

### PROPOSED ELECTRIC FENCING OF MAASAI MAU FOREST- NAROK COUNTY

### ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT

Prepared and submitted by:



DECEMBER, 2019



### CERTIFICATION

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**Assignment:** ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED ELECTRIC FENCING OF MAASAI MAU FOREST - NAROK COUNTY

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ESIA Study for the Proposed Electric Fencing of Maasai Mau Forest

Norken International Ltd



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### ACRONYMS

ADI	Area of Direct Influence
BLD	Bulk Density
CEC	Cation Exchange Capacity
CITES	Convention on International Trade on Endangered Species
DCC	Deputy County Commissioner
DEMP	Decommissioning Environmental Management Plan
DLP	Defect Liability Period
DOSHS	Directorate of Occupational Safety and Health Services
ENSO	El Niño Southern Oscillation
EPRA	Energy Petroleum and Regulatory Authority
ESIA	Environmental and Social Impact Assessment
ESMMP	Environmental and Social Management and Monitoring Plan
FAO	Food and Agricultural Authority
ITCZ	Inter-tropical Convergence Zone
IUCN	International Union for Conservation of Nature
KFS	Kenya Forest Services
KWS	Kenya Wildlife Service
KWTA	Kenya Water Towers Agency
LED	Lighting Emitting Diode
Mg/kg	Milligram per Kilogram
MMF	Maasai Mau Forest
NEMA	National Environment Management Authority
NO <sub>3</sub>	Nitrates
PV	Photo Voltaic
SAoI	Social Area of Influence
SOC	Soil Organic Carbon
STI	Science, Technology and Innovation

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STIs	Sexually Transmitted Infections	
WIPO	World Intellectual Property Organization	
WRMR	Water Resources Management Rules	
IBA	Important Bird Area	



### **EXECUTIVE SUMMARY**

#### Background

The Kenya Water Towers Agency (KWTA), hereinafter referred to as the Proponent, is proposing to fence the Maasai Mau Forest as part of the efforts to restore and rehabilitate the encroached sections of the forest. The electric fence will be put to secure the areas which were recently reclaimed.

The Kenya Government policy on all new projects requires that an Environmental Impact Assessment (EIA) study be carried out at the project planning stages to ensure that significant impacts on the environment are taken into consideration. Although the proposed project is not listed under the second schedule of the Environmental Management and Coordination Act (1999) that should undergo a full Study ESIA, a consultation with the NEMA Narok County Office recommended preparation of a Comprehensive Project Report or EIA Study Report because of the land ownerships issues surrounding the project site.

In order to comply with NEMA requirements, KWTA Contracted Norken International Limited, a firm of Experts (NEMA Reg. No.0181) to undertake ESIA Study for the project under the proposed developments.

The main objective of the ESIA is to identify all potential environmental and social risks and impacts of the proposed project, as well as the potential displacements of people and ecological disruption and subsequently formulate appropriate measures to mitigate undesirable impacts.

The specific objectives of this ESIA Study Report are as follows:

- Provision of an overall assessment of the social and biophysical environment affected by the project;
- Identification and detailed assessment of potentially significant impacts associated with the project;
- Identification and recommendation of appropriate mitigation measures for potentially significant environmental and social impacts;
- Public/stakeholder consultations to ensure that that the affected communities are engaged throughout the ESIA process and their issues and concerns addressed;
- Developing an Environmental and Social Management Plan necessary to minimize, mitigate any potential environmental impacts identified by the ESIA; and
- Preparation of an ESIA Study report in accordance with the requirements of the Environment (Impact Assessment and Audit) Regulations, 2003.
- The proposed electric fence project is planned to be constructed on the western side of Maasai Mau Forest.



#### **Project Location**

Maasai Mau Forest is part of the Mau Forest Complex which is situated in the southern part of forest complex. The forest block lies within Narok County, and is situated 21 Km to the northern part of Narok Town. The northern part of Maasai Mau is bordered by Ol Pusimoru Forest Reserve and Transmara Forest Reserve lies to the north west of the project forest area. The bounding extent of Maasai Mau lies, to the North 0.6622°S, South 0.9186°S, East 35.8978°E and to the West it lies on 35.6038°E. The proposed electric fence lies to the South 0.9076°S, North 0.7367°S East 35.7470°E and to the West it lies on 35.6038°E.

### **Project Description**

The Proponent proposes to construct an electric fence around the Maasai Mau Forest. The fence shall be of Intermediate Design type and shall consist of between five and ten strands. It shall have a combination of live wires and earth wires. The bottom earth wire shall be looped to the upper earth wire and later to a tight lock underground mesh. At 200m interval, the wire shall be attached to a 2m earth peg with a joint clamp. All live wires shall be attached to strain insulators at strainer assemblies and tied by joint clamps and looped across king post to the next wire tied in the same way. Galvanized staples shall be used to attach earth wires and insulators to the posts. All wires shall be strained to a tension of 180kg. Standard galvanized joint clamps shall be used to join the wire along the main fence line and at corners where looping shall be necessary. All joints shall be tight and of figure 8 or reef knot joint.

### **Project Cost and Schedule**

The first phase of implementation of the proposed Electric Fence is envisaged to cost approximately **Eighty Million Kenya Shillings**. The construction phase is expected to take at least 12 months and a defect liability period (DLP) of 6 months.

#### **Project Alternatives**

### The No Project Alternative

This option maintains the status quo where the MMF continues to be encroached and destroyed by anthropogenic activities including illegal logging, wild life poaching as well as demand for agricultural land. It is estimated that if this option is pursued approximately 17,000 hectares of forest cover will be lost which is equivalent to 37% of Mau Forest Complex which will consequently have catastrophic consequences to the ecosystem and communities. Under this option, any social and economic development benefits from the project would be foregone and neither would there be the associated impacts on the environment.



### With Project Option

Contrary to the No Project alternative, the proposed project is anticipated to address the issue of encroachment to MMF and generate environmental, social and economic benefits. The proposed fence will contribute to the long-term conservation of MMF by protecting against agricultural encroachment and illegal activities. The fence could also reduce human-wildlife conflict and improve productivity and food security among the locals neighboring the forest.

### Alternatives to Project Site

The Proponent considers Maasai Mau Forest as an ideal site for this project given the fact that rehabilitation activities have already begun on areas reclaimed from illegal settlers. The Maasai Mau Forest block is the most vulnerable of the Mau Forest Complex whose ability to provide ecosystem goods and services is under threat.

### Alternatives to the Design

Prior to settling on the proposed project; the Proponent also considered three other types of Electric Fences which have been used elsewhere in Kenya by KWS to control wildlife. These options are: comprehensive fence type 1, comprehensive fence type 2 and butterfly fence. The three options are similar to the proposed design in terms of the materials used. However, the spacing between the poles and the number of strands differ. Additionally, they are costlier and have limitation of preventing the public from illegal access into protected boundaries which is the primary objective of installing an electric fence at MMF.

### Alternatives to Project model

This alternative looks into the fencing model and the proposed electric fencing model. The proposed model considered is erection of electric fence to secure the forest from illegal forest activities. This will involve erecting an electric fence which could enable protection of the indigenous forest and ensure it continues to provide ecosystem goods and services. The alternatives to electric fence would be to adopt the following physical barrier systems:

a) Game Moats- deep and wide trenches used to confine wild animals in conservation areas. The merits of Game Moats are that they do not require special tools to construct and maintain and they utilise unskilled labour in construction and thereby help build stakeholder ownership (FAO, 1998). However, they are:

- Greatly affected by terrain and soil moisture,
- Incapable of controlling the movement of people and livestock into protected areas;
- Create artificial stagnant bodies of water that may become health hazards; and



Require extensive maintenance by large numbers of laborers, both because of erosion and resultant slippage of soil, and because elephants learn to cave in the sides to negotiate the moat.

b) Vegetative or live barriers, - They comprise of one or more species of plants used as fence or barrier. Vegetative barriers are, however, generally not effective against elephants and primates, and are probably never effective against people.

c) Other physical barriers- they include: stone wall; stock fences, non-electric fences; high tensile steel fences. However, none of them has proven to be effective barriers against wild animals such as elephants or humans.

### Alternatives in Project Materials

The Proponent considered currently available materials for the construction of the fence. The options available are: wood post (Eucalyptus and cedar posts), steel post, fiberglass post and posts made from recycled plastic. Each of these posts have advantages and disadvantages. Wood post are favorable because they are readily available, reliable and strong. Eucalyptus posts are very dense wood that resist decay and there are also claims that they have good electrical insulating value but there is no research to support this claim. The downside of wood posts is their purchase and installation costs.

### Alternatives in Project Implementation

This project's implementation could be realized through several options. One option is to do it in phases and observe the positive and negative impacts as they emerge. The second option is to have it all done at once over the planned construction period – an economically viable option. However, for the current project setting, KWTA will establish the various structures in phases based on available funding from the donors.

### Conclusion on Alternatives

The proposed intermediate fence type represents a viable option of securing MMF from human encroachment. The environmental impacts and cost of implementation associated with this option are low in comparisons to other options analyzed in this study.

### Legal and Administrative Framework

All the relevant national and county policies, laws, regulations and institutions were reviewed and discussed to ensure total compliance with the governing laws and regulations as well as contributing towards achievement of the objectives of the operational policies. Liaison with the identified relevant institutions will further contribute towards the success of the proposed project. The identified national policies, laws and guidelines include:

• The Constitution of Kenya 2010



- Environmental Management and Coordination Act, 1999 (and the amendments of 2015)
- Environmental Impact Assessment and Audit regulations, 2003 and the 2016 amendments
- EMCA (Conservation of Biological Diversity and Resources, Access to Genetic Resource and Benefits Sharing) Regulation, 2006
- EMCA (Waste Management) Regulations 2006
- Noise and Excessive Vibration Regulations
- The Wildlife Coordination and Management Act, 2013
- Occupational Health and Safety Act, 2007
- Employment Act, 2007
- Work Injury Benefits Act (WIBA)
- The Energy Act, 2019
- The Energy (Solar Photovoltaic Systems) Regulations, 2012
- The Public Health Act (Cap. 242)
- The Forest Management and Conservation Act, 2016
- Environment and Land Court Act, 2011
- The Physical Planning Act, 1999
- The Land Titles Act Cap 282
- The Penal Code, Cap 63
- The Water Act,2016
- IFC environmental and social sustainability guidelines were also reviewed and incorporated in the assessment.

### **Baseline environment**

The environmental and social baseline information is fully presented in Chapter 4 of this report. It provides specific information within the Project's area of influence which will be directly impacted (whether positively or negatively) by the project activities, as well as high regional baseline information to put the project into context.

The baseline environment described includes physical, biological and socioeconomic information on the proposed project area.

### **Consultations and Public Participation**

Stakeholders were identified on the basis of their interaction with the Mau Forest Complex as whole, and with Maasai Mau block specifically. Other than the forest-adjacent and the forest-depended communities who were identified as primary stakeholders, other parties who have been involved or outspoken over the forest matters were considered as having a stake in the proposed fencing of the forest. Stakeholders identified were therefore forest-adjacent and forest-dependent communities, State Agencies including the Public Administration, line State Departments and State Corporates charged with environmental conservation, Civil Society



Organizations whose activities are aligned to environmental conservation and human rights groups.

The public consultation exercise yielded varied outcomes. Reactions ranged from willful acceptance and full support for the proposed intervention, to outright hostility and opposition of the project. The Consultant adopted a balanced approach by ensuring that those who supported the project and those who opposed it, both gave their reasons for doing so. It is worth noting that majority of those who opposed the project indicated that they would be willing to support under certain conditions. Since views varied from location to location, the consultation outcomes have been presented as such in Chapter 5 of this report.

All the above issues from project stakeholders were incorporated in this ESIA study. To ensure the conduct of appropriate post ESIA stakeholder consultation, a Stakeholder Engagement Plan (SEP) has been prepared to guide the Project Proponent and Contractor in post ESIA stakeholder consultations.

### Impact Assessment and Mitigation

Implementation of the proposed project will be associated with both positive and negative impacts during both the construction and operation phases. The identified and assessed impacts are outlined below.

