free movement is not impaired at all... All posts will be well tamped prior to the attachment of insulators and wires.

2.3.3 Straight and angle-strainer assemblies

Straight-line strainer assemblies will be installed at a maximum distance of 200 metres or at any point where there is a rise and fall in the fence line. Angle strainer assemblies will be installed at every point where the fence alignment changes.

2.3.4 Electrics

Shock stops: These will be coupled to the energizer to enable maintenance staff to switch the fence off and on during maintenance. They will be mounted on a panel located in an energizer house.

Lightening Diverters Kit: These will be built in spiral chokes manufactured using thick wall PVC pipes and galvanized wires and connected between the fence and the earth.

Earthing: The earthling system for both the energizer and the lightening diverter will be installed. Two earth pegs interconnected by an under gate cable tied by a joint clamp will be driven deep into the ground and space at two metres. This will be at least 10m from any water supply, earth peg, underground telephone or power cable.

Wiring: The high tensile plain wires will be highly galvanized with a tensile strength of 1200-1400N. The wires will be passed in line W-insulators on wooden posts and through porcelain reel insulators on the steel posts and directly nailed to the posts/tree. The earth wires will be stapled directly to the posts interlinked by wire links from the top strand to the lowest. The

Staples: On treated timber posts used in the fence framework, the wires will be secured with shanks, hot dipped, galvanized fencing staples. The staples will be hammered into the post

pointing slightly downwards, and to avoid the danger of splitting, the timber will be set in a staggered pattern down the post.

Line Clamps: All connections to the live wires will be made with line clamps, which will be well tightened and covered with a film of grease.

Warning: "HATARI" warning signs will be attached to the live wire at a spacing of approximately 90 meters.

2.3.5 Gates

These will be constructed at any point where access to the area is required. This will generally vary with different areas but gates will normally occur to allow human access for firewood, water and other conservancy products (wood and non-wood). The actual gate locations and distances between them will be discussed with the conservancy adjacent communities, KWS and each gate will need to be justifies as they should be as few as possible. It is proposed that due to pressure from elephants the gates are equipped with live droppers.

2.3.6 Energizer house

There is one energizer house already installed that serves some established areas. It is anticipated that the other two solar panel, the energizer and battery banks will be housed at the KWS Mtito Gate into the Triangle near Mtito Andei and the other at Kamungi Conservancy ranger HQ that borders the Park in a central and ideal location, thus they will be safe from theft, and the fence line itself will follow the Mtito River and be attached to trees on the community side as well as follow the boundary road around the "wildlife friendly" zoned section (phase 1) of Kamungi Conservancy developments (See Kamungi Conservancy Management Plan 2018 to 2022). This way people and community livestock will still have access to the Mtito River. This plan has been discussed with the community and they are very happy to help and participate in this project.

This fence configuration has been used extensively, with success, to mitigate HEC on National and Private Protected Areas especially in northern Kenya. They will be built to accommodate the maintenance staff or the security officers at the fence. The houses will be located at convenient points at intervals. There is already a built power house that powers some selected established institutions. The conservancy has involved itself in various corporate social responsibilities. It has committed to fence all individuals or organization within the conservancy at a certain

agreement. Already there are some fully established developments that are helping the community.

Fig 6: Already Established Energizer House

Fig 7: A 2- strand erected fence at Ngiluni dispensary

2.3.7 Access roads

The fence will have a service or access road which is fairly motorable road, and which will be well maintained for proper monitoring of the fence.

Fig 8: Access Earth road to various locations along the proposed fence route

2.3.8 Materials and equipment

The materials and equipment to be used in the fencing project will include the following as indicated below.

Table 2*: Materials and equipment's to be used in the fencing project*

DESCRIPTION	SPECIFICATIONS
Line posts	15 cm x 270 cm Blue Gum (treated)
Corner posts	15 cm x 300 cm Blue Gum (treated)
Fencing wire	High tensile 2.5 mm 350 gm/m2 zinc coating 25 kg 650 m
Energizer	B. 700 High Power 7.0 joules
Strain insulators	Porcelain strain insulator white
W-insulators	Wooden post insulator black
Solar Panel	70-80 watts type or equivalent
Battery	Solar battery 12 volts 100 AH deep cycle cells
Joint clamps	Fence clamp
Warning signs	Yellow plastic
Under-gate cable	Double insulated under gate cable 2.5 mm 100 m
Staples	2.5 cm x 2.5 cm fencing nails
Nails	10 cm flat end
Earth pegs	15 cm x 180 cm G.I tube
Lightening arrestor	Lightening diverter
PVC pipe	Plastic 2.5 mm diameter
Cement	Ordinary 50 kg bag
Ballast	2.5 cm x 2.5 cm machine crush
Sand	River sand

2.4 Operations Phase

Once erected, the fence's operational phase will mainly involve maintenance work and monitoring to ensure that the fence is live and serving as a barrier to mitigate human-wildlife conflicts.

Maintenance work will mainly involve clearing of vegetation, the corridor established for the fence's alignment. This is because the fence should be free of all vegetation as these serve to drain voltage from the fence making reducing its efficiency. Other maintenance work will involve regular servicing of equipment.

The fence will also require close monitoring especially with regard to vandalism, loss of voltage, and wire breakages. Vandalism of batteries and wires is common and this should be monitored. The fence should also be monitored to ensure that there are: -

- No broken wires
- No broken posts
- No broken insulators
- No disconnected or intertwined live wires or earthlings
- No disconnected lead-out wires
- No wires are in contact with vegetation or other objects

To ensure proper monitoring and maintenance, the community members will be trained by KWS especially with regard to how the fence works, taking voltage measurements, and how to undertake simple repairs. They will also be given any tools and equipment required to undertake this work.

Illustrations

The following diagrams show a clear picture of how the two strand installation will be.

Fig 9. Photo shows "Elephant Exclusion Zone" showing 2 wires attached to trees.

At a time when the human encroachment on wildlife habitat has reached untenable heights where HEC occurrences are regular, every measure possible should be looked at. This mitigating project could be a “win, win” venture to halt crop raiding elephant and at the same time halt illegal activities in the Protected Area, especially elephant poaching.

Fig 10. wire strands attached to trees, using super strainer insulators, where soft and loose pipe is used around the live tree so as to allow its continued growth unimpaired.

Fig 11. Photo shows 2 wire strands attached to a live tree, using W-insulators, where the tree acts as the support instead of a fence post.

Fig 12.Photo shows a rustic / natural looking fence post (left) with 2 wire strands attached to a live tree ,5 feet off the ground, that allows free movement of other wild and domestic animals and people to move underneath.

Fig 13. Photo shows a road pass through the Elephant Exclusion Zone style fence, with 2 x 20-foot posts on either side of the road holding up the electric wires with “drop down wires” to allow vehicles to pass underneath.

2.5 Decommissioning Phase

The main reason for the erection of barriers is to mitigate human wildlife conflicts. As such, the fence may be regarded as 'permanent' in the sense that, the without it, the conflict will persist, and in so long as the wildlife and human beings continue to be in close proximity, there is bound to be conflict.

With time however, and considering that research is always ongoing, there might come a time when other management tools may be discovered to adequately address the issue of human-wildlife conflicts without needing the fence. In this case, the poles and fence may be left to serve as boundary, and the electrics removed and used elsewhere for provision of solar energy.

CHAPTER THREE
3.0 RELEVANT POLICY, LEGISLATIVE AND REGULATORY FRAMEWORKS

3.1 Legal Framework

This chapter is a description of the national environmental legislative, policy, administrative and regulatory framework related to the project.

ESIA is a tool for ensuring new projects and programmes incorporate appropriate measures to mitigate adverse impacts to the environment and peoples' health and safety as well as enhancing sustainable operations with respect to environmental resources and co-existence with other socio-economic activities in their neighborhood. Necessary policies and legislation that ensures annual environmental audits (EA) are carried out on every running project, activity or programme and a report submitted to National Environmental Management Authority (NEMA) for approval and issuance of relevant certificates.

According to the Kenya National Environment Action Plan (NEAP, 1994) the Government recognized the negative impacts on ecosystems emanating from industrial, economic and social development programmes that disregarded environmental sustainability. Following on this, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been accomplished and/or are in the process of development. The NEAP process introduced environmental assessments in the country with among the key stakeholders being industrialists, business community and local authorities. This culminated into the enactment of the Policy on Environment and Development under the Sessional Paper No. 6 of 2015.

3.1.1 Environmental Management and Coordination (Amendment) Act, 2015.

The Environmental Management and Coordination Act, Cap 387 received assent on 6th January 2000 and was gazetted on 14th January 2000 and amended in year 2015. The Act correlatively entitles every person in Kenya to a clean and healthy environment meaning people are entitled by others but they also have a responsibility of ensuring they do not undermine other people's enjoyment of the environment. The main objectives of the Act are to:-

- Provide guidelines for the administration of an appropriate legal and institutional framework for the management of the environment in Kenya.
- Provide guidelines for environmental impact assessment, Environmental Audit and monitoring, environmental quality standards and environmental protection orders.

- The second schedule to the Act lists the projects for which an ESIA and EA must be carried out.
- Section 68 of the Act specifies that accurate records should be maintained and annual reports submitted to NEMA as required.

3.1.2 Environmental Management and Co-ordination Water Quality Management Regulations, 2006 (Legal Notice No. 120)

These regulations were drawn under section 147 of the Environmental Management and Coordination Act 2015. In accordance with the regulations (part II), every person shall refrain from acts that could directly or indirectly cause immediate or subsequent water pollution and no one should throw or cause to flow into water resources any materials such as to contaminate the water. The regulation also provides for protection of springs, streams and other water sources from pollution. The act also states that no farming activities should be carried out near a river or stream to a minimum of six meters and maximum of thirty meters based on the highest recorded flood level. Part IV provides regulations for agricultural use and it states that any owner or operator of an irrigation scheme shall create a buffer zone of at least fifty meters in width between the irrigation scheme and the natural water body into which such irrigation scheme discharges its waters.

This regulation is relevant in two ways: (a) the proposed project will be implemented in a wetland area, within the floodplain of River Mtito , and in an area which has a number of springs and; (b) the fence major purpose is to end human- animal conflict. The contractor will therefore be required to exercise extreme caution to ensure pollution of the river is avoided as much as possible. Further, they will have to go by the stipulated regulations for spring protection and irrigation.

3.1.3. Environmental Management and Co-ordination (Wetlands, Riverbanks, Lakeshores, and Seashores Management) Regulations 2009

The main purpose of this regulation is to provide for the conservation and sustainable use of wetlands and their resources in Kenya. Environmental Impact Assessment and Environmental Audit as required under the EMCA shall be mandatory for all activities likely to have adverse impact on the management of wetlands. Part II section 4 of the act provides for the management of wetlands and wetland resources, especially with a view to (c) to ensure the conservation of water catchments and the control of floods; and (e) to ensure the protection of wetlands as habitats for species of fauna and flora. Section 5(1)(a)states that wetland resources shall be utilized in a sustainable manner compatible with the continued presence of wetlands and their hydrological, ecological,

social and economic functions and services. In that line, section 5(1)(b) requires that an environmental impact assessment and environmental audits as required under the Act shall be mandatory for all activities likely to have an adverse impact on the wetland.

While this report serves as a compliance to the section 5(1)(b), the proponent and the contractor will be required to ensure that the project complies with all the relevant provisions of the act, especially those that have been cited above. This should be achieved in terms of project design, sitting and adherence to good engineering practices during development phase.

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

The regulations are formed under sections 92 and 147 of the Environmental Management and Coordination Act, 2015. Under the regulations (Part I CAP 243), a waste generator is defined as any person whose activities produces waste while waste management is the administration or operation used in handling, packaging, treatment, conditioning, storage and disposal of waste. Part II of the regulations requires a waste generator to collect, segregate and dispose each category of waste in such manners and facilities as provided by relevant authorities. Part II section 9 states that, licensed persons shall operate transportation vehicles approved by NEMA and will collect waste from designated areas and deliver to designated disposal sites.

This regulation puts specific obligation on the contractor to ensure that the waste generated (especially the bulk soils which will be generated during the excavation for the construction) is carefully handled and transported to a designated place offsite. Any other wastes generated during the development phase and from the energizers will also require proper handling and safe disposal.

3.1.5 Environmental Management and Co-ordination Conservation of Biodiversity, Access to Genetic Resources and Benefit Sharing Regulations 2006

The Conservation of Biodiversity Act Sections 5-9 provides for the protection of endangered species, creation of an inventory, and monitoring of their status, protection of environmentally significant areas, provision of access permits, material transfer agreements and benefit sharing. Part II of Regulations, section 4 states that no person shall engage in any activity that may have adverse impacts on ecosystems, lead to introduction of exotic species or lead to unsustainable use of natural resources without an EIA license. The regulation puts in place measures to control and regulate access and utilization of biological diversity that include among others banning and restricting access to threatened species for regeneration purposes. It also provides for protection of land, sea, lake or river declared to be a protected natural environmental system in accordance

3.1.6 The Environment Impact (Assessment and Auditing) Regulations, 2003

Legal Notice No. 101 stipulates the ways in which environmental experts should conduct Environmental Impact Assessment and Audits in conformity with the stated requirements. It is concise in its report content requirements, processes of public participation, licensing procedures, inspections and any possible offences under the Act. Section 58 of the EMCA No.8 of 2015, second schedule 9 (I) and environmental (impact assessments and audits) regulation 203, stipulate that both new and old projects must undergo EIA and audits. This is necessary as many forms of developmental activities cause damage to the environment and hence the greatest challenge today is to maintain sustainable development without interfering with the environment. In section 8(e) of the Second schedule of EMCA, this project is among the listed projects that require an Environmental Impact Assessment before the start of the project.