### Positive Impacts

The fence is anticipated to restrict access of people into the Maasai Mau Forest and thus curtail wanton destruction of the forest through illegal settlement. It will boost the ongoing conservation efforts of rehabilitating reclaimed areas. In addition, the following positive impacts will mainly be realized:

- Direct and indirect employment opportunities and the procurement of goods and services and combined multiplier effect of this economic growth will result in increased incomes for successful candidates and their local communities; promoting some degree of increase in standards of living.;
- Restoration of vegetation cover on the reclaimed landscape
- Protection of threatened plant species inside the forest from illegal logging
- Enabled seed dispersal over the reclaimed landscape by birds and mammal species
- Improved physical and chemical properties of soil (SOC, pH, BLD, and CEC)
- Improved sustainable water discharge and quality from spring and streams
- Expanded ecological range for small mammals and birds foraging and breeding grounds; and
- Control of envisaged human-wildlife conflict

Negative Impacts



There are some negative impacts which will be associated with the construction and operation phases of the proposed project. These are:

- 1. Physical
  - Impacts on Local Air Quality
  - Noise and Vibration
  - Solid Waste
  - Impacts on surface water quality and quantity
  - Wastes and Effluents
- 3. Ecological
  - Destruction of vegetation cover
  - Potential destruction of population of threatened plant species
  - Pit falling of small mammals, herpatofaunal and crawling invertebrate
  - Introduction of alien invasive plant species along the fence alignment
  - Fatal electrocution of small mammals and birds
  - Restricted movement across the landscape
  - Disruption of connectivity and seed dispersal on the landscape
- 3. Socioeconomic
  - Impacts on Cultural Heritage
  - Increased Transmission of HIV/AIDS and STIs
  - Impacts on Employment, Procurement and the Economy
  - Loss of property and livelihood sources
  - Insecurity

#### Decommissioning phase impacts

It is anticipated that the impacts associated with decommissioning will be similar to those encountered during construction.

### Mitigation measures for negative impacts

For each of the negative impacts, a number of appropriate mitigation measures have been identified and recommended for implementation during project implementation. The mitigation measures are aimed at reducing the severity of the negative impacts to acceptable levels.

With the implementation of recommended mitigation measures, the ESIA consultant is convinced that all the negative impacts will be kept within manageable limits.

### Enhancement measures for the positive impacts



Measures to enhance the positive impacts have also been identified to maximize the project benefits. Once implemented; the positive impacts will supersede the negative impacts.

### Environmental and Social Management and Monitoring Plan (ESMMP)

All the recommended mitigation measures for the identified negative impacts and enhancement measures for the positive impacts have been summarized the ESMMP with clear monitoring indicator for each of the impacts and responsibilities to ensure effective implementation and management of the impacts.

It is expected that effective implementation of the ESMMP will maximize the project benefits whilst minimizing all the associated negative impacts to acceptable levels.



#### Recommendations

The implementation of the impact mitigation measures detailed in Chapter 6 and listed in the ESMMP (Chapter 7) will provide a basis for ensuring that the potential positive and negative impacts associated with the establishment of the electric fence are enhanced and mitigated respectively to a level which is deemed adequate for the fencing to proceed.

Based on the findings of this assessment, the study team recommends that the Project be authorized, contingent on the mitigations and monitoring for potential environmental and socio-economic impacts as outlined in the ESMMP.



### 1 INTRODUCTION

### 1.1 Project background

The Kenya Water Towers Agency (KWTA), hereinafter referred to as the Proponent, is proposing to fence the Maasai Mau Forest as part of the efforts to restore and rehabilitate the encroached sections of the forest. The electric fence will be put to secure the areas which were vacated recently by the forest settlers.

The Kenya Government policy on all new projects requires that an Environmental Impact Assessment (EIA) study be carried out at the project planning stages to ensure that significant impacts on the environment are taken into consideration.

In order to comply with NEMA requirements, KWTA Contracted Norken International Limited, a firm of Experts (NEMA Reg. No.0181) to undertake ESIA Study for the project under the proposed developments.

### 1.2 Project Justification

The Maasai Mau Forest (MMF) is one of the 22 forest blocks of Mau Forest Complex (MFC) covering an area of 46,278 ha and is registered as a trust land. MMF is currently the most vulnerable forest block of the MFC whose ability to provide ecosystem goods and services is under threat. The major threat facing the MMF and other water towers across the country is human induced pressure manifested by forest encroachment, commercial charcoal burning and illegal logging. The impact of the human related degradation has been catastrophic with frequent and intense floods, drought, reduced river flows, declining land productivity and food insecurity among others. The water tower ecosystem health and resilience is likely to deteriorate further unless urgent and appropriate measures towards their protection and conservation are undertaken.

It is in this regard that there is need to fence MMF in order for it to continue to provide the critical ecosystem services and maintain its integrity, health and resilience.

### 1.3 Scope and Objectives of the ESIA Study

The ESIA study has been carried out in compliance with the Government of Kenya's Environmental Management and Co-ordination Act of 1999 and in accordance with other environmental laws and regulations as well as meeting the standards established under the international environmental guidelines. The study is also guided by subsidiary legislations to EMCA, 1999 including Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003.

The main objective of the ESIA was to identify all potential environmental and social risks and impacts of the proposed project, as well as the potential displacements of people and



ecological disruption and subsequently formulate appropriate measures to mitigate undesirable impacts.

Risks and impacts have been analyzed for the key stages of the project based on the environmental and social baseline settings identified. This aided in the development of appropriate environmental and social management plans.

The ESIA study covers the following broad areas:

- (i) Literature review.
- (ii) Detailed and updated description of the project design and proposed implementation schedule, costs, as well as possible alternative options.
- (iii) The establishment of environmental and social baseline conditions currently prevailing in the proposed project area.
- (iv) An outline of the policy, legal and institutional framework governing the water sector and other regulations directly or indirectly affected by the activities to be carried out during the entire project cycle of the proposed electric fence.
- Establishment of the details of significant environmental and social impacts associated with the design, construction, operation and decommissioning of the proposed electric fence.
- (vi) An evaluation of mitigation measures for each social and environmental impact identified in all the phases of the project cycle including preconstruction, construction, operation and decommissioning phases.
- (vii) Development of environmental and social management and monitoring plans for all project phases giving actions, responsibilities, cost estimates, timeframes and relevant monitorable indicators.
- (viii) An assessment of any alternatives to the proposed fencing activities including the no-action alternative in order to select with reason, the most appropriate option that is environmentally, socially and economically sustainable and feasible.
  - (ix) A review and evaluation of the potential environmental and social impacts as well as their mitigation measures with respect to the established environmental and social standards in order to determine whether the project is acceptable and in compliance with applicable norms.
  - (x) Stakeholder consultation. The consultation process gave stakeholders an opportunity to engage with the project adequately in each phase. It gave them an opportunity to learn about the Project, raise concerns, understand the potential effects, and comment on the Project as well as on the report. The firm of experts undertook the public stakeholder consultation (PSC) for the proposed project in accordance with the requirements for an EIA Study stipulated in the EMCA, 1999 and EIA/EA Regulations 2003.

#### 1.4 The ESIA Process



In Kenya, the Environmental Management and Coordination Act (EMCA) of 1999 (and the 2015 amendments) and the Environmental (Impact Assessment and Audit) Regulations of June 2003 (and the 2016 amendments) define the legal basis for and the requirements of environmental impact assessment and management.

Although the proposed project is not listed under the second schedule of the Environmental Management and Coordination Act (1999) that should undergo a full Study ESIA, a consultation with the NEMA Narok County Office recommended preparation of a Comprehensive Project Report or EIA Study Report because of the land ownerships issues and the debate surrounding the reclamation activity that had taken place at the project site.

EMCA (1999) defines environmental impact assessment as a systematic examination conducted to determine whether or not a programme, activity or project will have any adverse impacts on the environment. The EMCA (1999 and the 2015 amendments) and Environmental Regulations (2003 and the 2016 amendments) define different requirement for environmental impact assessment based on the sector, nature of the project and its likely environmental impacts. Specifically, a project proponent may be required to implement only an Environment Project Report (EPR) study or both an Environment Project Report (EPR) study and a detailed ESIA, the former being a precursor to the latter.

Where a detailed ESIA is deemed necessary, it is intended to establish and describe the baseline environmental and socio-economic conditions within the project areas, identify and analyse potential significant impacts associated with the proposed project, develop effective mitigation and management measures for the analysed risks and impacts, and submit an ESIA Study Report with this information to NEMA for review.

After the ESIA Study Report is submitted to NEMA, copies are sent to the relevant Lead Agencies for review. A Technical Committee then sits to review the report and either issues an Environmental Impact Assessment License, declines to issue the license with reasons, or requests for more information or wider consultation.

### 1.5 ESIA Study Methodology

The ESIA applied both qualitative and quantitative research methods to collect relevant data and information. A participatory approach that recognizes the importance of all stakeholders, and seeks to incorporate opinions and suggestions of all, especially the intended beneficiaries was adopted. The methodology comprised literature review, field visits and data collection from the project area, data analysis and report writing. The main tools applied included:

**Task 1**: Desk review of available literature which included:

• Bill of Quantities for the proposed project;



- Terms of Reference for Consulting Services for ESIA;
- Narok County Integrated Development Plan (CIDP) (2018 20122); and
- Relevant legal Framework and Policies both national and international
- Taskforce Reports
- Biodiversity Assessment Reports
- ESIA Reports of Similar projects

Task 2: Stakeholder and Community consultations:

Stakeholder and Community consultation meetings were held in Nkareta, Nkoben, Olo-Shapani, Sogoo and Sagamien Wards. One stakeholder consultation workshop was convened for key informants drawn from the public sector and civil society including human rights groups.

**Task 3**: Identification of relevant government institutions and their responsibility in ensuring that the project is implemented within the current institutional framework including review of relevant legal and policy issues relevant to the Environmental and Social Safeguard Requirement by Government of Kenya.

**Task 4**: The task involved identification, collection and analysis of environmental baseline data, identification of impacts; analyses and evaluation of impacts; formulation of mitigation measures for significant negative impacts; development and analysis of project alternatives, and development of environmental/social management and monitoring plans.

#### 1.6 Study Team

Name	Position
Isaiah Kegora	Team Leader (NEMA Lead EIA/EA Expert)
Loise Kioko	Associate EIA/EA Expert
Lavina Omondi	Associate EIA/EA Expert
Eng. Samuel Wahome	Electrical Engineer
Eunice Opondo	Social Expert
Dickens Odeny	Flora Expert
Alfred Owino	Fauna Expert
Joseph Muthike	Land Surveyor/GIS Expert

The ESIA Study was conducted by the following Experts:



### 1.7 Structure of This Report

### The structure of this report is as follows:

#### Table 1-1: Report Structure

Chapter	Contents
Chapter 1 – Introduction	Presents a brief background to the proposed Project, Project rationale, the ESIA process and the purpose and structure of the report.
Chapter 2 - Project Description	Provides a brief overview of the proposed Project components and discusses the Project alternatives that have been considered thus far in the ESIA process.
Chapter 3 – Legal, Policy and Administrative Framework	Describes the legislative, policy and administrative requirements, as well as international best practice applicable to the proposed Project.
Chapter 4 -Baseline Information on Environmental and Social Conditions	Provides a brief overview of the physical, biological and socio- economic characteristics of the Project Area.
Chapter 5 -Consultations and Public Participation	Summarises the consultation process during the ESIA and provides the Stakeholder Engagement Plan for implementation during the life of the proposed Project.
Chapter 6 - Impact Assessment and Mitigation	Identified, describes and analyses the potential environmental and social impacts that have been identified during the study, and proposes mitigation measures to minimise the significances of the negative impacts.
Chapter 7 – Environmental and Social Management and Monitoring Plan	Outlines the programme established to manage identified impacts, and to monitor the implementation of the key environmental and social issues in relation to the full range of environmental and social management requirements that apply to the Project.
Chapter 8 – Conclusion and Recommendations	Summarises the key findings of the study and the overall expert opinion of the ESIA study team.