This report has been done to meet the requirements of EMCA for the projects approval.

3.1.7 Water Act 2016

The purpose of the 2016 Water Act is to align the water sector with the Constitution's primary objective of devolution. The act recognizes that water related functions are a shared responsibility between the national government and the county government. It also gives priority to use of abstracted water for domestic purposes over irrigation and other uses. The 2016 Water Act defines national public water works as water works whose water resource is: cross county in nature, financed out of the national government share of national revenue and intended to serve a function of the national government. These may include assets such as water storage and water works for the bulk distribution of water services. Furthermore, it specifies that development and management of national public works will be undertaken by the WWDAs whilst county public works will be a responsibility of the respective county. The 2016 Water Act provides for handing over of national public works upon commissioning from WWDAs to the county government, joint committee or authority of the county governments if the water works' assets exclusively rest geographically within their jurisdiction. The national government has the responsibility of supporting county governments to perform their respective duties. As such, upon commissioning of cross county assets, in a case where several county governments collectively want to transfer these assets from WWDA, the Act makes provision for establishment of an authority of county governments or a joint committee. Transfer of the ownership and management of these assets from the WWDA can then be done to the authority of the county governments or joint committee.

3.1.8 Conservancy Act

The Conservancy Act provides for the establishment, development and sustainable management, including conservation and rational utilization of conservancy resources for the socio-economic development of the country. Under Section 5 of the Act, the relevant functions that are applicable to the project are:

- Development of programmes and facilities in collaboration with other interested parties for tourism, and for the recreational and ceremonial use of conservancy s, collaborate with other organizations and communities in the management and conservation of conservancy s and for the utilization of the biodiversity
- Promote the empowerment of associations and communities in the control and management of conservancy s.
- Enforcement of the conditions and regulations pertaining to logging, charcoal making and other conservancy utilization activities

3.1.8 Physical Planning Act (Cap 286)

Section 24 of the Physical Planning Act gives provision for the development of local physical development plan for guiding and coordinating development of infrastructure facilities and services within the area of authority of County, municipal and town council and for specific control of the use and development of land. The plan shows the manner in which the land in the area may be used. Section 29 of the physical Planning Act gives the county councils power to prohibit and control the use of land, building, and subdivision of land, in the interest of proper and orderly development of its area. The same section also allows them to approve all development applications and grant development permissions as well as to ensure the proper execution and implications of approved physical development plans. On zoning, the act empowers them to formulate by-laws in respect of use and density of development.

Section 30 states that any person who carries out development within an area of a local authority without development permission shall be guilty of an offence and the development shall be invalid. The act also gives the local authority power to compel the developer to restore the land on which such development has taken place to its original conditions within a period of ninety days. If no action is taken, then the council will restore the land and recover the cost incurred thereto from the developer. In addition, the same section also states that no person shall carry out development within the area of a local authority without development permission granted by the local authority.

Section 36 states that if in connection with development application a local authority is of the opinion that, the proposed activity will have injurious impact on the environment, the applicant shall

be required to submit together with the application an Environmental Impact Assessment report. The environmental impact assessment report must be approved by the National Environmental Management Authority (NEMA) and followed by annual environmental audits as spelled out by EMCA 2015. Section 38 states that if the local authority finds out that the development activity is not complying to all laid down regulations, the local authority may serve an enforcement notice specifying the conditions of the development permissions alleged to have been contravened and compel the developer to restore the land to its original conditions.

3.1.9 The Wildlife (Conservation and Management) Act 2013 (Cap 376)

Part IX Section 62 to this Act provides for compensation for personal injury, death and loss of property by an animal. It states that any person who 'suffers any bodily injury from or is killed by any animal, or suffers any damage to or loss of crops or property or in the case of a deceased person, any person who was dependent upon him at the date of his death, may make application to a District Committee…for the award of compensation for such injury or death or damage or loss'.

3.2 POLICY PROVISIONS

3.2.1 Constitution of Kenya 2010

Article 42 of the Bill of Rights of the Kenyan Constitution provides that 'every Kenyan has the right to a clean and healthy environment, which includes the right to have the environment protected for the benefit of present and future generations through legislative and other measures'. Under Chapter 5 (Land and Environment), Part 1 is devoted to land. It requires that land be used and managed in 'a manner that is equitable, efficient, productive and sustainable, and in accordance with the following principles;

(i) Equitable access to land

(ii) Security of land rights

(iii) Sustainable and productive management of land resources

(iv) Transparent and cost effective administration of land

(v) Sound conservation and protection of ecologically sensitive areas

The provisions of the Kenyan Constitution therefore requires that wide consultations between the project proponent and key stakeholders (including the relevant institutions and the wider public, especially the affected persons) be held to ensure the right of Kenyans to enjoy a cleaner and sustainable environment versus the right to enjoy the potential benefits that the proposed development may bring are matched.

3.2.2 The Kenya Vision 2030

Kenya Vision 2030 is the current national development blueprint for period 2008 to 2030 and was developed following on the successful implementation of the Economic Recovery Strategy for Wealth and Employment Creation which saw the country's economy back on the path to rapid growth since 2002. GDP growth rose from 0.6% to 7% in 2007, but dropped to between 1.7% and 1.8% in 2008 and 2009 respectively. The objective of the vision 2030 is to transform Kenya into a middle income country with a consistent annual growth of 10 % by the year 2030". The 2030 goal for urban areas is to achieve "a well-housed population living in an environmentally-secure urban environment." This will be achieved by bringing basic infrastructure and services namely roads, street lights, water and sanitation facilities, storm water drains, footpaths, and others.

One of the aims of the vision is to make Kenya to be a nation that has a clean, secure and sustainable environment by 2030. This will be achieved through promoting environmental conservation to better support the economic pillar. Improving pollution and waste management through the application of the right economic incentives in development initiatives is critical. The current land use practices in the country are incongruent with the ecological zones. For instance, large portions of land in high potential areas have been subdivided into uneconomic parcels, while some parts of land in the medium and low potential areas are rapidly being converted into agriculture, despite the fragile environment they are located in.

3.2.3 National Environment Action Plan (NEAP)

According to the Kenya National Environment Action Plan (NEAP, 1994) the Government recognized the negative impacts on ecosystems emanating from economic and social development programs that disregarded environmental sustainability. In this regard, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been accomplished and/or are in the process of development. Under the NEAP process, EIA was introduced and among the key participants identified were the District Development Committees.

3.2.4 National Policy on Water Resources Management and Development

The National Policy on Water Resources Management and Development (Sessional Paper No. 1 of 2015) was established with an objective to preserve, conserve and protect available water resources and allocate it in a sustainable rational and economic way. It also desires to supply water of good quality and in sufficient quantities to meet the various water needs while ensuring safe disposal of wastewater and environmental protection. The policy focuses on streamlining provision of water for domestic use, agriculture, livestock development and industrial utilization with a view to realizing

the goals of the Millennium Development Goals (MDGs) as well as Vision 2030. To achieve these goals, water supply (through increased household connections and developing other sources) and improved sanitation is required in addition to interventions in capacity building and institutional reform.

While the National Policy on Water Resources Management and Development (2015) enhances a systematic development of water facilities in all sectors for promotion of the country's socio-economic progress, it also recognizes the by-products of this process as waste water. It, therefore, calls for development of appropriate sanitation systems to protect people's health and water resources from institutional pollution. Development projects, therefore, should be accompanied by corresponding waste management systems to handle the waste water and other waste emanating there from. The same policy requires that such projects should also undergo comprehensive EIAs that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighbourhood and further downstream are not negatively impacted by the emissions.

In addition, the policy provides for charging levies on waste water on quantity and quality (similar to polluter-pays-principle) in which case those contaminating water are required to meet the appropriate cost on remediation, though the necessary mechanisms for the implementation of this principle have not been fully established under the relevant Acts. However, the policy provides for establishment of standards to protect the water bodies receiving wastewater, a process that is ongoing.

3.2.5 Sessional Paper No. 6 of 2015 on Environment and Sustainable Development

Among the key objectives of the Sessional Paper No. 6 of 2015 on Environment and Sustainable Development (1993) are;

To ensure that from the onset, all development policies, programs and projects take environmental considerations into account,

To ensure that an independent environmental impact assessment (EIA) report is prepared for any development before implementation,

To ensure that effluent treatment standards will conform to acceptable health standards

3.2.6 The Agricultural Policy

In Kenya the agricultural policy revolves around key areas of policy concern including increasing agricultural productivity, especially for small-holder farmers, emphasis on irrigation, encourage

diversification into non-traditional agriculture commodities, enhancing food security, encourage private sector-led development and ensure environmental sustainability. The policy observes that droughts and floods have increased in frequency and intensity in the past three decades resulting in high crop failure and livestock death. Increased land degradation has decreased land resilience thereby exacerbating the effects of drought and floods leading to devastating famine that has taken a toll on human and animal lives. Some of the famine experienced could have been avoided or their impacts significantly mitigated.

Environmental degradation and rising poverty is of major concern for agricultural development. The continued scarcity of productive land and increasing poverty levels has led to an increase in agricultural practices that conflict with the environment particularly in the rural areas. Pressure on high potential areas is pushing people to migrate into ASAL lands where they practice inappropriate farming practices leading to environmental degradation and thereby creating a vicious cycle of environmental degradation and poverty.

3.2.7 Land Policy

Environmental management principles include to restore the environmental integrity the government shall introduce incentives and encourage use of technology and scientific methods for soil conservation and maintain beaches at high and low water mars and put in place measures to control beach erosion. Fragile ecosystems shall be managed and protected by developing a comprehensive land use policy bearing in mind the needs of the surrounding communities. Zoning of catchment areas to protect them from further degradation and establishing participatory mechanisms for sustainable management of fragile ecosystems will also be done. it will also develop procedures for co-management and rehabilitation of conservancy resources while recognizing traditional management systems and sharing of benefits with contiguous communities and individuals. Lastly all the national parks, game reserves, islands, front row beaches and all areas hosting fragile biodiversity are declared as fragile ecosystems.

Conservation and sustainable management of land based natural resources. The sustainable management of land based natural resources depends largely on the governance system that defines the relationships between people, and between people and resources. To achieve an integrated approach to management of land based natural resources, all policies, regulations and laws dealing with these resources shall be harmonized with the framework established by the Environmental Management and Coordination Act(EMCA),99.

CHAPTER FOUR
BASELINE INFORMATION OF THE STUDY AREA

4.1 Overview

This chapter describes the biophysical and social economic environment of the project area. This would form the basis for future appraisals. The information in this chapter is mainly derived from literature review by the ESIA study team.

4.2 Background Information on the Project Area

Makueni County covers an area of 8,034.7 square kilometers within the former Eastern Province of Kenya, one of three predominantly inhabited by the Akamba peoples of Kenya. The County capital, Wote, is 130km east of Kenya's capital, Nairobi. The County lies between 259m and 2138m above sea level in four distinct forms: the undulating and very steep uplands of Kilungu, Kilome and Mbooni to the northwest, vast open gently-inclined plains stretching south-east from Kilome's foothills, the bottomlands of Kibwezi and enclosed by the Chyulu Hills mountain range at the southwest and the Yatta linear plateau to the northeast. The contoured undulated uplands host a dense rivulet network of tributaries that flow downstream, successively merging into larger rivers, including, Thwake, Kaiti, Kikuu, Muooni, Kiboko, Kambu, Tsavo, Mtito Andei, Kambu and Kiboko. The latter eventually channel their waters into the giant Indian Ocean-bound Athi River, which meanders southwards across the County's bottomlands.

An estimated 63% of all county land is considered arable, with an ability to support meaningful crop production. Conservancy s account for 17% of the total land cover in Makueni, bushlands cover 48% of the county, grasslands 5%, croplands 6%, barren lands 16% and 8% is under intensive settlement. While majority of residents are land owners (of an average of 1.58 Ha), land adjudication remains incomplete with only 35% of people having title deeds. The land sector faces challenges of uncontrolled land fragmentation, landlessness and the existence of squatters.conditions.

Makueni County has a high potential for solar power generation with an average County-wide insolation of 4.2-4.4kwh/kwp. Wind energy equally remains unexploited despite the existence of wind speeds of up to 15.4kmph on the hills. While there are currently no hydropower plants in the county, completion of the Thwake multi-purpose dam is anticipated to generate 17.6 megawatts of hydro power per day.

Makueni County is spatially structured by both geo-physical and man-made components. The geo-physical elements that have structured the county's territorial space include the landforms, the

county drainage and ecological systems. A variety of activities associated with the peopling and habituation of this landscape by humans that have also structured Makuen spatially include transport, settlement, land use and spatial practices.

The current population of Makueni County is estimated to be 1,002,979 people (in 2018), growing at a rate of 1.4% annually. 51% of the population is women while an estimated 7% are vulnerable persons aged above 75 years or living with disability. The population pyramid of the County is bottom-heavy, with 44% of all persons being children below 15 years of age. 34% of the County residents are categorized as absolutely poor.

Agriculture is the predominant economic activity in the County contributing 78% of the total county Gross Domestic Product. Dairy farming and the production of coffee, avocadoes, passion, horticulture, maize and vegetables is predominant in the uplands. The production of green grams, pigeon peas, cow peas, mangoes, citrus fruits, paw paws, melons, cotton and sisal is predominant in the plains in the middle zone of the County. Poultry production, bee keeping, pasture development, fruit farming (mangoes, water melons, paw paw), green grams, sorghum, millet, pigeon peas, cow peas, cassava, sweet potatoes among others is practiced in the lowlands. Value-addition however remains inadequate in the agricultural sector, although facilities such as the Makueni Fruit Processing plant in Kalamba and the Kikima Milk processing plant have revitalized their specific sectors.

Trade and commerce are a vibrant occupation in Makueni County, with the informal sector growing at an annual rate of 3%. The mining sector mainly involves the extraction of sand, soil, granite, stone and ballast. While there are deposits of Kaolin, limestone, volcanic rocks, marble, salt, granite (green and red), quartz, gypsum, vermiculite, mica, copper, dolomite, iron ore, basalts, gemstones in Kibwezi West Sub County, their commercial viability has not been established. The County shares part of the famous Tsavo National park with Taita Taveta and Kitui Counties. However, the potential this sector holds has largely been under-tapped in Makueni County such as from the Standard Gauge railway line and stations, gazette conservancy s and scenic views in the uplands. Makueni County is strategically anchored within and connected to its context through an elaborate and hierarchical network of international rail and road trunks, national and regional highways. This includes the 140 kilometers of the Standard Gauge railway line, the A109 highway, Makindu airstrip, a national pipeline and other highways connecting the County to Moshi, Kitui, Machakos, Voi and Mwatate. Numerous other feeder roads further penetrate the County's interior. Of the 3,203.5 km2of the County's road coverage, 69% are earth roads and only 14% are tarmacked.

4.3 Project Location

The map below shows Tsavo East Nat. Park in green (Triangle area) to the south, Kamungi Conservancy in orange and other small-scale community farm lands in grey. The black line with spaced dots shows the possible alignment of a HEC 2 strand electric fence line as per the details in this document.

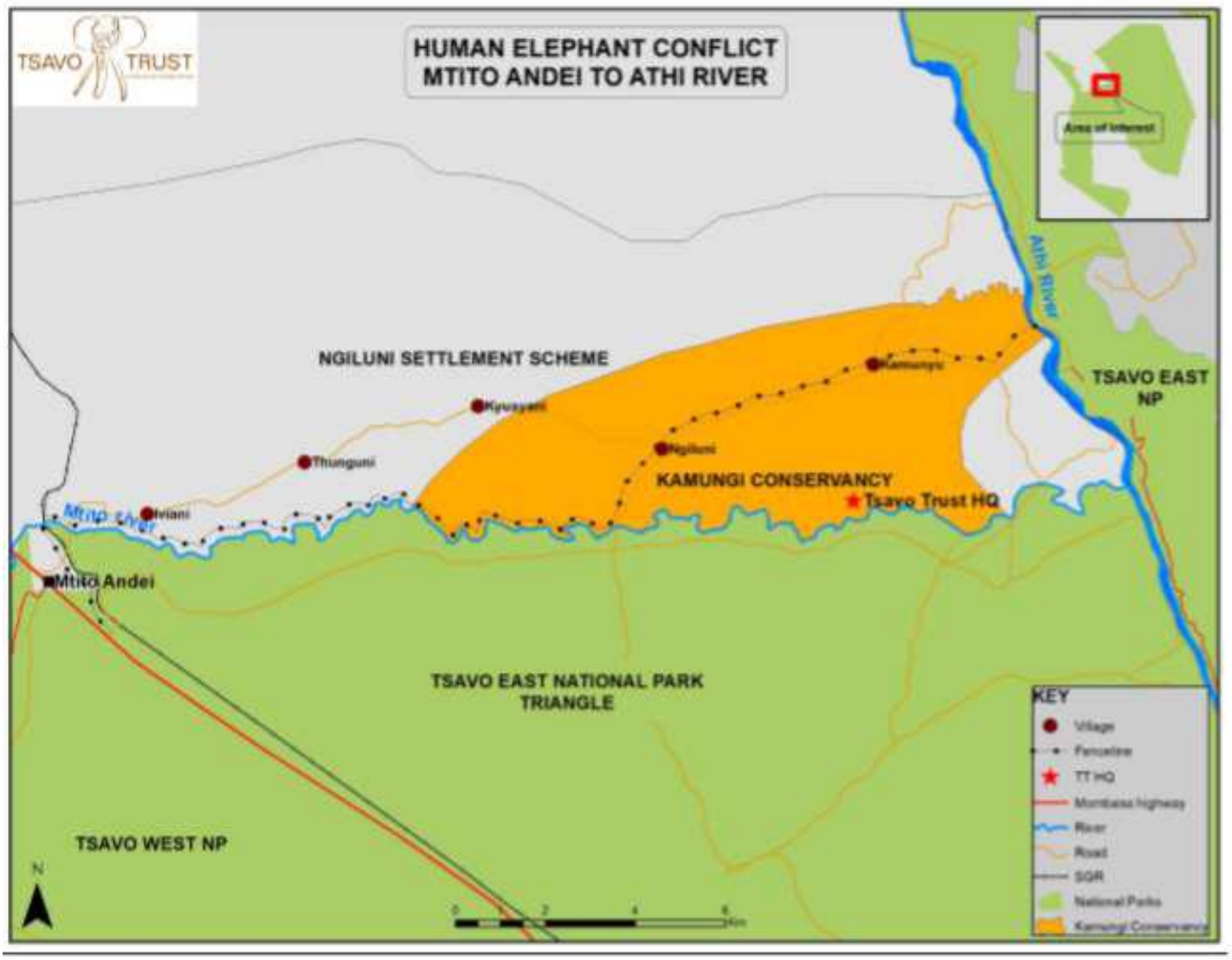

Fig 14. The proposed 2 strands electric fence at Kamungi Conservancy.

4.3.1 Climate and Temperature

Climate change has been a major challenge in Makueni County, with 12 climatic disasters having been recorded in the County since 1980. The result has been erratic rainfall, frequent droughts and shortage of water to sustain agricultural development. This has also further constrained water sources replenishment and thus the frequent drying up of perennial rivers and water pans. Environmental challenges in the County are mainly depletion of water catchment areas, destruction

of reserve s, and invasion of wet areas, unabated sand harvesting and poor agricultural practices such as cultivation along riverbanks.

4.3.2 Rainfall Pattern

The County has three relief and climate-differentiated zones, namely; arid (Mtito Andei, Tsavo), semi-arid (Masongaleni, Kibwezi, Kathonzweni, Makueni) and sub-humid (Mboono, Kilungu). Precipitation is higher in the highlands of Tulimani, Mbooni, Kilungu and Matiliku which receive 800-1200mm of rainfall per annum. The and middle altitude zones of Kalawa, Kasikeu, Mbitini, Chyulu hills, Kibwezi and Makindu record a mean seasonal rainfall of 350-450mm. The lowlands of Kilome, western sides of Kasikeu, Nguu and Kathonzweni receive significantly lower rainfall averaging between 200 and 350mm.

4.3.3 Physical and Topographic Features

The County's positioning within Kenya's marginal southeast, coupled with the fragilities associated with its varied and topographically challenging landscape, unpredictable and often harsh climate, has often served to limit the ability of Makueni peoples to derive maximum potential from their land resource. There therefore needs to be sensitive to the intrinsic, unique and often fragile qualities of the land and environment. The challenging topography of the County's northwest, as characterized by undulation and steepness of hills, and this, coupled with the fact of the area's watershed properties. The areas were identified as undergoing degradation, both of the land, and of the watershed, inflicted by the land use practices of an expanding local population.

4.3.4 Soils and Geology

The undulating uplands which have their origin in the tectonic movements responsible for the Great Rift Valley's formation, host a substratum of erosion resistant metamorphic granitoid, folded into very steep hills, topped with a moderate layering of rich volcanic soils. The rocks have undergone significant weathering and fracturing making it possible for them to play an important role in the workings of the hydrological system, particularly as a mechanism for groundwater recharge, thereby making them highly aquiferous. This latter quality is the reason for their christening as crying hills.

On their part, the lowlands' pre-cambrian metamorphic sub-strata, equally composed of weathered and fractured gneisses and schists, is overlain by a thin profile of sandy clays with low dry-season water retention properties, although the sandy rivers host substantive aquifers. The County's soil distribution pattern is a direct consequence of its geology. Soil types range from clayey black cottons over the Konza steppe, dark sandy loams atop uplands of the northwest, to red sandy soils alongside the Yatta plateau, and sand clays upon the Kibwezi plain.

4.4 Biological and Ecological Environment

4.4.1 Vegetation within the Study Area

The County's land cover profile ecosystem structure is greatly influenced by variation in altitude, climatic patterns and distribution of soils. The County is generally dry and precipitation significantly low compared to other areas in Kenya. It is largely arid and semi-arid and usually prone to frequent droughts. Consequently, moderate rainfall in the uplands support a vibrant vegetation cover while depressed rains in the lower parts only allow for stunted vegetation and which likewise influence the land cover profile.

Sandy loams, which are localized in the highlands, are generally high in fertility, and together with high precipitation, allow a dense vegetative conservancy covers to flourish. Black cotton clays of the Konza steppe, as well as sandy clays of the Kibwezi plain, are generally low in fertility, and given the interceding dry climate, host vast stretches of savannah grasslands, scattered acacia trees and other shrubbery. Approximately 40% of the county is covered by vegetation. Of this, 90% is natural indigenous vegetation.The following are some of the vegetation found within Makueni County.

Fig.14. Hedge false bindweed (*Calystegia sepium)*

Fig 15 Sodom Apple (*Solanum incanumL)*

Fig .16 Cactus (Cactaceae)

Fig 17 Bao Bao Tree (Andansonia)

4.4.2 Wildlife Variety

The County has varied wildlife species, most of which are localized at the Tsavo National park which lies in the southern part of the County. There is also a great variety of bird life both within and outside the Tsavo and in Kiboko sanctuary.

- **Elephants**

The elephants of Tsavo are known around the world for their distinctive red colouring and this region is also home to some of the last great tuskers of Africa. The title "Red Elephants" of Tsavo doesn't mean that the elephants were born that way. The name is more of a nickname. Tsavo East National Park soil is somewhat red and when the elephants wallow in the mud they look that shade of red. Tsavo has always been a special place for elephants and this vast expanse is currently home to Kenya's largest elephant population numbering around 14,000. Tuskers (Tusker term used to describe bull elephants) are now incredibly rare with possibly as few as 20-30 left on the entire African continent. The greater Tsavo ecosystem containing Tsavo East, Tsavo West and Chyulu Hills National Parks is home to possibly the largest population of tuskers left in all of Africa.

Fig 18. Tsavo Red Elephants

- **Hyena**

Hyenas or hyaenas (from Ancient Greek ὕαινα, hýaina are feliform carnivoran mammals of the family .With only four extant species (in three genera), it is the fifth-smallest biological family in the Carnivora, and one of the smallest in the class Mammalia. Despite their low diversity, hyenas are unique and vital components of most African ecosystems.

Fig 19. African Spoted Hyena

- **Lion**

The lion is a species in the family Felidae; it is a muscular, deep-chested cat with a short, rounded head, a reduced neck and round ears, and a hairy tuft at the end of its tail. It is sexually dimorphic; adult male lions have a prominent mane, which is the most recognizable feature of the species.

Fig 20. African Lion at Tsavo National Park

- **Zebra**

Zebras are several species of African equids united by their distinctive black-and-white striped coats. Their stripes come in different patterns, unique to each individual. They are generally social animals that live in small harems to large herds. Habitat loss due to human encroachment, agricultural practices, and livestock grazing remains an issue in the ongoing conservation of this

species. These problems seem to be especially prevalent in the southern half of their range and account for much of recent population decline.

Fig 21. Zebra

- **Cattle egret**

The Cattle Egret is a small heron. Only half the size of a Great Egret, the Cattle Egret's size is a useful field mark. Juveniles and adults in non-breeding plumage are pure white with dark legs. Adults have yellow bills. Adults in breeding plumage are unmistakable, with buff-colored plumes creating patches on the back, breast, and crest. Breeding adults also have orange bills and reddish-orange legs.

The Cattle Egret eats mainly insects, especially grasshoppers, and in some parts of the world, parasitic flies. An adaptable species, they have been known to eat nestling birds and eggs, and to scavenge in dumps. Cattle Egrets typically first breed at two years old. Both parents incubate the 3-4 eggs for about 24 days..

Fig.22.Cattle egret

- **Horn bill**

This hornbill is a common, widespread resident of the dry thorn fields and broad-leafed woodlands. Frequently they can be sighted along roads.. They feed mainly on the ground, where they forage for seeds, small insects, spiders and scorpions. Termites and ants are a preferred food source in the dry season.

Fig 23. Horn bill

- **Salts Dick-dick**

The dik-dik is a tiny antelope, standing only around 35cm at the shoulder. It is a reddish-brown colour on the back, with lighter flanks and white belly. Size is usually the easiest way to identify a dik-dik, but other marks are the almost total lack of a tail and the tuft of dark hair on the forehead. Horns (found on the males only) are so short (around six cm) that they are often lost in the hair tuft. Dik-diks are usually seen singly or in pairs and are in found in the bushes. They are mainly nocturnal but can be seen grazing in acacia scrub in the early morning and late afternoon; like so many animals they rest in the heat of the day.