### 2 : PROJECT DESCRIPTION

#### 2.1 Introduction

The Kenya Water Towers Agency (KWTA) is proposing to fence the Maasai Mau Forest as part of the efforts to restore and rehabilitate the encroached sections of the forest. The electric fence will be put to secure the areas which were recently reclaimed.

This chapter provides the description of the project in terms of: location, components, schedule of works, workforce, estimated cost, activities to be undertaken during construction, operation and maintenance and decommissioning phases as well as project alternatives.

### 2.2 Project Location

The proposed electric fence project is planned to be constructed on the western side of Maasai Mau Forest. Maasai Mau Forest is part of the Mau Forest Complex which is situated in the southern part of forest complex. The forest block lies within Narok County, and is situated 21 Km to the northern part of Narok Town. The northern part of Maasai Mau is bordered by Ol Pusimoru Forest Reserve and Transmara Forest Reserve lies to the north west of the project forest area. The bounding extent of Maasai Mau lies, to the North 0.6622°S, South 0.9186°S, East 35.8978°E and to the West it lies on 35.6038°E. The proposed electric fence lies to the South 0.9076°S, North 0.7367°S East 35.7470°E and to the West it lies on 35.6038°E.



**Figure 2-1: Site Location map for the project** 

### 2.3 Project Components

The Proponent proposes to construct an electric fence around the Maasai Mau Forest. The following sections provide detail description of the fence:

### 2.3.1 Design

The fence shall be of Intermediate Design type and shall consist of between five and ten strands. It shall have a combination of live wires and earth wires. The bottom earth wire shall be looped to the upper earth wire and later to a tight lock underground mesh. At 200m interval, the wire shall be attached to a 2m earth peg with a joint clamp. All live wires shall be attached to strain insulators at strainer assemblies and tied by joint clamps and looped across king post to the next wire tied in the same way. Galvanized staples shall be used to attach earth wires and insulators to the posts. All wires shall be strained to a tension of 180kg. Standard galvanized joint clamps shall be used to join the wire along the main fence line and at corners where looping shall be necessary. All joints shall be tight and of figure 8 or reef knot joint.

The general layouts and sample photographs of the proposed electric fence are illustrated by Figure 2-1 and Plate 2-1 respectively.





# Figure 2-1: General Layout of Intermediate Electric Fence Design

Source: KWTA/KWS

drg. 04





Plate 2-1: A view of section of Intermediate Electric Fence 5 No. strand fence at Arabuko Sokoke Source: KWTA/KWS

### 2.3.2 Construction Materials

The fence will be constructed using the following materials and parts:

1) Posts

The posts shall be pressure impregnated *eucalyptus saligna* and shall have a smooth and cylindrical surface free of knots and cracks. There will be of two types; line and strainer posts. The former shall have a minimum diameter of 150mm and height of 3050mm. They will be spaced at 10m on level ground (slope <5%). The spacing will be reduced to 2000mm on sloppy and undulating terrain (slope of >5%). The posts shall be set in holes 450mm wide by 950mm in depth in such a manner that 2100mm will be above the ground. The posts shall be embedded all round in 1.3.6 concrete with a cover of 150mm.

The former shall be used where there is change in the fence alignment both horizontal and vertical change (corner or depression) and at every 200m on a straight line.

The strainer assembly consists of the King posts, 2No. Strainer posts and two struts. They shall all be 150 – 175mm diameter 3150mm in height. The strainer posts shall be connected to the King posts by a 2000mm long 150mm diameter strut (side arms) Fastening shall be by means of ordinary galvanized wire nails 125mm long. 4.0mm heavily galvanized soft wire shall be tide in 4 rounds diagonally from the supporter posts to the bottom of the King posts and twined to form a stay wire and held in place by use of 50mm heavily galvanized staple nails nailed to hold in place. The posts shall all be embedded all round in 1.3.6 concrete in a predug holes measuring 525mm diameter and 1050mm in depth. They shall be set in such a way that 2100mm is above ground level. A minimum of 4days will be allowed for the curing of the concrete during which period no external forces shall be exerted on the posts.

2) Plain Wires



Plain wires will be used as live and earth wires. Both wires shall be High Tensile Steel wire 2.5mm diameter heavily galvanized to a zinc coating of not less than 280gm/m2 and of steel class BS 1044 or BS 1065 and tensile strength of between 1200 and 1400N. The wire shall be strained on each end on porcelain strain insulator and run through W-plastic insulators nailed to posts by use of deep sunk heavily galvanized 2" U-nails.

3) Nails.

U shaped staples (U nails) shall be used in the fence. The nails shall be heavily galvanized, long shank, 2 inch, hot dipped and of 4mm wire gauge.

4) Insulators-

Line, strain end and corner insulators will be utilized. The line insulators shall be Winsulators made of UV protected polythene material. They have open face for good drainage, holes for anchoring staples and strong jaws to withstand large horizontal and vertical movements.

The Strain end insulators shall be 38mm in size and of bull nose type. They shall be made of porcelain material, fire resistant and long tracking distance. They will also be high quality white glaze finish.

The Corner insulators will be 41 mm in diameter, reel round, made of porcelain material, fire resistant and high quality glaze finish as well.

5) Energizers

Solar powered and main energizers will be used in the fence. The former shall have the following features:

- i) fully modular
- ii) 16 joules stored energy
- iii) In built lightening protection
- iv) A select switch for at least 3 different voltage power settings (HML)
- v) Input voltage of 12volts
- vi) Output --Short pulse > 9 KV (Off load)
- vii) 7 KV (500 Ohms load)
- viii) Self-contained charging facilities.
- ix) Battery consumption 1.2Amps to 0.3Amps
- x) LED light indicator to show when the energizer is OK and flashes Red on Low Battery voltage.

While the later shall also have the following features as well:



- i) fully modular
- ii) At least 50 joules stored energy
- iii) In built lightening protection
- iv) Remote ON/OFF operation capability.
- v) A status LED.
- vi) Capable of integration with
  - Alarm system
  - Remote and fault finder
  - SMS Energizer controller
  - Fence monitor.
- 6) Lightning diverter/arrestor -

The lightning diverters will be used where energizes are installed. They will be: 90x100x60mm in size, complete with spiral wire earthing system connection, adjustable to suit any module and shall be able to divert multiple lightning strikes to the ground(earth).

7) Earth Peg

The earth peg will be 2mx20mm in diameter and of GI pipe class C. They will be heavily galvanized and not less than 500gm/Square meters. They will also have a heavily galvanized Joint clamp 200mm below the upper tip.

8) Others

In addition to the materials/parts described above, the following will also be used in the fence: solar panels, solar batteries, charge controller/regulator; Hatari/Warning/Danger Signs; spring gates; joint clamp; barbed wire; cut- off switch; multi units; digital voltmeters and under gate cables.

### 2.3.3 *Construction Phase*

The construction phase is expected to take at least 12 months and a defect liability period (DLP) of 6 months. The construction works will include:

- Clearing of site 3m on either side along the alignment
- Pegging
- Excavation of holes to receive treated posts
- Construction of assemblies: single, double and corners
- Backfilling and ramming of posts
- Tying of strainers, porcelain insulators and reel fasteners
- Fixing of W Insulators
- Straining of wires: HTS, soft wires



- Excavation of trenches to receive portion of tight lock mesh
- Straining of 2.5mm dia. tight lock mesh
- Backfilling of portion of tight lock mesh
- Fabrication and fixing of steel gates
- Construction of uni- huts
- Installation of solar panel and Energizers
- Installation of Security Management System
- Powering
- Earthworks, gravelling, compaction, Light grading of 5m wide service road, gravel patching where necessary on both sides of the fence alignment, shaping and including cutting of mitre drains where necessary
- Testing & Commissioning

### 2.3.3.1 Workforce

The number of employees to be hired during construction phase is not known at this stage of the project. However, the contractor will have the discretion of determining the staff required.

During construction, it is likely that workforce will be sourced country wide for skilled labour while the un-skilled and semi-skilled labour will be from the local area and the county.

The contractor will be required to develop and implement labour management plan in line with the national labour laws and county human resource policies. It will ensure the project maximizes local recruitment.

### 2.3.3.2 Estimated Project Cost

The first phase of implementation of the proposed Electric Fence is envisaged to cost approximately **Eighty Million Kenya Shillings**.

### 2.3.4 Operation and Maintenance Phase

The contractor shall be responsible for the immediate maintenance of the fence to the required Performance standards during the period of construction. The Start Date for maintenance (PBC) shall be immediately after declaration of practical completion of all Works and shall run concurrently with DLP. The PBC shall run for Twenty-Four (24) Calendar Months upon issuance of Order to Commence.

The contractor will monitor the fence to ensure it remains live and serve the intended purpose. This involves testing live ground wire system and ground return wire system using Volt Meter devices. In the former, the voltage between the wire connecting through the ground rods to the Energizer ground terminal and an independent ground rod will be measured. While in the later, the voltage between the hot wire and the ground wire across the load tester installed will be measured.



The maintenance activities during operation phase will include; clearing of the vegetation along the fence alignment, servicing of equipment such as the energizers and repair of any malfunctioned or broken structures.

Considerations should be made to involve the local community in the maintenance of the fence. However, the community should be equipped with skills and tools to undertake the maintenance.

### 2.3.5 *Decommissioning Phase*

The fence is anticipated to operate to an indefinite period and then decommissioned. Decommissioning phase of the project will involve removal of the fence and rehabilitation the site to acceptable standards.

### 2.4 **Project Alternatives**

### 2.4.1.1 The 'No Project' Alternative

This option maintains the status quo where the MMF continues to be encroached and destroyed by anthropogenic activities including illegal logging, wild life poaching as well as demand for agricultural land. It is estimated that if this option is pursued approximately 17,000 hectares of forest cover will be lost which is equivalent to 37% of Mau Forest Complex which will consequently have catastrophic consequences to the ecosystem and communities. Under this option, any social and economic development benefits from the project would be foregone and neither would there be the associated impacts on the environment.

### 2.4.1.2 With Project Option

Chapter Six (6) of this report presents potential impacts of the proposed Electric Fencing. The project is anticipated to generate both positive and adverse impacts. The significances of the adverse impacts range between moderate to low levels in the absence of mitigation and expected to reduce further with the implementation of the mitigation measures.

Contrary to the No Project alternative, the proposed project is anticipated to address the issue of encroachment to MMF and generate environmental, social and economic benefits. The proposed fence will contribute to the long-term conservation of MMF by protecting against agricultural encroachment and illegal activities. The fence could also reduce human-wildlife conflict and improve productivity and food security among the locals neighboring the forest.

### 2.4.1.3 Alternatives to Project Site

The Proponent considers Maasai Mau Forest as an ideal site for this project given the fact that rehabilitation activities have already begun on areas reclaimed from illegal settlers. The Maasai Mau Forest block is the most vulnerable of the Mau Forest Complex whose ability to provide ecosystem goods and services is under threat.