Fig 24. Salts Dick dick

CHAPTER FIVE
5.0 PUBLIC CONSULTATION AND PARTICIPATION

5.1 PUBLIC PARTICIPATION

Overview

Consultation and public participation processes is a mandatory requirement as stipulated in Environmental Management and Co-ordination (Amendment) Act, 2015. Section 17 of the Environmental Impact Assessment and Audit regulations (2003) requires that all ESIA studies must incorporate Public Consultation (PC). The aim of public consultation is for;

- Disclosure of planned activities of the proposed project and impacts identified through the Environmental and Social Impact Assessment;
- Identification of concerns and grievances from interested and affected people;
- Harnessing of local expertise, needs and knowledge from interested and affected people;
- Response to grievances and enquiries of affected people.

5.1.1 Mapping of the stakeholders was done based on the following characteristics:

- Those who will be adversely affected by potential environmental and social impacts.
- The most vulnerable stakeholders.
- At what stage of the project development is which stakeholder to be engaged.
- What are the various interests of the project stakeholders and what might influence them.
- Which stakeholders might help to enhance the project design.
- Which stakeholders can best assist with early scoping of issues and impacts.
- Who opposes or supports the project, its changes and impacts.
- Whose opposition could be detrimental to the success of the project.
- Which departments of government are relevant to the project.
- Who is critical to engage with first and why.
- What is the optimal sequence of engagement?

5.1.2 Public participation was guided by a number of objectives namely to:

- Improve transparency and increase public confidence in ESIA Study
- Identify the social, bio-physical, economic and environmental concerns as perceived by the public.
- Identify the positive and negative impacts that the project should consider.
- Identify and record contentious issues that could later bring conflict.

- Obtain local input into the design of the project, alternatives and mitigation measures of negative impacts of any nature.

5.2 Objectives of Stakeholder Engagement during the ESIA

The objectives of the stakeholder engagement during the Environmental Social Impact Assessment phase, taking into consideration regulatory requirements and good practice guidelines are to provide sufficient and accessible information to stakeholders during the:

1. Screening Phase; - Receive and disseminate initial information about the proposed project; - Contribute to the design of the stakeholder engagement process; - Provide initial comments and responses to the proposed project; and - Contribute local information and knowledge
2. The Scoping Phase; - Raise issues of concern and suggestions for enhanced benefits sharing Verify the following:-
    - ✓ that the community issues are always recorded
    - ✓ Community is engaged in identifying reasonable alternatives for siting various site specific activities and projects elements;
    - ✓ Contribution of relevant local information and traditional knowledge to the environment assessment.
3. The Impact Assessment Phase - Dialogue impacts with the local community - Ensure contribution of relevant information and local and traditional knowledge to the environmental assessment; - Verify that their issues have been considered in the environmental investigations; - Comments on the findings of the social and environmental assessments. - Discuss the reports and provide consent as to their project issues
4. Mitigation Management Plans - Verify and dialogue how the impacts have been managed; - Contribute relevant information and knowledge to management plans; - Comments on the proposed management plans; and - Commit to monitoring and grievance mechanism defined; - Discuss the management plan proposed

The consultant employed various forums to ensure public consultation. They included; focus group discussions, administration of key Stakeholder questionnaires.

5.3 Stakeholder Engagement during Development and Operation Phase

Stakeholder engagements during the development and operations phases of the project are determined both by various activity schedules that the project demands and the commitments defined within the specific requirements including the following:

- Considering the commitments to continuous reporting to the stakeholders throughout the life of the project;
- The need for local community based engagement and dissemination of information about the project; Given the detailed and comprehensive information demands that this commitment imply;
- Identifying the need to keep the community ready and engaged on the project

Pre-Development Phase

At the pre-development stage the following stakeholder engagement process details are on-going and in preparation for the development stage:

1. Following up on commitments made and subjected to the environmental permit acquired from the regulatory authorities
2. Following up on the commitments made to the community in relation to the reporting on various activities as key stakeholders in the process.
3. Clear communications including tenders stages, survey works and the investment due diligence requirements of various potential and actual investors of the project.
4. Coordinate community meeting to enable new opportunities including the CDM to engage with the community with clear explanations to the community about their benefits to these or any additional opportunities, brought about by the project.
5. Preparing the community for the up-coming development phase and the challenges expected as delineated in the potential impacts assessment through sensitization meetings and information;
6. Continuing with process engagements that are incomplete even as the ESIA draft report is submitted including: Completion of detailed in-depth engagement, deliberations and drafting of the Community Trust documents.
7. Completion of the ESIA for the associated institutions
8. Setting up detailed structures, plans and resources for management of the identified potential mitigation measures;
9. The development and dissemination of a grievance mechanism to manage the pre and development and operations phase of the project.

5.4 Grievance mechanism:

Development Stage: Management of community issues associated with the project. Locally accessible community liaison officers able and willing to manage grievances within outlined procedures will be engaged. Clear and transparent non-judicial process of management of grievances with the help of local traditional structures including elders has been discussed and agreed as the mechanism by which grievances will be handled. A well-functioning grievance mechanism is designed and proposed by the community during the meetings is necessary and will include the following aspects:

1. Be predictable, transparent and credible process to all the parties in any grievance but more so to the local community members.
2. The outcomes should be fair, and effective and lasting as would also be judged by the elders who participated in considering the grievance as was reported.
3. Should build trust as an integral component of broader community relations activities.
4. Should enable systematic identification of emerging issues and trends, and in general meetings facilitate awareness of these trends and facilitate correction and pre-emptive engagement.

During construction, the site manager will be responsible for handling the grievances

1. There should be a grievance desk in the community
2. All grievances and complaints solution mechanism should be devolved to the lowest possible unit so that different project actors can lodge their concerns easily and effectively.
3. The person dealing with the complaints should avoid bribery and distortion of the complaint from the community. The grievance officer should be a member of the community with the community interests at heart; have effective ways to avoid changes of the complaint through corruption.
4. Provide ways in which the complaint can be forwarded in local language and effectively translated into official languages.
5. Ensure an effective data management system (storage, retrieval of complaints)
6. Have a prescribed way of managing a complaint from beginning to end;
7. Have an elders represented in the first level of mediation;
8. Second level of mediation should include local administration like the chief
9. Third level should include a elders, local administration and legal representatives,
10. Community participation and ownership is important
11. Ensure an effective community reporting on how the grievances were resolved.
12. Continuous, efficient monitoring and evaluation of the effectiveness of the whole grievance mechanism should be adopted.

5.5 Community Awareness and Information

5.5.1 Project Management Communications

The project should maintain engagement throughout the life of the project. The communication given should be consistent to the information needs provided in the plan. This includes communication about meeting of the community relevant activities. These include but not limited to:

1. **Project Activity Plans:** during development and operations to enable effective participation and review. There should equally be adequate information disclosure about the activities as has always happened during the ESIA and the feasibility stages.
2. **Community Trust Communications:** the activities of the trust should be communicated in an effective and participatory manner so that to enable continuous engagement and the feeling that the community is part and parcel of the establishment and management of the community trust.
3. **Accessible Methods of Project Communications:** the local meetings are an effective way of providing information that is general as opposed to information targeting individual land owners or residents community members. The site office should have communications about development activities in a clear and ongoing manner. Community liaison officers should be accessible and fair. Grievances should be clearly recorded and fairly reviewed with the interests of the local community prioritized.
4. **Project Report Communications**: reports produced will be in simple formats and will be discussed in open meetings. A summary in the local language will be given to allow and involve the least literate members of the community participate and understand the contents of the meeting proceedings. The reports will be periodically produced and shared with the community.
5. These communications will be guided by operational phase plan scheduled.

5.6 Community Trust

The establishment, function, control and responsibilities of the Community Trust are as to be formed in line with intentions expressed by the developers of the 8ifence: -

5.6.1 Objectives of the Trust

These are continuous further engagement of the wider community to ensure the objective meet the wider community for its benefit. A project website will provide detailed information on the project. While other reports and news will be provided through the county media, county submitted reports, flyers etc. The broad areas of support, subject to full consultation and engagement, will be:-

- To preservation of the locals' culture and language for the specific betterment of the community

- To development of infrastructure within the project area to benefit the indigenous community;
- To promote and sustain formal education (including schools and other facilities);
- To promote and sustain adult education and awareness into economic matters, including financial and legal services to understand the implications of the increased resources in the community;
- To promote health services (including clinics and other facilities) focusing on community based healthcare, primary health care, education and prevention on sexually transmitted diseases including HIV/Aids, education and awareness to avoid substance abuse and general management of good hygiene and good health;
- To manage natural resource including provision and preservation of water;
- To ensure that there is equality in representation of all focus groups:- women/widow, orphaned children and youth groups and that their interests are protected;
- Generally ensure equitable distribution, management and use of wealth. This way no one section of the community is disadvantaged in deployment of resources that are available to the Trust;
- A central team or teams to be appointed from the various groups of the Community to ensure their interests are added to the formal establishment of the Trust.

5.7 Views of the Public Concerning the Project

Based on the study, the types of probable social reactions, arising from the implementation of the project was surveyed and recorded.

In line with the ESIA regulations, face to face interviews with local people were accomplished. A wide range of people were selected to consult on the project that included county government of Makueni representatives, national government administration representatives, farmers, business people, health workers, youth, women, etc. Their views are assumed to represent those of the entire community that will be affected by the project.

A summary of the suggestions and issues discussed by the beneficiaries are listed below:

Affected persons raised some pertinent issues of concern which are hereby summarized.

(i) Sensitization/Education of the community

There is the need for further consultations and sensitizations of the community regarding the proposed projects i.e. extent of development area as per the produced map(s) of fence area.

(ii) Approach of community Engagement

It was agreed that an adoption of a bottom up approach be taken when undertaking the planning and implementation of projects. Men, women, youth, and persons with disabilities to be consulted at all stages of the project planning and implementation

(iii) Benefits of electric fence to Community

Whereas the benefits of the fence are known, the local community wanted to be assured that the fence will employment opportunities especially for the local people be put into considerations

(iv) Corporate Social Responsibility

The local community requested for the Kamungi conservancy to extend to extend CSR policy in the areas of education scholarships/bursaries, improved roads, provision of health and education facilities Improvement.

(v) Availability of water

The locals also wanted to know if the erecting of the fence will disrupt the ability to access water both for human and domestic animal consumption needs.

(vi) Accidents

The issue of electric fence safety was also raised as if incase accidental contact with the fence could cause fatal cases.

(vii) **Conservancy Rehabilitation**

The residents strongly proposed that the local community conservancy associations, women and youth groups be actively involved in raising tree seedlings nurseries and implementation of catchment management plan as proposed in the Environmental Management plan.

Selected photos of Stakeholder's and public consultation Meetings in the area.

Fig 25. Public barazza with ommuity leaders

Fig 26. Consultations with a school headmistress

Fig 27 .Consultations with individuals living in the conservancy.

Fig 28. Field preparations by the consultation team

Fig 29. Data collection from Tsavo Trust representative

Fig 30. Consultant organizing field team

Fig 31. .Liasing with the Administration departments

Fig 32.. Liasing with Mr Nichondemus County Wildlife officer

CHAPTER SIX
6.0 ANALYSIS OF PROJECT ALTERNATIVES

6.1 General

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

6.1.1 Scaring of problematic animals

This is the main method used by conservancy adjacent communities when they are invaded by wildlife. The main methods used are creating noise and use of fire. However, the success of this method is short-term and expensive in terms of time spent, staying awake in the cold night, and even in terms of risk. Sometimes the method does not work at all with the animals being stubborn and having being used to the methods used which include:

- Shouting /screaming
- Beating of empty tins
- Using dogs to scare
- Using whistles
- Lighting fires, torches and smoke
- Burning of tyres to produce foul smelling smoke

This form of problem animal control has no adverse ecological impact but has a highly significant social impact on the farmers including disruption of social order and diseases.

6.1.2 Moats

This is the second method used to control human-wildlife conflicts and has had a good measure of success. TT has successfully used moats in the past especially with regard to establishing conservancy plantations in Mount Kenya and Aberdares.

Moats are essentially trenches dug to stop wildlife from entering community land. Moats are expensive to build and maintain. Though low in terms of material inputs, they require a lot of manpower in development and maintenance, and most have indeed failed due to lack of the latter. Several moats of different sizes and lengths exists in the proposed project area though some are no longer working due to lack of maintenance with subsequent filling up through erosion. Elephants have also learnt how to fill moats up with soil and cave in the sides.

Moats are also unsuitable in swampy and rocky soils, and along river valleys which wildlife use to gain access to community land. Moats are also un-environmentally friendly with regards to vegetation clearance, soil erosion, interruption of drainage systems, and are liable to siltation and refilling through erosion and by the elephants. They may also become health hazards when filled with stagnant waters.

Thus, though moats have shown some success rate, they are an expensive option as a long-term solution. Further, the terrain is unfriendly and maintenance a major problem with regard to their sustainability.

6.1.3 Live Fences

This is the most environmentally friendly option though its capacity to mitigate human-wildlife conflicts may be limited especially considering that elephants are the main problem.

Live fences mainly consist of trees/shrubs and serve well to demarcate boundaries and limit human access. Its establishment may also take a long time and may even require another barrier to assist formation. Changing environmental conditions may also inhibit its establishment.

A cactus species Opuntia exultata has been tried in some parts of Laikipia and Narok but is slow growth process and potential to spread are a major limitation. The sharp prickly thorns of the plant inflict intensive pains on the elephants, thus deterring them. Mauritius thorn (Caesalphinia decapetala) was effectively used to control virtually all animals (including primates) along the Salient of Aberdare national park before the electric fence was introduced in 1989. There is however differing opinion on whether it is an invasive species or not.

6.1.4 Barbed Wire

This is also feasible but would have more or less similar impacts of development as an electric fence with regards to pitting and posts. It would however require little clearing and maintenance would also be low. It would also be cheaper to construct and maintain.

The fence would however be ineffective in terms of control of the problem animals in the area, namely, elephants. It would be destroyed severally and would not offer long-term protection.

6.1.5 Chain Link

The effectiveness of a chain link would be like that of a barbed wire, though it is stronger. It would be able to control all small animals but be ineffective in controlling larger ones. A chain link would also be destroyed severally and maintenance would be very high.

Impacts of pitting and pole erection would be similar to that of the barbed wire and electric fence. Its installation costs are higher than the barbed wire and it would require minimal clearing of vegetation.

6.1.6 Stone Wall

This would be an effective but expensive method in terms of both development and maintenance. It would however be un-environmentally friendly and would limit all access. It would create an eye sore and be visually intrusive, and completely out of character with the surrounding. It would also take a long time before establishing such a barrier.

6.1.7 Control Shooting

KWS uses the Problem Animal Control (PAC) method to scare, kill or drive away problem animals from community areas. This method may at times lead to loss of wildlife and human deaths.

The method is basically a reactive measure rather than a preventive measure and only serves short term remedies after damage has occurred. PAC can only be undertaken by KWS and is thus limited by scarce manpower, fuel, time, and maintenance costs for vehicles and planes. It is thus ineffective where human- wildlife conflicts abound, and in areas as large as Kamungi conservancy where this conflict is spread. In terms of conservation, the method is also unsustainable.

6.1.8 Electric Fences

The scoping exercise established that electric fences are the preferred and most suitable human-wildlife resolution mechanism. They have been tried and have had a good success rate in mitigating the problem. They are also a long- term solution so long as they are well maintained, and vandalism kept at bay.

The fence however has high initial costs of establishment and also require regular monitoring. Where fences have been erected, human-wildlife conflict has drastically reduced and livelihoods improved, social order has been maintained and even academic performance improved. People have also appreciated wildlife better in these communities and they generally relate better with KWS staff.

There are various fence designs with different efficacy in terms of mitigating human-wildlife conflicts. There are two-strand fences which only control elephants while allowing all other animals to pass through; four strand; 6 strand and eight strand fences, a two-strand fence has been recommended, as it will easily control the large animals without limiting movement of humans and domestic animals. The two-strand electric fence has also very minimal disruption to the environment.

6.1.9 Bee keeping.

The idea explores the use of Beehive Fences as a natural elephant deterrent, helping protect farmers and farmland. It is based on an innovative study using elephants' fear of African honeybees to help reduce crop-damage and minimize other human-elephant conflict incidences. A win-win addition to a toolbox of deterrent methods, beehive fences help create a social and economic boost to farmers through pollination services and the harvesting of 'Elephant-friendly honey'

6.2 Analysis of Power Sources

Even if the two-strand electric fence option is chosen, the question of how the fence will powered comes in and there are a few alternatives to choose from.

Power from the national grid: This is a possible and reliable source of power for the proposed fence. However, operation costs in terms of power bills may be unsustainable. The option would also require getting the necessary licenses and working agreements with the Kenya Power.

Thermal power: This option would require use of a generator to power the fence. Though easy to undertake, the option would be expensive in the long run due to fuel costs. There would also be negative impacts from noise and exhaust fumes, oil and fuel spillage, and others like dust and noise associated with vehicular movement.

Wind power: This is an attractive option but may be difficult to implement due to high initial cost.

Solar power: This is the best option and the option that the project design intends to use. It is fairly easy and cheaper in the long run. It has also been tried and seen to work within the conservancy and elsewhere. Its main handicap is vandalism and theft of panels and batteries.

6.3 Alternatives of Fencing Poles

Different fencing poles can be used in the erection of barriers. These include plastic poles, cement poles, live trees, and timber poles. Plastic poles have in the past been used successfully in the Aberdares and have the distinct advantage of being malleable and easy to work with. They are

also light and longer lasting as pests do not attack them. They have in the recent past become very expensive.

Cement posts are also longer lasting but are heavy and also very expensive. Transport costs due to weight and carrying them by hand through rough terrain would also prove fairly difficult.

The project intends to use both live trees and timber poles to cater for areas where alignment of trees will be difficult

6.4 No project Option and its Associated Impacts

This aims at maintaining the status quo of the situation. This will mean there will be no fence as proposed and therefore, all the efforts by the community and other institutions will be rendered useless. This will make the local people continue suffering from wildlife destroying their crops, property and endangering their lives. This makes the 'no project option' expensive and unacceptable to the community.

1. **Continued Destruction of Crops**: The communities settled next to the Kamungi Conservancy are smallholder farmers who grow a wide range of crops. All these crops are subjected to severe damage by the elephants and constitute a major economic loss to the farmers.
2. **Food insecurity**: The destruction of food crops means the settlement communities do not harvest adequate amounts of food and sometimes rely on relief food. Being agriculturists, they also hope to have some surplus food to sell. They thus need to buy food they would ordinarily grow.
3. **Impacts of human health:** Community members' long stays outside their shelters to scare the elephants at night will continue to expose them to health hazards like pneumonia, flu and common colds. They thus become a weaker community and will have to incur medical expenses which are difficult to get compensation for. With increased conflict, people will also be injured or killed by the wildlife leading to further medical and funeral bills impacting negatively on the living standards of the community and individual families affected.
4. **Disruption of social order:** The human wildlife conflicts disturb social order with people being awake at night and sleeping during the day. The most annoying thing was that the whole neighborhood has to remain awake including children.
5. **Loss of Productivity:** The disruption of social order results in reduced community productivity especially with regard to agriculture which the main economic activity. This is

compounded by illnesses associated with their being out at night. Productivity also includes children performance in schools as they either miss school due to fatigue from lack of sleep, or because of insecurity as the elephants may still be in the surroundings.

6. **Insecurity:** This is both real and perceived insecurity as animals like elephants have injured and claimed several lives in their communities. They (people) also disclosed that it is scary for them to walk at night for fear of being attacked by wild animals including elephants, hyenas and wild pigs. After a night of terror from the elephants, children are afraid of going to school early in the morning, meaning they get to school late and their leaning is negatively affected.
7. **Destruction of infrastructure:** Elephants also cause infrastructure damage to water pipes , water tanks and even to schools. Water supply and learning are thus affected, with children having to stay home or learning from outside as repairs are being undertaken. Communities also have to pay for such repairs.
8. **Poverty:** All the negative impacts associated with human-wildlife conflicts affect the living standards of the communities. They make the communities poor and perpetuate them in poverty. With increased conflict, the poverty situation will get worse as communities become unable to send their children to school.
9. **Poaching and snaring:** These are bound to rise with increase of human-wildlife conflicts and poverty levels. The wildlife barriers, though meant to control animal movement, also restrict human access to selected areas which are easy to monitor. The no intervention approach will thus leave the whole boundary open for illegal human activities like poaching. Other illegal activities like charcoal burning may increase with the uncontrolled access in and out of the conservancy. Other environmental crimes like theft of biodiversity may also occur.
10. **Community relationship with wildlife and KWS**: Communities, especially where barriers do not exist, are already tired of the human-wildlife conflict menace. Their view towards wildlife is that of a nuisance other than a resource. Their tolerance towards wildlife is changing to hostility and this is bound to increase with the no intervention approach, making conservation of fauna and even flora difficult. With the no intervention approach, the relationship between the settlement communities and KWS will continue to be lukewarm. The communities are of the opinion that KWS is more concerned with wildlife than the people: “They rush in when they hear a wild animal is killed in an area but take time when a person is killed by their animals”.

CHAPTER SEVEN
7.0 POTENTIAL ENVIRONMENTAL & SOCIAL IMPACTS AND MITIGATION MEASURES

General Overview

The potential impacts are derived from the project activities and baseline information in addition to issues that emerged during scoping.

The potential environmental impacts predicted from the proposed project are varied and are expected to be both positive and negative. Some impacts will occur only during certain phases of the project life cycle while some will persist all through. Impacts are also expected to be of different severity irrespective their longevity, and as such, though some may be long-term, their severity might be low and vice versa. Some negative environmental impacts already exist in the area and are bound to occur even without the proposed project taking off.

7.1 Positive Impacts

7.1.2 Controlled human-wildlife conflicts

Human-wildlife conflicts in the conservancy adjacent communities have a lot of negative impacts to both humans and wildlife, threatening their livelihoods and life. The electric fence will drastically reduce this conflict. This will improve the livelihoods of neighboring communities and even endear the animals to them.

7.1.3 Food security and better yields

Human-wildlife conflict has resulted in decline in agricultural productivity due to crop damage, demoralized farmers, and social upheaval. With the wildlife barrier in place, there will be minimize crop damage and return social order allowing for increased productivity by farmers.

This will enhance food security and alleviate poverty. Farmers who might have abandoned their farms may also will start farming since the problematic animals will be contained within the protected area.

7.1.4 Sustainable conservation

Fencing of the ecosystem will enhance conservation activities in Kamungi Conservancy. Illegal activities such as poaching or subsistence hunting will be minimized, as access to the conservancy will be done through legal access routes. The involvement of communities in project will also ensure that perpetrators of such illegal activities are apprehended through community policing.

Other activities such as illegal logging and exploitation of conservancy vegetation will also be reduced. People will only use conservancy resources for specific purposes and in a non-degrading

manner such as firewood collection and collection of fruits and tubes and other available food sources. Access to conservancy will only be at specific times of the day and through legal access gates.

Fencing will enable conservancy restoration of the already degraded conservancy sections by incompatible land use activities such as cultivation.

7.1.5 Improvement in environmental, health and safety issues

The proponent has incorporated environmental, health and safety concerns at the project planning stage. This will ensure a positive impact to the environment, as any adverse impacts have a mitigation plan in place.

7.1.6 Water catchment protection

The fence will lead to reduced catchment degradation whose positive impacts will be felt through improved water flow within Mtito River. This will bring benefits to surrounding farming communities and pastoralists further downstream.

7.1.7 Improved security

The electric fencing project will certainly have positive impacts to local communities who live adjacent to the conservancy. It is envisaged that community members will no longer be living in fear of potential raids and attacks by animals.

7.1.8 Mitigation of climate

Conservancy restoration will lead to improved carbon sequestration; thereby help reduce the accumulation of CO2 in the atmosphere. Coupled with improved water flow, this will also enhance the capacity of local people to cope with climate change through livelihood adaptation.

7.1.9 Improved social aspects

Communities living adjacent to Kamungi conservancy have complained about lack of sleep especially during cold seasons when animals come from the conservancy , and harvest seasons when they raid their farms. Members of communities where there are no fences have to form vigilante groups to keep away animals especially elephants. This in essence disrupts their social order as they sleep during the day when they are supposed to work. Children also go to school late due to fear of encountering animals on the road or sleep in class as they keep vigil at night. Hence setting up a fence along will restrict animal movement and ensure that they can sleep.

7.1.10 Reduced cases of pulmonary diseases

Keeping vigil at night to prevent animals from raiding farms predisposes community members to cold related diseases such as pneumonia. Hence erecting a fence will ensure that farmers can stay in their houses at night.

7.1.11 Social-economic impacts

One of the benefits of erecting up a fence is that it will ensure that families live in peace and harmony with wildlife. Members will be able to have time to socialize especially in the evening and bond in all that pertains to a normal family set up.

Losses incurred due to property damages, livestock injuries, will be reduced. This means that community members can have utilize their resources in other development activities rather than repairing or replacing damaged properties.

Farming activities will be intensified in areas where farmers had abandoned farming due to crop destruction by wild animals. Land will be fully utilized for farming which will lead to food security and increased income in households.

Other social economic impacts will include: employment opportunities during the development and maintenance of the fence; improved relations between the Kamungi Conservancy and community members, which is currently unwholesome; and improved relations between communities and wildlife as they will co-exist.

7.2 Potential Negative Impacts from Electric Fencing

7.2.1 Some degree of vegetation loss

Clearing of vegetation during erection of the fence will destroy some biodiversity and also reduce wildlife habitat. The vegetation affected also forms part of the overall life supporting resources for animals, and an important component of the reserve 's ecological services role which will be lost with the clearing. Loss of vegetation will also result in soil erosion and loss of soil moisture.

The fence will retain the animals within the park, as they will not be able to move in their former dispersal areas. This may result in range deterioration due to reduced habitat and resultant overgrazing and trampling. Degradation may also arise as the animals try to get ways to move into their former dispersal areas for food, water, saltlicks which may be fenced off. This will mainly be along the fence line where some destruction of vegetation may arise especially from elephants.

Mitigation

The alignment of the fence will generally pass along the reserve boundary. Some existing fences however pass between the natural and plantation reserve s. The fence will invariably lead to the clearing of vegetation. As part of the mitigation measures, the clearing will be limited to the fence alignment section only. Further, vegetation destroyed will be compensated through trees planting in the rehabilitation of degraded areas and agro-reserve ry components of the larger programme. Proper surveying and disposal of the cleared vegetation through sale or auction will

be undertaken as past experiences have shown that large areas may be cleared of the fence's alignment with the aim of illegal logging.

7.2.2 Soil erosion

This will arise from loss of vegetation and also from the pitting exercise while erecting the fences. Soil erosion will also arise from the development of energizer houses and other infrastructure associated with the electric fence.

Soil erosion will also arise due to vehicular movement during surveys and transportation of materials. Vehicles and machinery will also contribute to soil compaction, and even potential soil pollution through oil spillage.