### 2.4.1.4 Alternative to the Design

Prior to settling on the proposed project; the Proponent also considered three other types of Electric Fences which have been used elsewhere in Kenya by KWS to control wildlife. These options are: comprehensive fence type 1, comprehensive fence type 2 and butterfly fence. The three options are similar to the proposed design in terms of the materials used. However, the spacing between the poles and the number of strands differ. Additionally, they are costlier and have limitation of preventing the public from illegal access into protected boundaries which is the primary objective of installing an electric fence at MMF. Table 2-1 below present a brief description of the proposed design viz-a-vis the other three alternative designs:


#### Table 2-1: Summary Description of types of Electric Fence Design

Design Option	Description	Use	Estimated Cost Per Kilometre
Comprehensive Fence Type 1	<ul> <li>Treated timber gum poles (<i>eucalyptus saligna</i>) spaced at 10m centres</li> <li>8 No. strands of wires and a mesh/tightlock installed below the electric strands</li> <li>600mm of mesh is laid below the ground at an angle of 30<sup>o</sup> with the tip of the mesh at least 300mm below general ground level.</li> <li>900mm wire mesh above ground level, is strained at the strainer assemblies and stapled on the wooden posts</li> </ul>	Designed to control all animals except those smaller than the size of the mesh used on the lower section and underground	Between Ksh. 2.5 – 3.0 million depending on the terrain and the general soil conditions
Comprehensive Fence Type 2	<ul> <li>timber gum poles (<i>eucalyptus saligna</i>) spaced at 5m centres;</li> <li>8 No, strands of wire and full height mesh/tightlock installed on one side of the wooden post</li> <li>500mm of mesh laid straight below the ground.</li> <li>2000mm of mesh above ground level is strained at the strainer assemblies and stapled on one side of the wooden posts.</li> </ul>	Design to control all animals except those that are smaller than the size of the mesh used on the lower section and underground.	Between Ksh. 6.0 – 8.0million depending on the terrain and the general soil conditions.
Intermediate Fence (Preferred Option).	<ul> <li>treated timber gum poles (<i>eucalyptus saligna</i>) spaced at 10m centres</li> <li>5 to 10 No. strands</li> </ul>	Designed to control big game, antelopes, carnivals, but falls short of controlling the crawling and burrowing animals	between Ksh. 1.7 – 2.0million depending on the terrain and the general soil conditions





A BU, TUN	Decemb	er, 2019
Butterfly Fence	• treated timber gum poles ( <i>eucalyptus saligna</i> ) spaced at 10m	• Designed to control between Ksh. 2.0 – 2.4million
buttering relice	centres, 900mm overall height	elephants except with the depending on the terrain and
	• 3 – 4 No. strands,	limitation of lions jumping the general soil conditions
	• 1500mm long protruding outrickers/butterfly at spacing of	over because of the short
	900mm on either side of the fence	height.
		• It also prevent the public
		from short-circuiting the
		fence because of the close
		outrickers





The typical layouts and sample photographs of the three design options are illustrated by the figures and plates presented below. The layout and the sample photographs of the preferred option is already presented in section 2.2.2.1.



#### Figure 2-3: General Layout of Comprehensive Fence Type 2

Source: KWTA/KWS



Plate 2-2: A Section of Comprehensive Type 2 Electric Fence installed on Nairobi National Park ICD Road A

Source: KWTA/KWS







#### Figure 2-4: General Layout of Comprehensive Fence Type 1

Source: KWTA/KWS



(a) (b) Plate 2-3: Sections of Comprehensive Type 1 Electric Fence installed by KWS in Mt Kenya (a) and Rumuruti (b)

Source: KWTA/KWS





#### Figure 2-2: Layout of Butterfly Electric Fence

Source: KWTA/KWS



Plate 2-4: A view of sections of the Lukore butterfly Fence Source: KWTA/KWS

#### 2.4.1.5 Alternatives to Project model

This alternative looks into the fencing model and the proposed electric fencing model. The proposed model considered is erection of electric fence to secure the forest from illegal forest activities. This will involve erecting a fence which could enable protection of the indigenous forest and ensure it continues to provide ecosystem goods and services. From literature, electric fences have been found to be efficient in minimising human-wildlife conflict.



However, FAO 1998 posits that Electric Fence create "hard edges" between dissimilar forms of land use, thus causing long-term inflexibility that limits integrated planning and forecloses alternative management options. They also require intensive maintenance and can be ineffective if power is lost.

The alternatives to electric fence would be to adopt the following physical barrier systems presented below.

# a) Game Moats

Game moats are deep and wide trenches used to confine wild animals in conservation areas. In Kenya, they were widely constructed during colonial period, particularly in Laikipia District, at Maralal, and in Mt. Kenya, Meru, Tsavo, and Aberdare National Parks. They were constructed mainly to prevent wild animals particularly elephants from moving into farm lands.

The merits of Game Moats are: they do not require special tools to construct and maintain; and utilise unskilled labour in construction and thereby help build stakeholder ownership (FAO, 1998). These merits are, however, outweighed by the following demerits highlighted by Butynski and Jong (2016) in their Feasibility Study on Game-proof Barrier for the nearby South Western Mau Forest. They noted that Game Moat are:

- a) Greatly affected by terrain and soil moisture,
- b) Incapable of controlling the movement of people and livestock into protected areas;
- c) Create artificial stagnant bodies of water that may become health hazards; and
- d) Require extensive maintenance by large numbers of labourers, both because of erosion and resultant slippage of soil, and because elephants learn to cave in the sides to negotiate the moat.

Based on the above demerits especially item no. 3 which is a huge disadvantage of Game Moat, this option is not recommended as it will not will not achieve the objective of preventing human encroachment of MMF. In addition, Moat cause more damage to the vegetation than do electric fence. For moats, it is preferred that the vegetation be cleared over an 18 m wide swath, while for an electric fence the preferred width is 7-10 m. Thus, the damage to the vegetation is only about half as great when constructing an electric fence as when building a moat (Butynski and Jong, 2016).

# b) Vegetative or live barriers,

They comprise of one or more species of plants used as fence or barrier. A good example of vegetative barrier is the Nyayo Tea Zone planted along the western and southeast edges of the South West Mau Forest Reserve. According to Omoluabi & Coompson, (2002) Nyayo Tea Zones were established in Kenya with the hope of discouraging theft and agricultural encroachment into Forest Reserves as well as prevent wild animals from leaving Forest Reserves.



Vegetaive barriers are, however, generally not effective against elephants and primates, and are probably never effective against people. Nyayo Tea Zones have been criticized for the destruction of large areas of montane forest and for not achieving all of the positive conservation impacts expected ((Butynski and Jong, 2016). They have also been found to attract additional people to the edge of the Forest Reserve. According to Butynski and Jong, (2016) the Majority of these people are poor and landless and are likely to rely on the natural forests for fuel wood and poles.

## *c) Other physical barriers*

The other physical barriers that have been utilised in protection of conservation areas and especially prevention of human-wildlife conflicts include: stone wall; stock fences, non-electric fences; high tensile steel fences. However, none of them has proven to be effective barriers against wild animals such as elephants or humans. The non-electric fences and high tensile steel fences have present the same maintenance obligations as electric fences, but have added disadvantages of being costlier, and acting as a lethal trap to animals that get entangled (Butynski and Jong, 2016).

## 2.4.1.6 Alternatives in Project Materials

The Proponent considered currently available materials for the construction of the fence. The options available are: wood post (Eucalyptus and cedar posts), steel post, fibreglass post and posts made from recycled plastic. Each of these posts have advantages and disadvantages as presented below:

- Wood post- they are readily available, reliable and strong. Eucalyptus posts are very dense wood that resist decay and there are also claims that they have good electrical insulating value but there is no research to support this claim. The downside of wood posts is their purchase and installation costs.
- Steel post Although they will definitely work, they have some major disadvantages. They aren't cheap to install because all of the wires need to be insulated. Steel is an excellent conductor and shorting out is real problem.
- ✓ Fibreglass post these is one of the most popular types of posts used for line posts in high-tensile electric fences. Their advantage is that they are self-insulating and can save on insulation costs. However, their disadvantages are cost, availability and splintering with age. On cost, they can cost more than a 3-4-inch top wood post and definitely more than a steel t-post. As far as availability goes, not all fence suppliers handle the same kind of posts, and even those that do always continue to market them. The splintering is caused by the fiberglass's susceptibility to UV light. Over time fiberglass posts can breakdown and loss some of their strength. They can also start to splinter, which makes them tough





to work with, and the breakdown in the fibers can cause them to carry small amount of electricity, reducing their insulating value<sup>1</sup>.

## 2.4.1.7 Alternatives in Project Implementation

This project's implementation could be realized through several options. One option is to do it in phases and observe the positive and negative impacts as they emerge. The second option is to have it all done at once over the planned construction period – an economically viable option. However, for the current project setting, KWTA will establish the various structures in phases based on available funding from the donors.

## Conclusion

From the analysis of the alternatives presented above, the proposed electric fencing represents a viable option of securing MMF from human encroachment in spite of the limitations presented earlier. The environmental impacts associated with the fence are low in comparisons to options such as the Game Moat.

And with regards to the 'No-go option' it is our considered opinion that it does not compete with the benefits of proceeding with the project.

Table 2-1 below presents summary of analysis of effectiveness, impacts and cost of the respective alternative methods of securing the forest:

Alternative Methods	Effectiveness in Preventing Human Encroachment	Potential Environmental Impacts	Cost of Implementation
Electric Fence (Comprehensive Fence Type 2)	High	Low	High
Electric Fence Type 1	Low	Low	High
Intermediate Electric Fence (Preferred Option)	High	Low	High (However, it has the lowest cost in comparison to the other electric fences)
Butterfly Electric Fence	Low	Low	High

ESIA Study for the Proposed Electric Fencing of Maasai Mau Forest

<sup>&</sup>lt;sup>1</sup> <u>http://www.milkproduction.com/Library/Scientific-articles/Nutrition/Fencing-systems-Line/</u>



Game Moat	Low	High	High
Vegetation Barrier	Low	High	Medium
Stone Wall	Low	Low	Medium
Steel Fence	Medium	Medium	High



# 3 : LEGAL, POLICY AND ADMINISTRATIVE FRAMEWORK

## Overview

Kenya has a policy, legal and administrative framework for environmental management. Under the framework, NEMA is responsible for ensuring that EIAs are carried out for new projects and environmental audits on existing facilities as per EMCA, 1999.

ESIA acts as a tool for ensuring new projects incorporate appropriate measures to mitigate the adverse impacts to the environment and peoples' livelihood while still targeting the optimal operation of the proposed project. this ESIA study was carried to identify potential positive and negative impacts associated with the proposed project with a view to taking advantage of the positive impacts and developing mitigation measures for the negative ones. The guidelines on EIAs are contained in Sections 58 to 67 of the Act.

This chapter is a description of the various national policies, legal provisions and international ESIA provisions that have a direct bearing on the implementation and operation of the proposed project.

## 3.1 POLICY PROVISIONS

#### 3.1.1 Vision 2030

Vision 2030 is Kenya's long -term development blueprint which aims to create a globally competitive and prosperous country providing a high quality of life for all its citizens. It is built of three pillars of economic, social and political which are anchored on the foundations of macroeconomic stability; infrastructural development; Science, Technology and Innovation (STI); Land Reforms; Human Resources Development; Security and Public Sector Reforms. The Economic Pillar aims to achieve an average economic growth rate of 10 per cent per annum and sustaining the same until 2030. Under the Social Pillar, it aims at ensuring a just and cohesive society enjoying equitable social development in a clean and secure environment while the Political Pillar aims to realize an issue-based, people-centered, result-oriented and accountable democratic system.

This project will contribute towards achieving the social goal by conservation of the forest and harnessing all the ecosystem services for an improved social welfare.

## 3.1.2 Session Paper No.10 of 2014 on the National Environment Policy, 2014

This Session Paper recognizes that the survival and socio-economic wellbeing of Kenyans is ultimately intertwined with the environment. It therefore aims at ensuring better quality of life for present and future generations through sustainable management and use of the environment and natural resources.

Specifically, policy statement number 4 of section 4.1.1 (Forest Ecosystems) calls for conservation of forest ecosystems and their associated resources for sustainable poverty



reduction and sustainable development. The Forest ecosystems are important in conservation of soil, water and biodiversity as well as in moderation of climate. They are the richest terrestrial habitats for biodiversity. Maintaining forest biodiversity safeguards the economic potential of future opportunities for new non-timber products such as food and medicine as well as social sustainability by offering aesthetic, spiritual and recreational settings for people.

The main aim of the project is to conserve the otherwise degraded forest and ultimately increase forest cover.

# 3.2 RELEVANT NATIONAL LEGAL FRAMEWORK

#### 3.2.1 Constitution of Kenya, 2010

The 2010 constitution of Lenya acts as a benchmark for legislations and regulatory frameworks in Kenya by acting as a regulator and supervisor of development measures and project controls. It demands proper management of the environment as a national heritage and benefits to the future generations.