Mitigation

The proponent will ensure that digging of holes will be done manually and only in surveyed areas. Considerations on slopes and general terrain will also be put in place while erecting the fence. Proper drains will also be set up, constructed along erosion prone sections. The workers will also undertake backfilling of excavated sights. On the whole, heavy machinery will be used only where necessary and vehicles used will be serviceable.

7.2.3 Solid waste

Solid waste will be generated from development of facilities, and from left over development materials used in the erection of the fence. Other solid wastes will be generated by development workers in form of waste food, papers, packaging materials etc. Solid waste may also result from dumping along the fence by communities living adjacent to the conservancy.

Solid wastes may result to subsequent soil pollution, foul smells, and if allowed to pile up or spread, to an eyesore. Solid wastes especially food, also have the potential for affecting some wildlife behaviour as some become dependent on human foods. Littered waste bags in the park may be swallowed by animals leading to death.

Mitigation

All solid wastes resulting from cuttings, materials used, and food stuff will be placed in bins and taken out of the conservancy for proper disposal in a sanitary land fill. Community members will be sensitized on the need to keep environment clean, and how to avoid inducing behavioral change in animals through food. Dumping along the fence will be mitigated through enforcement of existing laws and by-laws with the help of community policing.

7.2.4 Movement of wildlife restrictions

Kamungi conservancy is already virtually isolated from neighboring wildlife habitats by intense small scale agriculture. However, the fence will have the effect of curtailing some animal movement outside the conservancy. The fence will reduce their habitat and access to any resources like water and salt licks which may be fenced off. The fence will also prevent wildlife from accessing farm lands which they frequently invade to feed on crops. The development of sections of the fence might also lead to wildlife seeking alternative routes, which might create conflicts in other areas.

The reduced access to any resources that animals currently use may result in overgrazing and trampling of vegetation leading to environmental degradation, changes in breeding patterns and behavior. The fence will also any current or previously existing block migratory corridors for wildlife especially elephants.

Mitigation

It is envisaged that erecting fences will ensure that wild animals are confined within the conservancy. In order to mitigate against cases of trampling of vegetation along fence, habitat destruction and destruction of reserve s, the ecological corridors and migration routes will be secured and left open.

7.2.5 Increased human activity close to conservancy edge

Stoppage of wildlife incursions outside the conservancy will encourage intensification of cultivation and settlement right up to the edge of the reserve . This could lead to increased pressure of the reserve ’s resources (such as firewood and constructions materials), and an increase in the incidence of undesirable activities such as the setting up of fires and spraying of chemicals, which will impact negatively on wildlife.

Mitigation

Human activity next to the conservancy edge will be mitigated through community education and the need to reduce human-wildlife conflict even with the fence in place. Communities will thus be mobilized and educated on the importance of considering wildlife in their daily activities in order to co-exist.

7.2.6 Air pollution

This will arise from dust and exhaust fumes from vehicles and machinery during the transportation and erection and maintenance of the fence. Air pollution may result from development activities such as mixing of ballast and other development materials.

Mitigation

This will be mitigated by giving dust masks and protective kits. Watering will also be undertaken where necessary and vehicles used will be serviceable. Foul smells will be dealt with by proper solid and liquid wastes disposal

7.2.7 Noise

This will arise from vehicular movement and development machinery. It may also arise from the development workers. Noise will impact on animals especially their movement and sourcing for food.

Mitigation

Movement of materials and development vehicles at night will be restricted and so will any use of machinery at night and early morning. Machinery and vehicles used will also be well maintained.

7.2.8 Human wastes

This will arise from the development workers and will be dependent on how they will be accommodated during the development phase. If no proper facilities are availed, development workers might end up relieving themselves along the fence line with resultant impacts on health and hygiene, and pollution.

Mitigation

Mobile toilets will be provided during development or where feasible, arrangements made with neighbours for use of their toilet facilities.

7.2.9 Increased accidents

Accidents resulting from electric shocks may be experienced during fence operation phase. This will affect people and their livestock, especially if they are not sensitized about the dangers of the electric fence. Accidents may also occur due to exposure of community members to animals in the conservancy during development leading to death or injuries. Other accidents are likely to occur during transport and development phase as people handle different machines, tools and vehicles. People and livestock may be injured as a result uncovered holes.

Mitigation

Prevention of accidents will be of high priority to the proponent. Workers will be encouraged to take extra care in using equipment, on avoiding incidences of snake-bites, and animal attacks.

The electric fence will also be fitted with warning signs in order to ensure people are not exposed to electric shock.

7.2.10 Oil spills

This will arise from the various vehicles and machinery used during the fences erection. Spills will also arise from the development camps set up during the fences construction.

Mitigation

The proponent will ensure that no vehicles or machinery will be serviced on site to avoid instances of oil spillages

All servicing operations should be done in compliant garages or petrol stations

Table .3 Matrix showing significance of impact identified

ENVIRONMENTAL PARAMETERS	POTENTIAL NEGATIVE IMPACTS				CUMULATIVE IMPACTS			
	Design	Construction	Operation	Decommissioning	Past	Present	Future	cumulative
Flora		XXX	X	X	X	o	o	o
Fauna		XX	XX	XXX	XXX	o	o	o
Soil		XXX		XXX	XXX X		o	
Air		XXX	X	XX	XX		o	
Population	X	XX	XX	X	X			
Micro- climate		X	X	XX	XX	o	o	o
Microorganisms (Soil)		XX	X	X	X			
Microorganisms (water)	X	XX	X	XXXX	XXX X		o	+
Water availability		X	X	XXXX	XXX X			+
Humans	X	XXX	X	XX	XXX	o	o	+
Economy		XXX	XXX	XX	XX	+	+	+

Key: *X-Not significant; XX-low significance; XXX-significant; XXXX-highly significant and +Beneficial and o- occurrence*

Table 4. Summary of Impacts

PROBABLE IMPACT	TYPE	NATURE	PROPOSESED ENHANCEMENT /MITIGATION	RESPONSIBILITY
Job creation	Sociological	+,ST,R	Priority to available/willing youth	contractor
Skills capacity building		+,LT,P	Contact on/site training	contractor
Improved cross cultural relations		+,LP,P	Engage people from other ethnic backgrounds	contractor
Improved infrastructure		+,LT,P	Develop site access roads/health/education facilities	contractor
learning centers	Educational	+,LT	Promote site as a learning center	Educationist, CGoM
Improved local trade	Economical	+,LT,P	Buy from the local SMEs	Contractor
Misuse of site for suicide /homicide	Sociological	-,LT,P	Promote/fencing and lighting e security	Contractor /Kenya police
Rural moral degradation		-ST,R	Counseling , civil education, instruction	Parents, CBOs, schools, FBOs
Increased incidence/ HIV/AIDs		-ST,R	Equip health centers with ARVs and workers	Parents, schools, CBOs and FBOs
Risk of accidents	Sociological	-,ST,R	Fencing	Schools and CBOs
Increased number of outsiders		-,ST,R	Inform, educate, embrace ‘others’	All stakeholders

Increased human/road traffic		-,ST,R	Expand/modernize local road system	Contractor/KERRA
Locals vs outsiders workers tension		-,ST,R	Civil education, implementation of Kenya constitution 2010	
Poor waste disposal	Environmental	+,LT,R	Construct dump site, build sanitation equipment	Contractor,
Air pollution by tracks and machine		-,ST,R	Apply water on dusty roads regularly	Contractor/workers
Spillage and emissions on the river			Apply polluter pays regulations	Contractor and workers
Increase in water borne diseases	Health	-,LT,R	Training on water treatment before drinking	Community, MoH,NGOs
Loss of vegetation	Ecological	-,LT,R	Replace the trees	Contractor/ community
Reduced silt flow downstream		-,LT,R	Maintain 80% flow downstream	Contractor
Invasive flora		-ST,R	Do not introduce them/ biological removal	researchers
Changed water quality	Chemical/ecological	-,ST,R	Regular quality tests	
Changed river flow	Hydrological	-,LT,R	Maintain 80% flow	Contractor

Risk of land slide	Geological	-LT,R	Reinforce walls, barriers, buffer	Contractor

Key

Serial	Acronym	interpretation
1	LT	Long term
2	ST	Short term
3	R	Reversible
4	P	Permanent
5	-	negative
6	+	Positive

CHAPTER EIGHT
8.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

8.1 General Overview

The Environmental and Social Management Plan (ESMP) is prepared to show how site specific concerns and mitigation measures are addressed through the design, pre-construction, development and post-development / operation phase of a project might require amending. This is therefore a working document, which should be used as a basis for formulating more site specific Environmental Action Plans.

9.2 Objectives of ESMP

The Environmental and Social Management Plan (ESMP) describes the range of environmental issues associated with the Project and broadly outlines corresponding management strategies that will be employed to mitigate potential adverse environmental impacts. The ESMP conveys the project's environmental and social constraints.

The project will comply with all local laws and regulations, which seek to ensure that the development work does not adversely affect the environment and social community resources. The Supervising Consultant may periodically revise the ESMP in consultation with the Contractor, and subject to the approval from Kamungi Conservancy with copies to the National Environment Management Authority. Revisions may be made to accommodate changes in work, weather and site conditions. The ESMP should be made available to all project staff.

The objectives of the ESMP are:

- To bring the project into compliance with applicable national environmental and social legal requirements;
- To outline the mitigating/enhancing, monitoring, consultative and institutional measures required to prevent, minimize, mitigate or compensate for adverse environmental and social impacts, or to enhance the project beneficial impacts;
- To address capacity building requirements within the relevant ministries if necessary.

8.3 Institution Arrangement

The responsibilities of implementation of Environmental Management Plan will be jointly shared between the Contractor and the Kamungi conservancy to undertake these responsibilities will need to be set-up and should employ two ways communication at all levels of management. There will be various institutions involved in the process of ESMP planning and implementation. For effective environmental management and monitoring, it is proposed that Kamungi Conservancy acts as the responsible institution but supported by an Independent Consultant and an Environmental Monitoring Unit to be constituted by technically competent people from key

institutions. It is suggested that the TOR for the Contractor should include a resident Environment Manager who is to implement all the mitigation actions proposed in the ESIA.

9.3.1 Institutional Responsibilities

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

- The Contractor, which shall include an Environmental Manager (EM);
- Kamungi Conservancy, which in addition to its own internal capacity, shall contract a Supervising Engineer (SE) with one or more qualified environmental specialists; and
- An Independent Consultant Firm contracted by County Government to support Kamungi Conservancy in implementation and capacity development.
- The environmental Monitoring Unit, which shall consist of specialist organizations such as the Kenya Marine and Fisheries Research Institute, Kenya Medical Research Institute, Kenya Agricultural Research Institute, National Museums of Kenya, etc.
- The National Environment Management Authority (NEMA) and the representatives of all affected Counties

8.3.2 Responsibilities of the Kamungi Conservancy

As the project proponent Kamungi Conservancy shall bear the greatest responsibility and will undertake the following tasks:

- Oversee the development and implementation of the Final ESMP by the Environmental Management Unit (EMU) of the Kamungi Conservancy and coordinated by the Independent Consultant.
- Oversee and facilitate the implementation of all time-bound (non-recurrent) environmental management measures in the Final EMP by the Independent Consultant.
- Make Kamungi Conservancy staff available for environmental training, including working collaboratively with the Independent Consultant's personnel to implement particular environmental management measures.
- For environmental management measures specified in the final EMP that are recurrent – such as biota and water quality monitoring - provide the qualified staff to carry out these recurrent tasks, or ensure that they are carried out through operating agreements or contracts with other entities (see suggested composition of the EMU).
- Oversee the work of the Supervising Engineer and the Civil Works Contractor and associated subcontractors; facilitate adaptive responses that shall have been formulated by the EMU to any unforeseen environmental problems that arise during project construction; and apply all appropriate financial penalties in case of non-performance or serious non-compliance with the Final EMP or other environmental legal requirements.

8.3.3 Responsibilities of the Independent Consultant

The Independent Consultant will be an internationally professional firm contracted to:

- Assist in developing those plans envisaged under the Environmental Management Plan during Year 1 of project implementation, before bidding begins on the civil works. In developing these plans, the Independent Consultant shall coordinate with the EMU.
- On behalf of and in close collaboration with Kamungi Consevancy, assist in the development and the timely implementation of all plans and tasks, except for those tasks specifically assigned to other entities such as the Civil Works Contractor or Supervising Engineer.

8.3.4 Responsibilities of the Contractor

The main Civil Works Contractor shall be responsible for full compliance with the ESMP provisions, as well as health and safety measures specified in the Development The management Plan that will comprise part of the Final EMP. The Civil Works Contractor-and all associated sub-Contractors shall also ensure compliance with all Kenyan environmental laws and regulations, as well as international conventions.

The Civil Works Contractor shall appoint a Workplace Environment Manager (EM) and additional environmental specialists and staff as needed. The EM's expected to have at least 5 years relevant working experience regarding environmental management of infrastructure development projects, and should be familiar with Kenya's environmental legislatives requirements. The Contractor will be responsible for ensuring that all sub-contractors and workers are adequately informed and trained to comply fully with the letter and spirit of all environmental requirements specified in the Final EMP, the Environmental License(s) granted by NEMA and other Kenyan and international legal requirements.

8.3.5 Responsibilities of the Supervising Engineer

The Supervising Engineer will be a firm contracted by Kamungi Conservancy to supervise closely the daily work carried out by the Civil Works Contractor and relevant sub-contractors, including the environmental, health, and safety aspects. The environment-related staff of the Supervising Engineer will include (at a minimum) an Environmental Supervisor, who will lead the supervision of the environmental aspects of civil works, in accordance with the Development and Workers Camp Management Plan that comprises part of the Final EMP.