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;

- Equitable access to land
- Security of land rights
- Sustainable and productive management of land resources
- Transparent and cost effective administration of land
- Sound conservation and protection of ecologically sensitive areas

Article 69 on the obligations in respect to environment states in section (1) that the state shall:

- Ensure sustainable exploitation, utilization, management, and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
- Work to achieve and maintain a tree cover of at least ten % of the land area of Kenya;
- Protect and enhance intellectual property in, an indigenous knowledge of, biodiversity and the genetic resources of the communities;
- Encourage public participation in the management, protection, and conservation of the environment;
- Protect genetic resources and biological diversity;
- Establish systems of environmental impact assessment, environmental audit, and monitoring of the environment;



• Eliminate process and activities that are likely to endanger the environment.

Further, Article 70 states that if a person alleges that a right to a clean and healthy environment recognized and protected under Article 42 has been, is being or is likely to be, denied, violated, infringed or threatened, the person may apply to a court for redress. The sub-project should ensure compliance with the constitution in so far as equitable sharing of the resources, between the stakeholders. Further, the project should ensure the sustainability of livelihoods and biological resources within the project areas are protected. Any development proposals should also be cognizant of the increased powers under the Constitution given to communities and individuals to enforce their rights through legal redress

Relevance of the Constitution to the Project;

In drawing close reference to the Constitution, the project proponent must develop checks and balances against the stipulation of the above articles.

- The Project Proponent has a right to carry out the project but within the Kenya's legal structures
- While carrying out the project, the proponent should ensure that the right to a clean and healthy environment for all is upheld in all during the project schedule.
- The project proponent must ensure that the development is carried out in an ecologically, economically and socially sustainable manner.
- The project proponent is entitled to a fair administrative decision making process from NEMA and other state organs
- The project proponent will ensure that there is minimal disturbance of the existing environment
- The project proponent must ensure that all the applicable provisions of the constitutions are adhered to.

# 3.2.2 Environmental Management and Coordination Act, 1999 (and the amendments of 2015)

This Act provides the establishment of an appropriate and effective legal and institutional framework for the management of all environmental matters and concerns in Kenya. With the aim of establishing a desirable environmental legislation to coordinate and spearhead protection, conservation, management, and sustainable utilization of environmental resources in the country, the Act comes into forces with a series of regulations that govern different environmental aspects. The Act also established National Environment Management Authority as the lead government agency and environmental watchdog in the country.

Part VI of the Act describes the procedures and importance of EIA. Section 58 on Application for an EIA license stipulates that;

Notwithstanding any approval permit or license granted under this Act or any other law in force in Kenya, any person, being a proponent of a project, shall before for any financing,





commencing, proceeding with, carrying out, executing or conducting or causing to be financed, commenced, proceeded with, carried out, executed or conducted by another person any undertaking specified in the Second Schedule to this Act, submit a project report to the Authority, in the prescribed form, giving the prescribed information and which shall be accompanied by the prescribed fee; that the intended project may or is likely to have or will have a significant impact on the environment, so directs;

- The proponent of a project shall undertake or cause to be undertaken at his own expense an environmental impact assessment study and prepare a report thereof where the Authority, being satisfied, after studying the project report submitted under subsection
- The environmental impact assessment study report prepare under this subsection shall be submitted to the Authority in the prescribed form, giving the prescribed information and shall be accompanied by the prescribed fee;
- The Minister may, on the advice of the Authority given after consultation with the relevant lead agencies, amend the Second Schedule to this Act by notice in the Gazette;
- Environmental impact assessment studies and reports required under this Act shall be conducted or prepared respectively by individual experts or a firm of experts authorized in that behalf by the Authority.
- Environmental impact assessment shall be conducted in accordance with the environmental impact assessment regulations, guidelines and procedures issued under this Act;
- The Director-General shall respond to the applications for environmental impact assessment license within three months; and
- Any person who upon submitting his application does not receive any communication from the Director-General within the period stipulated under subsection (8) may start his undertaking.

# **Relevance to the Project**

- The proponent will seek to acquire an EIA license prior to any development.
- The operations of the project are similarly licensed since the EIA report contains an Environmental Management Plan, which forms the basis for approval of the project, by NEMA and imposition of conditions to safeguard the environment
- Due to its public participatory nature, the EIA process builds neighborhood support and sustainability into the project
- The proponent is expected to prepare and submit an environmental audit report in the first year of occupancy to confirm the efficacy and adequacy of the environmental management plan as set out in the EIA report to be submitted.

# 3.2.3 Environmental Impact Assessment and Audit regulations, 2003 and the 2016 amendments



In Kenya the requirement for development and existing projects to undergo EIA and Environmental Audits (EA) respectively follows on the enactment by the Kenya Parliament of the Environmental Management and Coordination Act No. 8 of 1999 and Section 3 of the Environment (Impact and Assessment) Regulation No. 101 of 2003. Under this legal provision major development projects are required to go through the EIA process whose report later submitted to NEMA for approval and awarding of an EIA license after demonstrating that the possible negative impacts of a project will be effectively mitigated.

Legal Notice No. 101 stipulates the ways in which environmental experts should conduct the EIA and Audits in conformity to the requirement stated. These regulation provides mechanisms for public participation, licensing procedures, inspections and any possible offences and penalties during EIA process as stipulated in the Act.

## Relevance to the proposed project

In line with the requirements of these regulations, this ESIA Report has been prepared for review and approval by NEMA before the proposed project activities are undertaken. Once approved by NEMA, the Project Developer will be required to implement the recommendations and mitigation measures presented in this ESIA Study Report as well as recommendations made by NEMA.

# 3.2.4 EMCA (Conservation of Biological Diversity and Resources, Access to Genetic Resource and Benefits Sharing) Regulation, 2006

This regulation aims at enhancing the preservation of biodiversity as well as safeguarding the endangered and rare species of plants and animals existing within a project area. Part II on conservation of biological diversity stipulates the prohibitions on the extraction and use of biological resources. Section 4 (1) states that a person shall not engage in any activity that may:

- Have an adverse impact on any ecosystem;
- Lead to introduction of any exotic species; and
- Lead to unsustainable use of natural resources.

According to World Intellectual Property Organization (WIPO), documentation on the regulation states that such activities can only be carried out upon presentation of a comprehensive EIA reports and licensing by NEMA. The regulations also empower lead agencies in the conservation and natural resource management to keep and update an inventory on the endangered species in the country.

Relevance to the Project

• Safeguarding the ecosystem resources during the project implementation phase ensures project proponent compliance with these regulations. Contrary to such compliance, proponent risks prosecutions upon accusation of such acts of introductions.



# 3.2.5 EMCA (Waste Management) Regulations 2006

The regulations are formed under sections 92 and 147 of the Environmental Management and Coordination Act, 1999 and are aimed at developing proper and sustainable structures for handling, transporting, and disposal of waste in a manner that ensure adequate protection of human health and environment. Despite the fact that waste management systems in the country seems unpopular and disregarded due to haphazard disposal and lack of sanitary landfills, the regulations provide precedence to waste minimization, cleaner production mechanism, and proper segregation of waste at the points of production. This regulation empowers NEMA to license transporters of waste, incinerators, sanitary landfill developers, composers, recyclers and waste transfers stations.

## Relevance to the Project

The Project, during both construction and operational phases, will generate wastes which will need to be managed in accordance with these regulations. Waste minimization will be given due priority, especially during construction. Wastes generated during both phases will need to be managed prudently by reusing or recycling where possible, and safe disposal to licensed waste management facilities in cases where wastes are to be disposed of.

## 3.2.6 Noise and Excessive Vibration Regulations

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

Time of the day;

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

Relevance to the Project

• The contractor / sub-contractor for civil works will be required to ensure compliance with the above regulations in order to promote a healthy and safe working environment throughout the construction phase due to the sensitivity of the Project Area which is highly populated. This shall include regular inspection and maintenance of equipment and prohibition of unnecessary hooting of vehicles, provision of Personal Protective Equipment to the workers working in a noisy environment.



• Ensure that the noise levels as a result of the construction process does not exceed NEMA's permissible limits prescribed below:

Table 3-1: Maximum permissible noise levels for construction sites (measurement taken within the facility)

Facility		Maximum Noise level permitted		
		(leq) in dB (A)		
		Day	(6.01am-	Night (6.01 pm-
		6.00pi	m)	6.00am)
(i)	Health facilities, educational institutions, homes	60		35
	for disabled and residential areas			
(ii)	Residential	60		35
(iii)	Areas other than those prescribed in (i) and (ii)	75		65

#### 3.2.7 The Wildlife Coordination and Management Act, 2013

Wildlife Coordination and Management Act was enacted to regulate, conserve, and ensure sustainable management of wildlife resources in Kenya. Passed in 2013, the Act came into force in 2014 with several changes in the manner in which wildlife resources are managed in the country. Section 4 of this Act states that implementation of the Wildlife Management and Co-ordination Act, 2013 shall be guided by the following principles: -

Wildlife conservation and management shall be devolved, wherever possible and appropriate to those owners and managers of land where wildlife occurs;

- Conservation and management of wildlife shall entail effective public participations;
- Wherever possible, the conservation and management of wildlife shall be encouraged using an ecosystem approach;
- Wildlife conservation and management shall be encouraged and recognized as a form of land use on public, community, and private land;
- Benefits of wildlife conservation shall be derived by the land user in order to offset costs and ensure the value and management of wildlife do not decline;
- Wildlife conservation and management shall be exercised in accordance with the principles of sustainable utilization to meet the befits of present and future generations;
- Benefits accruing from wildlife conservation and management shall be enjoyed and equitably shared by the people of Kenya.

Relevance to the Project



- The Wildlife Conservation and Management Act consolidate the previous laws relating to the protection, conservation, and management of wildlife in Kenya.
- This Act is administered by the Government of Kenya through the Ministry for the time being responsible for the matters relating to wildlife in conjunction with other relevant government agencies most importantly, the Kenya Wildlife Service.

## 3.2.8 Occupational Health and Safety Act, 2007

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

The purpose of this Act is to:

- Secure the safety, health and welfare of persons at work;
- Protect persons other than persons at work against safety and health arising out of, or in connection with the activities of persons at work.
- The Occupational Safety and Health Act 2007 (OSHA 2007) Kenya Gazette Supplement No. 111 (Acts No.15) dated October 26, 2007 revokes the Factories and Other Places of Work Cap.514.
- The scope of OSHA 2007 has been expanded to cover all workplaces including offices, schools, academic institutions, factories and plantations. It establishes codes of practices to be approved and issued by the Directorate of Occupational Safety and Health Services (DOSHS) for practical guidance of the various provisions of the Act.

Relevance to the Project

- The proponent will seek to comply with the provision of the Act in ensuring that workers operate in a safe and healthy environment and that their welfare is safeguarded. There is also a need to establish a safety policy in line with the Act.
- The Agency will have the responsibility of ensuring safety of the local communities against contact with the fence. This will include clear signage on the electric lines on the dangers of electrocution in case of close contact with the fence.

## 3.2.9 Employment Act, 2007

This is an Act of parliament that applies to all employees employed by any employer under a contract of service. It requires that employee recruitment, contract and grievance management, disciplinary measures and retrenchment and termination of service should be rational, fair and just.

Employment of children in the following forms is also prohibited in the following sections of the Act:



53. (1) notwithstanding any provision of any written law, no person shall employ a child in any activity which constitutes worst form of child labour.

56. (1) No person shall employ a child who has not attained the age of thirteen years whether gainfully or otherwise in any undertaking.

(2) A child of between thirteen years of age and sixteen years of age may be employed to perform light work which is:

(a) Not likely to be harmful to the child's health or development; and

(b) Not such as to prejudice the child's attendance at school, his participation in vocational orientation or training Programmes approved by Minister or his capacity to benefit from the instructions received.

Relevance

• The contractor will need to follow the requirements of the Act during employment, especially by being just and fair on recruitment, contract management, remuneration, and termination of service, as they are straight forward.

## 3.2.10 Work Injury Benefits Act (WIBA)

It is an act of Parliament to provide for compensation to workmen for injuries suffered in the course of their employment.