The responsibilities of the Supervising Engineer include the following:

- Carry out regular environmental site surveillance to investigate the Contractors' site practice, equipment, and work methodologies with respect to pollution control and adequacy of environmental mitigation implemented, and to ensure that the Development and Workers Camp Management Plan is complied with

- Monitor regularly the implementation of environmental mitigation measures and the Contractor' compliance with environmental protection, pollution prevention and control measures, and contractual requirements; advice to the Contractor and associated sub-contractors on environment improvement, awareness, proactive pollution prevention measures;
- Specify remedial mitigation measures that the Contractor must carry out, in the case of non-compliance with any part of the Final EMP or other environmental legal requirements. Oversee the implementation of remedial measures to reduce environmental damage;
- In conjunction with the supervising engineer, calculate the financial penalties that the Contractor will suffer for particular types and length of environmental non-compliance;
- Ensure that environmental, health and safety issues are prominently mentioned in the Supervising Engineer's periodic progress reports to NIB.

8.4 The Project Management Unit (PMU)

This unit will be the national body that will oversee implementation of all project activities including environmental mitigation measures. The unit will be established at least 1 month before the start of the Project and will operate as follows: 1 year for pre-construction, throughout the development period and 3 – 5 years to monitor post impoundment impacts and take action where necessary. The operational costs of the unit will be factored into the project cost.

Specifically, the roles of the PMU are:

❖ **Management Plan Principles**

The project is geared towards enhancing social and economic benefits through sustainable water supply. Development of the electric fence project would be expected to comply with the environmental conservation requirements in accordance with the established Kenyan laws and regulations. To realize these goals, acceptability by a majority of the stakeholders and minimal effects to the physical environment will require to be ensured through participation in the project and continuous consultations, evaluations and review of the design aspects throughout project implementation cycles.

It is also recommended that the environmental management guiding principles specific to this project improvement and water resources management be established to allow integration of environmental management considerations during development and operations. Among the factors that need to be considered in this particular project implementation will include;

- Ensure control of soil erosion and siltation of the water sources(rivers and the streams),Incorporation of electric fence safety provisions and the associated components,
- Enhancing integration of environmental, social and economic functions in the project implementation,
- Compensation of any land or property that may be affected by the project in accordance to the laid down regulations,
- The contractors and other players in the project activities be prevailed upon to implement the EMP through a sustained supervision and continuous consultations

❖ **Management Responsibilities**

In order to implement the management plan, it is recommended that an expert be identified to oversee the environmental and social management aspects including the electric fence conservation, soil erosion control, re-vegetation whenever appropriate, water conservation and equity in distribution, enhanced sanitation and hygiene measures throughout project area. The expert would also be required to coordinate and monitor environmental management activities during development and post monitoring audits. Other recommended participants include;

- Kamungi Conservancy will be responsible for coordination of all the activities and liaisons, particularly in regard to the quality control of the works and social issues.
- Water Service providers, in this case Kamungi Conservancy who have the responsibility to enforce water quality monitoring and efficient maintenance systems, procedures to minimize interruptions to water supply and ensure accessibility by all consumers,
- National Environmental Management authority (NEMA) through the county directors office shall be responsible of surveillance of environmental and social aspects of the project implementation,

8.5 Environmental Management Guidelines

The guidelines will include among other areas environmental management programmes, standard operation procedures, compliance monitoring schedules and environmental audit schedules as required by the law. Social harmony of the conservancy and associated component will be achieved through the collaborations with the stakeholders or community management committees introduced at various water consumption points

8.6 Institutional Framework Management

The National Policy on Water Resources Management and Development and the Water Act 2016 are the guiding tools on water resources management. The policy goal is to facilitate the provision of water in sufficient quantity and quality and within a reasonable distance to meet all competing uses in a sustainable, rational and economical way. It also separates policy formulation, regulation and services provision and defines clear roles for sector actors within a decentralized institutional framework and includes private sector participation and increased community development. The Ministry in-charge of Water is responsible for policy development, sector co-ordination, monitoring and supervision to ensure effective Water and Sewerage Services in the Country, sustainability of Water Resources and development of Water resources for irrigation, commercial, industrial, power generation and other uses. The Ministry executes its mandate through the following sector institutions:

(i) Water Services Regulatory Board (WASREB)
(ii) Water Resources Authority (WRA)
(iii) Water Services Trust Fund (WSTF)
(iv) Water Services Boards (WSBs)
(v) Water Services Providers

This integration encourages provision of sustainable development and a healthy environment to all Kenyans. The key functions of NEMA through the NEC include policy direction, setting national goals and objectives and determining policies and priorities for the protection of the environment, promotion of cooperation among public departments, local authorities, private sector, non-governmental organizations and such other organizations engaged in environmental protection programmes and performing such other functions as contained in the act. .

8.7 Environmental Education and Awareness Rising

Kamungi Conservancy and beneficiaries need to understand the basic environmental, water use sanitation and hygiene principles. In this regard therefore the following steps may be considered;

(i) Creation of liaisons on all matters related to environment, health and safety,
(ii) Encourage contribution of improvement ideas on specific issues related to the management of the facilities,
(iii) Establish initiatives that would instill a sense of ownership of the facilities and related components to all beneficiaries,

8.8 HIV/AIDS Issues

The contractor would be expected to incorporate HIV/AIDS programmes during development phase. Awareness, prevention and training on HIV/AIDS and other social diseases is important during project development and operation phase. The awareness creation should be improved

through putting up of banners, posters and training should be facilitated within the project area to the development workers and the community.

8.9 The Management Plan Matrix

Complying with the national laws and regulations, the ESMP will include;

(i) The monitoring plan.

(ii) The institutional and managerial arrangement for implementation of the full ESMP.

(iii) The cost of the implementation programme during pre-construction, development and post development if applicable.

In the final ESMP, It is proposed to analyze any measure present in the ESMP according to the following element;

(i) Justification and expected results.

(ii) Conditions of eligibility.

(iii) Main technical characteristics of the measure.

(iv) Activities to carry out to implement the measure.

(v) Operating arrangements to implement the measure.

(vi) Cost of the measure.

(vii) Arrangements for monitoring and evaluation of implementation and impacts of the measure.

An Environmental Management Plan (EMP) is generally a tool for an organization to keep aware of the interactions that its activities have with the environment, and to achieve and continuously improve a desired level of environmental performance. It is designed to continuously identify and reduce the environmental harm (impacts) created by the activities of a project. This Environmental Management Plan details strategies to be implemented in the various stages of the project.

Training and human resource development is an important link to achieve sustainable operation of the project and environmental management. Staff and community members will be informed of their responsibilities for successful operation of various environmental management plan items concerning the fence.

Apart from having an Environmental Management Plan, there will be a permanent staff charged with the task of ensuring its effective implementation of mitigation measures and to conduct environmental monitoring. This will ensure

- Implementation of the environmental management plan,
- Compliance with all relevant rules and regulations,
- Initiation of environmental monitoring as per approved schedule.
- Maintenance of documentation and records

- Coordination with regulatory agencies and communities
- Maintenance of record of public concerns, community welfare and the related responses

8.10 Environmental Monitoring Plan

This EIA proposes a Monitoring Plan that will be closely tied to the Environmental Management Plan (EMP). While the EMP will focus primarily on mitigating all adverse environmental impacts, the monitoring plan will look at the progress on the project's implementation and how it impacts on the community, the ecosystem, and on the performance of the fence itself. The monitoring plan will thus give room to identify and address any aspects that may not have been adequately captured in the EIA and by extension not included in the EMP. Thus it will allow for changes to ensure all impacts are adequately mitigated.

The monitoring plan will focus on the following three areas: -

1. Socio-economic impacts: This will cover both qualitative and quantitative impacts on the fence especially with regard to human-wildlife conflicts. Quantitative impacts will include benefits and losses in terms of food production, crop damage, monies raised in the local economic activities, conservancy coverage, conservancy destruction, school enrolment and performance, and other quantifiable aspect. Others will include any social hardships associated with the fence e.g. lack of firewood and water, long distances covered for the same, or lack of access to conservancy goods and services. These will be measured based on data from government sources and field surveys specifically undertaken for this purpose. Qualitative impacts will include change in attitude towards conservation and wildlife, better relations among communities and KWS/TT, community well being, human security, and better health.

2. Ecological monitoring: This will include monitoring whether the ecosystem's function and structure is impacted upon by the fence erected. This will include habitat changes – improvements or destruction in overall vegetation cover and biodiversity composition. Others will include the fence impacts on anthropogenic activity in the conservancy including illegal logging, charcoal making, and snaring/poaching.

Animal monitoring will include impacts on the fence on animal numbers and their distribution. This is more so in terms of increased large animal populations due to inability to move, or their congregating in key areas. Impacts will also include those on animal behaviour and on their breeding. In regard to the latter, issues of lack of access to breeding areas, and inbreeding will be closely monitored.

3. Fence monitoring: This will be with regard to the operations and maintenance of the fence. This will be done on a daily basis with regards to measuring voltage, monitoring fence for any vegetation touching on the fence, monitoring for broken or fallen posts and wires, disconnected earthings, and also ensuring that the fence is not vandalized especially with regards to energizers, solar panels and batteries. Other monitoring activities will include communication with patrol teams and training of the same group on a regular basis on fence operations and maintenance.

Table 5. Monitoring and Evaluation Matrix

1. Socio-economic impacts			
Aspects	Responsibility/ Information Sources	Frequency	Verifiable indicators
Incidences of human-wildlife conflict	KWS	Day-to-day	PAC reports; crops destroyed, infrastructure destroyed, human/anima hurt or killed
Food production	Ministry of Agriculture	Annual Bi annual	Crop production reports in conservancy adjacent district
Economic activity	Kenya National Bureau of statistics	Annual	District Development Reports
Conservancy cover/Damage	TT, DRSRS	Annual	Conservancy cover reports; incidences of damage, aerial photos/satellite imagery
School enrolment and performance	Sub-County Education offices	Annual	School enrolment and performance in schools
Access to reserve products	TT/KWS surveys	Annual	Reports from surveys
Attitude changes	KWS surveys Community wardens and KWS office	Annual/through normal interaction	Reports of KWS community officers and district wardens
2. Ecological Monitoring			
Aspects	**Responsibility/ Information Sources**	**Frequency**	**Verifiable indicators**
Vegetation cover	TT\DRSRS	Annual	TT reports, DRSRS aerial photos and satellite imagery
Anthropogenic activities	TT\KWS	Monthly	Arrest reports, kilns destroyed, illegal logging arrests

Animal monitoring	KWS	Annual	Animal counts – direct and indirect; changes in animal behaviour and breeding
Genetic monitoring	KWS	Ten years	Genetic analysis; incidences of diseases
3. Fence Monitoring			
Aspects	**Responsibility/ Information Sources**	**Frequency**	**Verifiable indicators**
Voltage measuring	Field teams/KWS	Daily	Daily records
Clearing of fence alignment	Field teams/KWS	Daily	Daily records
Fence monitoring for breakages/ vandalism	Field teams/KWS	Daily	Daily records
Communication with field teams	KWS	Daily	Daily records

Table 6. Summary of ESMP implementation Cost		
Environmental/ social aspect	**Description**	**Indicative cost estimate in KSH**
Water quality	Training on fence management	80,000
	fence monitoring and maintenance	130,000 per year
	Establish fence rules	No direct cost
	security of the fencing	550,000
Air quality	Fumes and dust control measures	Cost in BQ
	Disposal of earth spoil materials	KSH 420,000 on
Noise	Personal protective equipment for noise.	50,000
	Noise pollution permits	66,000
Work force	Training of local labour force	Cost in BQ
Soil erosion	Implementing soil erosion control measures along the fence	100,000
Health and safety	Provide protective clothing to workers	200,000
	Awareness and sensitization on health and safety	
	Providing signage and posters	
Culture	Accommodation of new immigrants in the area and protection of cultural heritage	Cost in BQ
Conservancy cover replacement and maintenance	Plan for replacement of indigenous trees in the conservancy	1,347,000
	Restrict vegetation removal to the demarcated project area.	
Loss of bio-diversity	Minimize vegetation clearing	Best engineering and management practices.
	Prevent oil spilling and flammable on ground to avoid soil contamination and fires	
Solid and liquid waste	Proper waste handling and management	Best engineering and management practices.
Water and airborne related diseases	Development waste(residue earth, debris and scrap material) be appropriately disposed	150,000
	Sprinkle water on loose soil to avoid dusty occurrences Mapping and control of water borne disease causing vectors	
Sedimentation Livelihood	Sediment residue downstream during development Support of livelihood improvement projects and corporate social responsibility.	No direct cost 500,000

CHAPTER NINE

9.0 The Environmental Monitoring and Audit Program me (EMAP)

General Overview

A comprehensive Environmental Monitoring and Audit Programme (EMAP) will be implemented to check effectiveness of the mitigation measures as proposed and environmental compliance with relevant statutory requirements.

The proposed key EMAP requirements include:-

- ❖ Monitoring health and safety measures
- ❖ Noise monitoring at designated monitoring stations during development phase.
- ❖ Dust monitoring at designated monitoring stations during development phase.
- ❖ Regular site inspections at the works areas as part of the EMAP procedures to ensure the recommended mitigation measures are properly implemented.
- ❖ The proponent through periodical audits will know how to monitor the project affected community during implementation and operations phase.