It outlines the following:

- Employer's liability for compensation for death or incapacity resulting from accident;
- Compensation in fatal cases;
- Compensation in case of permanent partial incapacity;
- Compensation in case of temporary incapacity;
- Persons entitled to compensation and methods of calculating the earnings;
- No compensation shall be payable under this Act in respect of any incapacity or death resulting from a deliberate self-injury &
- Notice of an accident, causing injury to a workman, of such a nature as would entitle him for compensation shall be given in the prescribed form to the director.

#### Relevance

The construction operations and activities may pose safety and health risks to construction workers. The contractor will need to abide by all the provisions of WIBA when handling injuries reported in the cause of implementation of the proposed project.



## 3.2.11 The Energy Act, 2019

The Energy Act of 2019 deals with all matters relating to all forms of energy including the generation, transmission, distribution, supply and use of electrical energy as well as the legal basis for establishing the systems associated with these purposes.

Relevance to the Project

• The proponent will liaise with the Kenya Power and Lighting Company before installation of electric power to the site to ascertain the requirements required to ensure that the power to the site is adequate and doesn't affect the other users in the area.

#### 3.2.12 The Energy (Solar Photovoltaic Systems) Regulations, 2012

This regulation requires the following;

- All persons designing and installing solar PV shall be licensed by EPRA;
- All manufacturers, vendors, distributors and contractors of solar PV systems shall be licensed by EPRA;
- A vendor or contractor shall be responsible for the design and specifications of complete solar PV systems;
- All manufacture, sale, installation, use and disposal of solar PV systems and components shall be in accordance with the provisions of the Environmental Management Coordination Act, No 8 of 1999 and the Occupational Safety and Health Act, No 15 of 2007; and
- The design, installation, repair, and maintenance of a solar PV system shall be in accordance with the relevant Kenya Standard.

Relevance to the Project

The proponent will adhere to these Regulations. Failure to do so is considered an offence and on conviction, one is liable to excessive penalties including a fine of one million shillings, or to imprisonment for a term of one year, or to both.

## 3.2.13 The Public Health Act (Cap. 242)

The operations and activities of the proposed project can be detrimental to human and environmental health and safety in the absence of appropriate measures. For example, waste, dust, noise and air emission generated from activities and process of the proposed project can directly or indirectly have adverse impacts on human and environment. The Act prohibits the Proponent from engaging in activities that cause environmental nuisance or those that cause danger, discomfort or annoyance to inhabitants or is hazardous to human and environmental health and safety.

#### Relevance to the Project



• The project will help ensure co-existence between wildlife and humans without potential for destruction of property and in some cases as noted in the chapter on baseline death or injuries by wildlife. The project will also pose public health hazard due to the electric wires that could electrocute community members if they come into contact.

## 3.2.14 The Forest Management and Conservation Act, 2016

This Act of Parliament makes provisions for conservation and management of public, community and private forests and areas of forest land that require special protection. It also defines the rights in forests and prescribes rules for the use of forest land.

Part IV on conservation and management of forest define the different classes (Public, Private and Community) of forest as well as the institutions mandated to manage and conserve them. The public forest is vested in the KFS while community and private forests are vested in the community and private owners respectively.

Section 42(1) covers on management of indigenous forest such as the MMF which is the subject of this report. Under this section the Act states that all indigenous forests and woodlands shall be managed on a sustainable basis for the purposes of:

- Conservation of water, soil, and biodiversity;
- Riparian and shoreline protection;
- Cultural use and heritage;
- Recreation and tourism;
- Sustainable production of wood and non-wood productions;
- Carbon sequestration and other environmental services;
- Education and research purposes; and
- Habitat for wildlife in terrestrial forests and fisheries in mangrove forests.

In order to achieve the above conditions, Section 40(2) stipulates that KFS shall in consultation with the forest conservation committee for the area where the indigenous forest is situated, prepare a forest management plan. Section 40(3) indicates that the board may enter into a joint management agreement for the management of any state indigenous forest or part thereof with any person, institution, government agency, or forest association.

Part V on community participation covers on application for community participation in forest management; obligation of forest associations, assignment of forest user rights. The Act puts emphasis on the need to strengthen community-based institutions by creation of Community Forest Associations, which gives the public a greater participatory role to the community in the forest conservation.

Section 67(7) makes it an offence and prescribe penalties for undertaking the following activities, in any forest areas;



- Introduces any exotic genetic material or invasive plants without authority form the service;
- Dumps any solid, liquid, toxic, or other wastes;
- Grows any plant from which narcotic drugs can be extracted; and/or extracts, removes, or causes to be removed, any tree, shrub, or part of thereof for export,

Relevance to the Project

- The project will be undertaken in an indigenous forest that is registered as trust land under the Trust Land Act (Cap 288).
- As an Act geared towards proper management of forest resources, the project proponent and associated contractors must adhere to the Forest Act and it provisions.
- KWTA, the project proponent, must consult all the stakeholders including KFS, KWS, County Government of Narok and local communities on the frameworks for effective management and use of forest resources.

#### 3.2.15 Environment and Land Court Act, 2011

This Act came into place as constitutional requirement for a legal framework for addressing environmental disputes. Section 3(1) of the Act states that the principle objective of this legislation is to enable the Court facilitate the just, expeditious, proportionate, and accessible resolution of disputes governed by this Act. Part II on establishment and constitution of the Court, the Act establishes the Environment and Land Court is Section 4(1). Section 4(2) states that the Environment and Land Court shall be a superior court of record with the status of the High Court. Part III of the Act elaborates on the jurisdiction of the environment and land court.

Section 13(1) under this part states that the environment and land court shall have original and appellate jurisdiction to hear and determine all disputes in accordance with Article 162(2) (b) of the Constitution of Kenya and with the provisions of this Act or any other written law relating to environment and land. Section 13(2) of the Act stipulates that in exercising of its jurisdiction under Article 162(2) (b) of the Constitution of Kenya, the environment and land court shall have the power to hear and determine disputes relating to environment and land including disputes;

Relating to environmental planning and protection, trade, climate issues, land use planning, title, tenure, boundaries, rates, rents, valuations, mining, minerals, and other natural resources;

- Relating to compulsory acquisition of land;
- Relating to land administration and management;
- Relating to public, private, and community land, and contracts choses in action or other instruments granting any enforceable interests in land; and
- Any other dispute relating to environment and land.

#### Relevance to the Project



• In developing plans and designs for implementation of the project, the project proponent will take into account the roles of qualified surveyors as stipulated in the Act. Addressing issue relating to ownership of the land slated for the development before the commencement of the project is necessary.

## 3.2.16 The Physical Planning Act, 1999

According to Section 29 of this Act, county governments are empowered to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. Similarly, prohibition or controls the use and development of land and buildings in the interest of proper and orderly development of an area is a mandatory under the Act.

In section 30, any person who carries out development without permission will be required to restore the land to its original condition. It also states that No other licensing authority shall grant license for commercial or industrial use or occupation of any building without a development permission granted by the respective county governments. Section 36 states that if in connection with a development application, local authority is of the opinion that the proposed development activity will have injurious impact on the environment, the applicant shall be required to submit together with the application an EIA report. EMCA, 1999 echoes the same by requiring that such an EIA is approved by the NEMA and should be followed by annual environmental audits.

Relevance to the proposed Project

- The proponent will be required to submit architectural design to Narok County for approval prior to the construction phase of the proposed project.
- This Act provides for order in terms of development execution. This development shall also comply with all the provisions of this law including vertical zoning requirements.

## 3.2.17 The Land Titles Act Cap 282

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

Relevance to the Project

• In developing plans and designs for implementation of the project, the project proponent will take into account the roles of qualified surveyors as stipulated in the



Act. Also addressing issue relating to ownership of the land slated for the development before the commencement of the project is necessary.

#### 3.2.18 The Penal Code, Cap 63

Section 191 of the Penal Code states, any person, or institution that voluntarily corrupts or foils water for public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence. Section 192 of the same act says Any person who voluntarily vitiates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carrying on business in the neighborhood or passing along a public way is guilty of a misdemeanor.

Relevance to the Project

• The Project Proponent will ensure that the proposed study does not pollute the atmosphere and water sources or cause injury to human health

#### 3.2.19 *The Water Act*,2016

The Water Act 2016 provides for the regulation, management and development of water resources, water and sewerage services; and for other connected purposes. Section 21 of this Act provides for national monitoring and geo referenced information systems on water resources. Following on this, sub-Section 2 mandates the Water Resources Authority to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specific records may require to be kept by a site operator and the information thereof furnished to the authority.

Section 63 of this Act makes it a right of every person in Kenya to clean and safe water in adequate quantities and to reasonable standards of sanitation as stipulated in Article 43 of the Constitution.

#### Relevance

• During construction, the project will be required to continuously reduce the silt and solid waste load from earthworks into nearby streams and other water bodies. Further the project is required to avoid any other contamination of water bodies and avoid activities in the riparian zones during the construction period.



# 4 BASELINE INFORMATION ON ENVIRONMENTAL AND SOCIAL CONDITIONS

This section of the report cover the biophysical conditions in the project area. Gathering of baseline data is necessary to meet the following objectives:

- To *understand* key biological, physical, ecological, social, cultural, economic, and political conditions in areas potentially affected by the proposed project;
- To *provide data* to predict, explain and substantiate possible impacts;
- To *understand* the expectations and concerns of a range of stakeholders on the proposed development;
- To *inform* the development of mitigation measures; and
- To *benchmark* future socio-economic changes/ impacts and assess the effectiveness of mitigation measures.

## 4.1 Setting the Project Limits and Area of Influence

## 4.1.1 Area of Environmental Influence

The effects of the Project activities on a particular resource or receptor will have spatial (distance) and temporal (time) dimensions. Some activities would impact a larger radius than other identified impact sources. The spatial and temporal dimensions have therefore been taken into account to define a Project's Area of Influence.

For this project, the areas of environmental influence have been identified as follows:

## Air Quality

It is anticipated that dust (particulate matter) will be generated during the construction phase along the project alignment. Due to the expected effectiveness of the proposed mitigation measures, the impacts outside the Area of environmental influence are insignificant.

## **Noise Pollution**

It is anticipated that noise will be generated during the construction phase of the project along all the project components. Due to the expected effectiveness of the proposed mitigation measures, the impacts outside the Area of environmental influence are insignificant.

#### Water Environment

The Area of Impact (AoI) for surface water quantity and quality is comprised of the drainage systems that will be affected by fencing the Maasai Mau Forest Block. Due to the cumulative nature of drainage systems, the impacts outside the Area of direct influence are significant and the Area of Indirect Impact(AII) will include areas outside Maasai Mau Forest Block.



The project philosophy for water quality is to discharge water that meets all applicable standards. The Area of Direct Impact (ADI) for surface water quality has been defined as the area where there will be discharges from the project area, which is the same ADI defined for quantity of surface water. Using the same philosophy as surface water quantity, there is significant impact beyond the direct area of influence after mitigation and the AII will not be the same as the ADI for surface water quality. Figure 4-1: Area of Direct Influence\_Water Environment shows the water environment that will be impacted.



#### Figure 4-1: Area of Direct Influence\_Water Environment

## Land Environment (relief and geomorphology, soils, and vegetation)

Impacts on soil and land are often restricted to the Project footprint area. Taking into account that it depends on the location of the infrastructure, the ADI for the relief and geomorphology, soils, and vegetation components comprise the surfaces that will be directly affected as a result of the location of project infrastructure. Due to the nature of these environmental components and the project characteristics, and considering that no impact has been foreseen beyond the direct location area, the Area of Direct Impacts matches the Area of Indirect Impacts.





#### Figure 4-2: Area of Influence\_ Land Environment

#### Ecology

Project operations and construction will impact both the quality and the availability of aquatic life habitat. It will also impact terrestrial habitats along transmission lines.

Because of this, the area of influence for the hydro-biological component included the Rivers within the project area (refer to **Error! Reference source not found.**)





#### Figure 4-3: Area of Influence\_Ecology

#### 4.1.2 Area of Social Influence

For this project, an area of interest considered for socio- economic consultations to determine perceived impacts due to the Project.