9.1 Health and Safety Measures

9.1.1 Safety First

The client will ensure that safety is given a priority before electric fencing and the associated civil works commence. This will take the workers through applicable safety measures. Key areas that will require extra measures to ensure safety of all working in the fencing project will include:

- Ensuring that workers erecting the fence take extra precaution to avoid accidents and injuries.
- The client will ensure that workers are accompanied by rangers to prevent cases human-wildlife conflicts during construction.
- Safety and health will also include awareness creation and capacity building in terms of enhancing a sense of appreciation of a clean environment and its positive impacts on both the environment, and the workers/communities welfare.
- Community members will also be sensitized on fire hazards and prevention mechanism in protected areas. The incorporation of community members in fire management will ensure that they are involved in firefighting during outbreaks.
- The electric fences will also have warning signs indicating “hatari” or “danger”, to ensure that people are not electrocuted, or shocked

9.2 Prevention and Management of Possible Accidents

Setting of minimum standards of construction: The project will ensure that all buildings and civil works are done in conformity with conditions of contract for civil engineering development including obligations and workmanship standards. The development phase will also ensure that legal Notice No. 40 - The Factories (Building Operation and Work of Engineering Construction) Rules, 1984 is observed.

Scaffolds and zoning: During construction, the development area will be fenced off, scaffolds put up, and well-placed and clear warnings put up to alert people against falling objects.

Setting clear emergency routes: This will be put in place to facilitate rapid responses in case of emergencies and accidents. An emergency exit route should be established within the research centers.

Protective attire: Development workers will be given helmets and overalls, and in some areas gloves for their protection and to minimize any adverse impacts should they occur.

Having all workers insured: The proposed project will ensure that the contractor has a workmen's compensation for all development workers as a contingency measure in case of any accidents.

Insurance: The building will also be insured for fire and other accidents and tenants advised to take insurance of their property.

Capacity building and training: The staff running the research centers, and rangers posts will be trained on safety in the building and minimum safety standards set for their observance. Signs on safety and a clean environment will also be put within the building.

Observation of Kenya's Factory and Places of Work Act: The project will observe to the letter this act as a way of minimizing and mitigating accidents especially during construction.

Feedback: Feedback from staff on accidents and near-accident cases should be solicited and adequately received so that accidents prevention can be stepped up in areas with high risks.

9.3 Emergency Response Plan

9.3.1 Relevance of an Emergency Response Plan

An Emergency Response Plan (ERP) is an essential tool in any project especially in protected areas. It is therefore crucial that a proponent puts in place an emergency response plan that will take into account disaster prevention through good design, operation, maintenance and inspection to reduce the probability of occurrence and consequential effect of such eventualities. However, it is not possible to totally eliminate such eventualities and random failures of equipment or human errors, omissions and unsafe acts cannot be ruled out. An essential part of

major hazard control has therefore, to be concerned with mitigating the effects of such emergency and restoration of normalcy at the earliest possible time. It is therefore imperative that as part of an emergency response, an Emergency Response Team will be formed incorporating KWS and community members.

The ERP has therefore to be related to the identification of sources from which hazards can arise and the maximum credible loss scenario that can take place in the concerned area. The plan takes into account the maximum credible loss scenario - actions that can successfully mitigate the effects of losses

The overall objective of an emergency response plan (ERP) is to make use of the combined resources at the site and outside services to achieve the following:

- To localize the emergency and if possible eliminate it;
- To minimize the effects of the accident on people and property;
- Effect the rescue and medical treatment of casualties;
- Safeguard other people;
- Informing and collaborating with statutory authorities;
- Initially contain and ultimately bring the incident under control;
- Preserve relevant records and equipment for the subsequent enquiry into the cause and circumstances of the emergency;
- Investigating and taking steps to prevent reoccurrence

9.3.2 Response procedure for emergency team

- Using the public address system, inform community members and other stakeholders.
- Inform the necessary authorities for aid by calling 999 or 911
- Ensure that the first aid ambulance and fire tender vehicles are summoned if necessary.
- Inform the nearby hospitals if there are any injuries.

9.3.3 Response in case of fire

- Required response during in the event of a fire should be described in signs located in strategic areas such as gates.
- On sighting a fire, it should be immediately reported to the park warden and community representatives giving the exact location and type of fire in detail.
- Initiate the Emergency Response Team for fires.
- If the fire is small, engage in extinguishing the fire using the nearest available means.
- The Emergency Response Team should immediately inform the nearest dispensary and security force. If required a fire tender should be summoned.

- The response team should immediately move to the point of fire and take all necessary steps to stop the fire. If the fire is not controllable and spreads then the in charge should inform the district authorities and call for external help.

Table 7. Table Environmental Management and Monitoring Plan Matrix for Electric Fence

Table Environmental Management and Monitoring Plan Matrix for Electric Fence						
Activity	Potential negative impact	Mitigation Measures	Responsibility	Frequency/Timing	Cost	Verifiable Indicators
1. Project Design Phase						
Planning, Surveying, EIA study, Alignment	Trampling on vegetation, animal disturbance, lack of consensus towards the project between stakeholders	Avoid vegetation destruction, use available tracks, maintain modicum of silence, intensified consultations	Senior Warden KWS,	Throughout project design stage, throughout the project cycle	N/A, as per the contract	Vegetation destroyed/animals affected, project acceptability
2. Development Phase						
Clearing	Throughout project design stage, throughout the project cycle	N/A, as per the contract	Vegetation destroyed/animals affected, project acceptability	All through development period	As per the project cost	Incidences of haphazard vegetation clearing, lack of backfilling in excavated areas
Constraining animals within the park	Obstruction of wildlife migration routes, habitat destruction	Provision of wildlife migration corridor and ecological sites, translocation	KWS	Through out the project cycle	In project contingency budget	Evidence of animal stress
Transportation of materials	Noise, trampling of vegetation,	Maintain modicum of silence, use designated tracks, avoid using noise prone vehicles	KWS/ TT/ Communities/	Development period	N/A	Number of vegetation destroyed, increase in animal stress

		such as old tractors	Stakeholders			

Environmental Management and Monitoring Plan Matrix for Electric Fence						
Activity	**Potential negative impact**	**Mitigation Measures**	**Responsibility**	**Frequency/Timing**	**Cost**	**Verifiable Indicators**
Digging holes	Soil erosion, solid wastes	Backfilling of excavated areas, solid waste put in bins are transported outside the park	KWS/TT/ Communities/ Stakeholders	Development period	As per the project budget	Evidence of exposed soil, and solid waste in the project area
Fencing	Locking out animals outside, /Spill over of conflicts elsewhere/continued human wildlife c	Due diligence ensuring animals are not locked out Strategic wildlife management	KWS	At planning, construction and operation stages	In project budget; separate budget for translocation	
3. Operation Phase						
Live fence	Public safety risks due to solar fence (electric shock)/injuries to wild animals	Install warning signs on the live wire, allow for migration corridors and safe gates in	KWS/TT/ Communities/S t akeholders	At development & operation stages	In project budget	Incidences of electric shocks reported, number of attendants enlisted

		designated areas, monitoring of voltage.				
Limited access to the reserve	Shortage of firewood, no grazing of animals and access to other products, sour relation between communities and KWS	Allow for access routes in designated areas, provide for utilization of reserve products	KWS/TT/ Communities/ Stakeholders	Through out the project cycle	N/A	Number of access routes installed, enhanced community ownership of the project, harmonization of TT/KWS policy on utilization of

Table 13.2 Environmental Management and Monitoring Plan Matrix for Electric Fence

Activity	Potential negative impact	Mitigation Measures	Responsibility	Frequency/Timing	Cost	Verifiable Indicators
						reserve products
Access to the reserve	Loss of life/injuries inside the fenced areas, introduction of invasive species	Community members should indemnify KWS/TT, Access at owner's risk, awareness creation on possible exposure to danger and	KWS/ TT/ Communities/ Stakeholders	During operation stage	N/A	No of accidents/incidence s reported, cases of invasive species
Maintenance	Clearing of vegetation	Minimum impact	KWS/T	During operation	As per the	Continued functioning of the

	along the fence,		T/ Communities/ Stakeholders	stage	budget	fence, project sustainability
4. Occupational Health and Safety Risks						
Accidents	Loss of life due to animal attacks, injuries due cuts, snake bites, falling	Adherence to safety requirements and standards, awareness creation on possible accidents, training of technicians on maintenance of the fence, installing warning signs	KWS	Through out project cycle	As per budget	Number of accidents/incidences recorded, number of technicians trained, number of warning signs installed and their intervals
	Clearing of vegetation along the fence,	Minimum impact	KWS/TT/			
Fire	Loss of vegetation, death of animals, destruction of habitat	Install warning and preventive signs along access routes, engage stakeholders in fire management	KWS/TT	Through out the project cycle	As per budget	Incidences of fire occurrence

Table 13.2 Environmental Management and Monitoring Plan Matrix for Electric Fence						
Activity	Potential negative impact	Mitigation Measures	Responsibility	Frequency/Timing	Cost	Verifiable Indicators
		exercises				
5. Decommissioning Phase						
Poles	Increase in solid	Sold as firewood	KWS	Once at the end of the project life	N/A	Income derived from the sale
Electric wires	Used as snares for trapping animals	Sold for recycling	KWS	At end of project life	N/A	Income derived from the sale
Other materials	Increase in solid wastes	Solar panels and energizers can be sold to willing buyers, other material dumped in designated sites	KWS	At end of project life	N/A	Income derived from the sale
No fence	Renewed human wildlife conflicts	Constant maintenance of the fence, establish a revolving fund for project sustainability	KWS/TT/ Communities/ Stakeholders	Throughout the project cycle	N/A	Funds available for maintenance

CHAPTER TEN
10.0 GENERAL CONCLUSION AND RECOMMENDATIONS

10.1 Recommended Actions

Current strategies to manage human-elephant conflict largely focus on either physical separation, or mitigating the problem by domesticating, fencing. Trans-locating, or culling problematic elephants and/or compensating farmers. While these tools remain important conflict management strategies, the majority appear to be driven by short-term, site-specific factors that often transfer the problems of human-elephant conflict from one place to another. We proposed a conceptual model that recognizes the competition for water, land, and plant resources between these species, and seeks to identify conflict hotspots and alternative resource access options for effective land management now and in the future. We highlighted the application of ecological, anthropological, and geographical knowledge and tools for developing long-term sustainable solutions to this complex problem, and hope our conceptual model provides guidance for future research focus.

The diverse data needed to build out our conceptual model require interdisciplinary cooperation to synthesize multiple historic, contemporary, and projected datasets from the biophysical and social sciences. While biophysical data may already be in a form that readily lends itself to landscape level modeling and planning, integration of ethnographic information will likely involve more effort including extensive social science fieldwork in conflict-prone communities. However, understandings of how people living in or near conflict prone areas use natural resources, and how they make decisions about current and future resource use, remains key to addressing the underlying drivers of human-elephant conflict and their spatial variation. Without this knowledge, the task of resolving human-elephant conflict and finding a means for these species to coexist in the Anthropocene is sisyphean.Several measures have been suggested to prevent or minimize the negative environmental impacts and to maximize the positive ones using a comprehensive environmental management plan.

- Fence Alignment: The fence alignment should be on the conservancy boundary because it is primarily meant for mitigating human-wildlife conflicts.
- Fence design: We recommend that the electric fence put up should be a two-strand fence which will be able to control the movement of only large animals especially elephants from the adjacent community lands. 2-strand fences have limitations in that they only keep off larger animals, while the smaller animals are still able to get access to community farms.
- Putting up a secondary fence for reserve plantations: This fence will keep off elephants which are the main problem animals as regards plantation, while at the same time allowing animal movement between the natural conservancy area and plantations. This fence will also give secondary protection for the reserve adjacent communities.

- Incentives for Fence Maintenance: The effectiveness of electric fence is closely tied to its maintenance. The reserve adjacent communities have given their commitment that they will maintain the fence especially if the alignment is between them and the conservancy boundary (if it is near them).
- Community Involvement and ownership: Communities have been involved in the planning process ad this involvement must continue in the implementation and maintenance phases for the project sustainability o be assured. In this way, they will feel a sense of ownership and thus be able to protect the fence from being vandalized. Community contribution in the barrier's installation will also bring a sense of ownership.

10.2 Conclusion

Human wildlife conflict remains rife in the Tsavo area adversely impacting livelihoods of reserve adjacent communities and actually threatening their very survival. The public consultation with communities in the course of the ESIA study identified the electric fence as the optimum wildlife barrier to reduce human – wildlife conflicts around Kamungi conservancy area. The fence also has high socio-economic impacts for the adjacent communities especially with regard to poverty alleviation and general human security. Other benefits include improved health, improved agriculture production, improved incomes, and general improved living standards. The fence will also contribute to improved conservation of both flora and fauna in the Kamungi conservancy eco-system.

The ESIA study has also identified some minimal negative environmental impact and come up with workable mitigation measures. The ESIA study has also come up with an Environment Management and Monitoring Plan, which the Kamungi Conservancy and communities have committed themselves to follow. Both parties have also committed themselves to follow the recommendations arising from this study.

The study team has considered the various environmental impacts as they are at the present. However, ecosystems remain dynamic and thus the need for monitoring and constant evaluation of the EMP. In this regard, the other phases of the fencing project will need to reviewed in light of lessons learnt from the first phase of this project. Consequently, the EMP may take a few alterations during the implementation of these phases.

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ANNEXES

- ✓ Key Stakeholders Questionnaires
- ✓ Community Questionnaires
- ✓ NEMA Licensing