Stakeholders were identified on the basis of their interaction with the Mau Forest Complex as whole, and with Maasai Mau block specifically. Stakeholders identified were therefore forestadjacent and forest-dependent communities, State Agencies including the Public Administration, line State Departments and State Corporates charged with environmental conservation, Civil Society Organizations whose activities are aligned to environmental conservation and human rights groups.

The first level was focused on the regional context characterization, or a general study area which is Narok County. The second level was focused on the local characterization, up to the ward level which includes Sogoo, Sagamian, Ololung'a, Nkareta, and Melelo in Narok county





Figure 4-4: Area of social Influence

## 4.2 Physical Environment

## 4.2.1 Topography

The major geomorphological features of the forest comprise of the escarpments, hills, rolling land and plains. The altitude rises from about 2100m at Nkareta to the West to 2600m towards the boundary with Olpusimoru to the North.

## 4.2.2 *Climate*

The climate of the project area is largely influenced by the North – South movement of the Inter-Tropical Convergence Zone (ITCZ) modified by local orographic effects. In terms of seasonality, the climate can be classified as trimodal, with the long rainy season predominant between the months of May and June and the short rainy season prevalent between the months of September and November. Generally, the area receives an average annual rainfall of about 1300 mm on normal years devoid of climatic extremes such as the El Niño Southern Oscillation (ENSO). Mean monthly rainfall events in the range of 30 mm to over 120 mm are common.

## 4.2.3 Geology and soils



The area is mainly composed of quaternary and tertiary volcanic deposits (Sombroek et al., 1980). The soils are largely of high content of silt and clay consequent of Ferrasols, Nitisols, Cambisols and Acricsols according to the Food and Agricultural Organisation of the United Nations (FAO-UN) soil classification procedure (World Soil Information [ISRIC]/FAO-UN, 1995).

# 4.2.4 Hydrology

Almost the entire Maasai Mau Forest forms the upper catchment for the Ewaso Ngiro River, while the most western part of the forest is part of the upper catchment of the Mara River (Maasai Mau Forest Status Report, 2005). The Ewaso Ngiro River flows into Lake Natron, while Mara River crosses the Maasai Mara National Reserve and Serengeti National Park. The two rivers provide much needed water to pastoralist communities, agriculture and urban areas in Narok and Kajiado Counties.

## 4.2.5 Air Quality

There was no existing air quality data for the area for review. However, being located in a rural area with agriculture being the dominant land use, the existing air quality in the project area appears to be generally good. Potential impacts of the project on air quality will mainly emanate from dust from construction activities and storage of materials, and combustion emissions from construction vehicles which are anticipated will be much localised.

## 4.2.6 Water Quality

The inflows of the project rivers are provided by rain and groundwater. The primary input is rainfall which is the main source of river water inflow. There are no glaciers in the catchment. The river systems are very active with erosion, transport and deposition of sediment creating a wide range of channel morphology along the length of the Rivers.

There is no historical data on water quality for the rivers. As discussed in Chapter 4 on baseline information, samples of water were drawn from the subject project rivers and submitted to a laboratory for analysis of physio-chemical and biological tests. The objective was to establish baseline quality of the river water prior to construction phase of the project. The sample was collected during high rainy season representing high flow period. The levels of some parameters; electrical conductivity, temperature, pH and dissolved oxygen were determined onsite using Hansatech Instruments. The analysis of the rest of the water quality tests was done at NEMA designated laboratory (SGS Kenya Laboratory). The analytical results obtained (Table 7-22) indicated that E. Coli Coliform in water sampled from all project rivers exceeded the limits for potable water recommended under WHO Guidelines and Kenya Standards for Drinking Water.

## 4.3 Ecological Baseline

## 4.3.1 Ecological Survey Approach



Ecological surveys were undertaken as part of environmental setting evaluation. The survey focused on the invertebrates, mammals, birds, reptiles and amphibians and plants.

## 4.3.2 Sampling Framework

Preliminary field visit (reconnaissance) was conducted to determine biodiversity conservation issues in Maasai Mau Forest. Detail study of biodiversity of Maasai Mau was conducted by desktop review and field observation. Interview with selected local residents were used to improve knowledge on the distributions of fauna species that may not be possible to record within the study period. The result of interview on fauna distribution were validated using relevant guide books for each taxa. The study covered taxa of mammals, birds, invertebrates, fish, amphibians and reptiles in both terrestrial and aquatic habitats. Field sampling were conducted in five sites with transects of 2 km; 1 km on the eastern side (inside forest) and another on the western side of the proposed electric fence (Figure 4-5: Strategy and Design for biodiversity study along the proposed electric fence).



Figure 4-5: Strategy and Design for biodiversity study along the proposed electric fence



#### 4.3.2.1 Field Reconnaissance

Field visit was conducted on October 15<sup>th</sup>, 2019 to Maasai Mau Forest area and Major stakeholder of conservation. The visit was made to the National Environment Management Authority (NEMA), Kenya Wildlife Service (KWS) and Kenya Forest Service including the posts for the Joint Enforcement Team around Maasai Mau Forest. Posts that were visited were in Loliondo, Sierra Leone, and Nkoben. However, all sections that experienced encroachment are Toltol, Loliondo, Nkoben, Sierra Leone and Nkareta. Forest cover in the latter is vastly intact compared to the other four sections. The authorities pointed out issues that are of concern with regard to electric fencing of Maasai Mau Forest are:

- Wildlife corridors: Presence of elephant families have been recorded in the recent
- Prevention of human-wildlife conflicts that are however at minimum level at the moment
- Importance of natural regeneration and enrichment planting of trees
- Improved water discharge

In addition to above, other issues were prior identified and validated as important to focus on during the kick-off meeting at KWTA. These are environmental variables would be affected by the proposed project negatively or positively. Their validation will therefore be very vital during the detail field study; i.e.:

- Species diversity and population for both flora and fauna
- Species movements: Local and Migration patterns
- Species of conservation importance
- The existing or potential Human-Wildlife Conflicts
- The biodiversity conservation hotspots and critical water resources
- Soil conditions: Physical-Chemical variables
- Cumulative environmental impacts

# 4.3.3 Field Study

## 4.3.3.1 Mammal survey

## 4.3.3.1.1 Small Mammals Survey

a) Live trapping

Eleven trap stations were established within each of the four sites. At each station, two 8.3x9.3x23 cm Sherman live traps (H. B. Sherman Traps, Tallahassee, Florida, USA) were placed on flat ground at the likely capture spots. The traps were baited with the mixture of oat, peanut butter and cooking oils (Eymann, 2010).

A 1day trap session was conducted at each site; a typical session including 22 sites of the two main two habitat gradients; the farmlands and forested areas. Captured animals were euthanized with chloroform according to the American Society of Mammalogy and Animal Care Committee Guidelines. Captured animals were identified to species, where possible, in the field using the keys provided in Kingdon (1997). Additional data including sex, age,



weight, and reproductive condition were recorded following Gurnell & Flowerdew (1990) and Barnett & Dutton (1995). Specimens were injected in the abdomen with 10% formalin solution for preservation and deposited in the Nairobi National Museum Mammal Collection.

# 4.3.3.1.2 Large mammal survey

Monitoring wildlife populations and habitats can provide insights in to the impacts of human actions on nature and rates of wildlife changes. A systematic analysis of population trends and habitats is needed to mitigate the accelerated decline of biodiversity during the Anthropocene. This study provides baseline information for monitoring and evaluation of the potential impacts of fencing programme on wildlife populations within Mau forest complex restoration. Several methodologies were used to survey large mammal populations.

# a) Line transect

Mammals were surveyed on line-transects. Transects were walked at a speed of around 1km per hour, starting at 6.30am. Mammals especially primates are most active in the morning, and surveys were completed by 11.00am. When an animal or a group is encountered and it is possible to watch a group, the maximum number of individuals present were recorded over a 10-minute observation period. Distances and bearings from the transects for the individual first identified were recorded. Data were analyzed using program DISTANCE by Buckland et al. (2001) which estimates densities from line transect and point sampling. An estimate of population density can be converted from these distances by modelling the probability of detection as a function of distance from the transect line (Buckland et al., 2001).

# b) Scat counts for detecting presence/absence of mammals

Bones and hair samples collected from owl pellets or the scats of carnivorous mammals can provide valuable additional information on the presence of other vertebrate species. A record all mammalian sign detected along the four transects were used to provide additional information on species richness. Possible signs included actual observation of mammals, tracks, or scat (Nichols & Conroy, 1996). Scats were searched in the following locations; below the nests or perches of raptors, along breakaways, under rock overhangs or in cave entrances Any scat were collected, identified, and removed from the transect at the time of detection. A location of the mammalian signs was recorded as the distance (m) to the nearest vegetation plot or trapping station.

# c) Dung and Pellet counts

Many animals leave behind a number of signs of their presence, such as dung, pellets, nests or tracks, which are often much easier to quantify than the animals themselves. Indirect counts provide qualitative data regarding relative use of habitat by herbivores. Four transects were established to survey each site for dung and pellet samples. Line transect sampling allows an observer to count the number of dung samples whilst traversing along the transect lines (Marques et al., 2001). For each site, transects were 1000 meters in length along the edge



gradient. For the purposes of the study each dung sample from the count were regarded as a separate individual. Two observers will search for and count all the dung/pellet piles in each transect. Dung from domestic animals e.g. cattle (*Bos indicus*) will not be included in the sample. Identification of dung and pellets were carried out in the field with the help of an information guide.

# d) Trail sampling, scanning and sign surveys

Trail sampling were used for detection of mammals in different habitats of the study area. Trails were identified for observation in all transects. Scan sampling and sign surveys were carried out along trails, ridges and streams once in each of the other four sites.

## 4.3.3.2 Herpetofaunal sampling

Visual Encounter Survey protocol with time constrained searches (Heyer et al 1986) were used for Systematic searches along 1 km transect on either side of the proposed electric fence (speed of 1 km/hr) in Maasai Mau Forest. Existing wetlands along or near the designed study transect were search for frogs and toads including their tadpoles and eggs. Drift pitfall traps were set in three transects for about 3 days to maximize trapping of species that are difficult to observe. Where possible, night sampling was conducted mainly targeting amphibians and other nocturnal herpetofauna on wetland areas. The trapped live specimens were euthanized in S222 before being fixed in 10% formaldehyde injection and preserved in 70% alcohol. The specimens were deposited as voucher specimen at the National Museums of Kenya.

## 4.3.3.3 Bird sampling

Bird survey were conducted using Point Counts along the designed transects in Maasai Mau Forest. The surveys were conducted from very early in the morning; from 6am to 9am in each site. Bird species were identified based on direct observation and the calls their unique calls they make. Photograph of birds were taken as evidence and to assist in the identification and verification of the species identities. Physical observation of wetland birds was conducted on wetlands along or near the transects Opportunistic sampling of birds were conducted from 9am to 11am and in the evening from 4pm to 6pm.

## 4.3.3.4 Terrestrial Invertebrate Sampling

Five methods of sampling terrestrial invertebrates were used which include pitfall trapping, pan trapping, sweep net sampling, litter sampling and beating.

## 4.3.3.4.1.1 Pitfall trapping

Pitfall traps were laid along one independent edge gradient transects in each of the five sites. Single pitfall traps were set at 11 intervals ranging from farmland into the forest habitat. These were set at inside forest boundary –1000, –500, –250, –125, –25, at the proposed electric fence 0 m, and outside forest boundary) +25, +125, +250, 500, and 1000 m tangent to the forest boundary. A total of 55 pitfall traps were used to allow comparisons to be made within and



between sites as well as within and between habitats. The traps will consist of plastic bottles (500 ml, diameter 9 cm, depth 11 cm), partly filled with a water and few drops of scent free detergent as collecting medium. Previous studies have proven those larger pitfall diameters are more effective when sampling ground active soil invertebrate (Ward, et al., 2001; Work, et al., 2002; Woodcock, 2005). Soil corer were used to dig pitfall trap holes to ensure a snug fit and the pitfall rim was flush with the ground surface. In all the five sites, pitfalls were collected once over 24-hour duration beginning late October 2019. Contents of the traps were collected by straining the preservative through a fine mesh sieve and using ethyl alcohol to rinse the contents of the strainer into a specimen container.

## 4.3.3.4.1.2 Pan trapping

Plastic bowls of three different colours of fluorescent blue, yellow and white measuring 15cm in diameter and 4-cm deep were used to capture flying arthropods. On warm, clear sunny days, three bowls containing approximately 200 ml of water and soap to a depth of 2-cm were placed at a same point as pitfalls, approximately 1-m apart. A total of 33 bowls (11 blue, 11 yellow and 11 white) were placed in each edge gradient transect and left for three hours between 9:00 a.m. and 12:00 noon. After three hours, the bowls were drained with a strainer and all the contents placed in 70% ethanol. The contents of each colour bowl from any one day were combined into a single sample. Samples will then be transported to the Nairobi National Museum Invertebrate Zoology laboratory for sorting, pinning, drying, identification and labelling.

## 4.3.3.4.1.3 Sweep net sampling

Sweeping is a technique used to sample invertebrates on herbaceous vegetation. Ten sweeps, one taken at each step, to constitute a sample were conducted at five randomly selected points on each of the 1 km transect. The collector will follow a standard route each day at each sample location, between 08:00 and 12:00 hours, and from; 14:00–18:00 hours. At each sampling location the collector will make sweeps of the vegetation tops of understory vegetation with a 40 cm diameter sweep net. The net contents will then be killed in ethyl acetate saturated plaster of paris glass jars, placed in a containers and labels with date, time of day, location, and plant species.

## 4.3.3.4.1.4 Litter sampling

Eleven, 1x1m<sup>2</sup> quadrat litter samples were randomly collected along the traversing transects from each site. Litter samples were placed in sealed plastic bags and transported back to the Nairobi National Museum Invertebrate Zoology laboratory for sorting and invertebrate extraction within a maximum of three days from collection. Specimens were stored in 70% ethyl alcohol. Litter samples were dried, and dry weights established for standard measurement.



Timed counts of 20 minutes were conducted at least twice over the study period at each site, involving focused searching with an aspirator tube and tweezers, collecting all invertebrates encountered, particularly at the base of vegetation, dead lying logs and under stones.

# 4.3.3.5 Beating

Beating is a manual collection method suitable for collecting invertebrates that are closely associated with understory vegetation. A standard beating sheet  $(1 \times 1 \text{ m})$  were placed beneath a suitable substrate (e.g., shrub, understory trees). The collector will then vigorously shake the vegetation and collect all the invertebrates that drop into the sheet (Southwood 1978). A total of 10 beats on numerous branches will constitute one sample (Winchester & Scudder, 1993). Invertebrates were collected from the sheet with an aspirator. Beating were conducted early in the day and in the evening, when insects are most likely to be seeking shelter in the vegetation. Eleven stations were selected randomly for beating. One beating sample were collected at the selected trapping stations. A total of forty-four independent beating samples were taken from the randomly chosen points along the edge gradients transects.

# 4.3.3.6 Plant sampling

Random sampling was used to assign three replicates of one hectare plots outside the forest boundary, in areas under eviction and in forest. Five subsampling plots were used for sampling tree richness. Grass and herb richness and cover analysis were conducted within 1m quadrat in each subsampled plots. Vegetation cover were analysed within 1 km square in cropland outside the forest boundary, in areas under eviction and in forest covers in order to establish baseline for future comparison. The plot-less method was employed along the transects in the three treatments. The identification was done with reference to the field guide books. Photographs were taken for representative tree species or vegetation formations occurring in the riverine system.

# 4.3.3.7 Aquatic macroinvertebrate survey

The group of invertebrate considered for survey are invertebrate species that can be retained by a 500 – 600-micron mesh screen. These species potentially include aquatic insects such mayfly, dragonfly and caddis fly larvae), aquatic worms, amphipods (scuds), leeches, clams and snails. Kick-sampling were used for three minutes kicking/sweeping water media using a standard 1 mm mesh pond (hand) net. Loose pebbles were turned to observe invertebrates hiding under stones. Observation of dragonflies and damselflies were performed along the river within the riverine system. Identification were conducted in the field and further in the laboratory.

# 4.3.4 *Water quality parameters:*



Water quality parameters that were measured include pH, temperature, the total dissolved substance, and electrical conductivity. Measurements were conducted using Hansatech Instruments for the above parameters.



Plate 4-1 - Water quality parameter measurement at Nyangores River

## 4.3.5 Soil Variable Analysis

Physical-Chemical conditions of soils were analysed from the 5 – 20 cm depth for Soil Organic Carbon (Matter), Bulk Density, pH, Cation Exchange Capacity (CEC), Nutrients (N & P). Sampling were conducted in cropland occurring outside the forest boundary, area of eviction and in forest cover area. Three replicates were sampled in each treatment in three transects. The three replicates were mixed thoroughly and subsampled for laboratory analysis. Thus, a total of 9 samples of soil were acquired from Maasai Mau Forest.






Plate 4-2: Coring of surface soil 10 - 30 cm from cropland (grassland) for laboratory analysis

#### 4.3.6 Local accounts of species

Study design will involve field surveys to sample the different biodiversity groups in the different sites along the proposed Electric Fence alignment. Due to time limitation in the field, more species data were collected from interview with the local people with experience on species within the forest ecosystem. The information from the locals were verified by comparing it with the literature distribution of the concerned species. The identification was done using the relevant guide books for each taxon.

#### 4.3.6.1 Validation of Species of Conservation Importance

These are threatened species listed under IUCN red list, species endemic to the region, and species listed under CITES. Impact of the proposed electric fence were analysed against the ecology of species of conservation importance.

# 4.3.6.2 Validation with IUCN Red Listed Species

Conservation status of species in checklist generated by desktop analysis, field observations and local accounts were validated using IUCN red list of threatened species. There are different categories of conservation status of species and are described in the IUCN red list data. Based on the categories, species were assigned status:



- CRITICALLY ENDANGERED (CR) when it is facing an extremely high risk of extinction in the wild in the immediate future, as defined by any of the criteria (A to E in the IUCN Red List Categories);
- ENDANGERED (EN) when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future, as defined by any of the criteria (A to E in the IUCN Red List Categories);
- VULNERABLE (VU) when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future, as defined by any of the criteria (A to E in the IUCN Red List Categories);
- LOWER RISK (LR) when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Species included in the Lower Risk category are separated into three subcategories;
- Conservation Dependent (CD). Taxa which are the focus of a continuing taxonspecific or habitat-specific conservation programme targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above within a period of five years;
- Near Threatened (NT). Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable;
- Least Concern (LC). Taxa which do not qualify for Conservation Dependent or Near Threatened;
- DATA DEFICIENT (DD) when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status, and;
- NOT EVALUATED (NE) when it has not been assessed against the IUCN criteria

# 4.3.6.3 Validation with the Endemic Species list

The IUCN online database were used to validate species checklist generated from the field and literature search for status of endemicity. Other online database will also be used for verification.

# 4.3.6.4 Validation with the Convention on International Trade on Endangered Species (CITES)

Species checklist were run against list of CITES which is categorised into Appendices, according to the degree of protection species require. (For additional information see <u>www.cites.org</u>). Appendix I includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances. Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival. Appendix III contains species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade.



## 4.3.6.5 Conservation Hotspots

Conservation hotspot were generated from spatial variables that influences the distribution of species. These variables include biodiversity data and drainage resources. Spatial overlay was used for generating hotspot from land use layer, drainage density, species distribution and topography.

# 4.3.7 Biodiversity field survey

A total of 7 transects were surveyed from October 31<sup>st</sup> to November 8<sup>th</sup> 2019 (Table 4-1). The survey was rapid with a maximum of 2 days cover on transect. Biodiversity survey covered assessment of taxa including plants, mammals, invertebrates, and birds and herpetofaunal (amphibians and reptiles). Other activities completed are measurement of water quality parameters and collection of soil samples. The survey exercise was challenged by heavy down pours which affected limits of sampling animal taxa. Security issues also determined how far the survey team would access into the interior of the reclaimed areas and forest.

Site	Sector	Number of Transects
Nkoben	Forest (Nkareta)	1
	Cropland (Endebes)	1
Chepalungu (ENSDA)	Forest	1
	Reclaimed Area	1
Sierra Loene and neighbouring areas	Reclaimed Area	2
Kass FM	Reclaimed Area	1
Toltol	Reclaimed Area	1

Table 4-1: Sites and transects covered during the biodiversity survey on the western side of Maasai Mau for the proposed fencing project





Figure 4-6: Sampling location in the western side of Maasai Mau for the proposed fencing project

# 4.3.7.1 Plant Diversity

An estimate of 268 plant species was recorded on the western side of Maasai Mau Forest. These include grasses/sedges, herbs, shrubs and trees. This was largely identified from the sectors of Reclaimed Areas, adjacent farmland and forest near the two sectors. These species aggregate to a total of 89 families, 38 orders in the taxonomic hierarchy. The Order Asterales dominates with 30 species in Reclaimed Areas and 20 in Farmland; while the Order Lamiales has the highest number of species (20) in Farmland. The plant life form with the highest representation is herbs which constitute 43%, followed by the shrubs (34%), Trees 17%, Grasses 5%, and Sedges 1%. The reclaimed area has an estimated 73% of plant species, farmland 34%, and the forest has 39% of plant species recorded during the survey. The reclaimed area represents areas that were recently forest but were encroached that saw most of the forest species cleared. Thus, there is drawn similarity between the reclaimed areas with the forest. The similarity is also expected between the farmlands and adjacent forest, and the adjacent reclaimed areas. An estimated 24% of the plant species in the western side of Maasai Mau Forest occur in both forest and Reclaimed Areas. About 32% of the plant species were recorded in both farmland and Reclaimed Areas; that is farmland has about 43% of species in Reclaimed Areas. While, 8% of the plant species occur in both forest and farmland. Similarity



of plant species in forest are relatively low in all sites visited in Nkoben, Chepalungu, Toltol, Kass FM, and Sierra Leone.



Figure 4-7: Distribution of plant Species (%) among Life Forms of plants Species in different sectors



Figure 4-8: Distribution of species richness (%) among sites

Among the plant species recorded in forest 43% are herbs, 36% are shrubs and trees constitute 21% (Figure 4-7). In Farmland herbs constitute 50% of plant species recorded in the sector, 33% are shrub species, tree species are 9%, and grass species constitute 7%. The distribution of species among the life forms in Reclaimed Areas is dominated by herbs which forms 45% of plant species recorded in the sector, shrubs are 32%, trees constitute 15%, grasses forms 6% and sedges are less than 1% of plant species in the sector (Figure 4-7). Out of the tree species recorded in forest, 50% occur in the Reclaimed Areas and only 4% occur in the farmland. An



estimated 22% of tree species are found both in forest and the Reclaimed Areas; 17% are only found in the forest and 41% occur only in the Reclaimed Area. Among the shrub species recorded, 11% occur in all the sectors; 14% occur only in adjacent forest, 22% are only found in the Reclaimed Areas, and less than 1% occur only in farmland. About 9% of the herbs in the area occur in the three sectors; 13% occur only in forest, 23% only in Reclaimed Area and less than 1% only occurs in farmland.



Figure 4-9: Distribution of Species Richness by percentage among study sites

Validation with the IUCN red list of threatened species shows about 28% of the plant species (74) occur in the database. The species, *Polyscias stuhlmannii*, is categorized as Endangered (B2ab(iii)). The population of the species is severely fragmented and mature population is currently under decline in area, extent and quality of the habitat. The existence of *P. stuhlmannii* is threatened by logging and wood harvesting for local use. This species is endemic to Kenya and Tanzania; where in Kenya, and its distribution is very limited to few number of locations. THE species is possibly facing extinction in Kenya; however, in Tanzania it is extant.

Below plant species are of special conservation importance including medicinal value (*Aloe sp.* and *Piper capensis*), Invasive species (*Cuscuta sp.*) and CITES listed plant species (Sandalwood).





Plate 4-3 – Selected plant species recorded from the western side of Maasai Mau Forest. 3(a) - Aloe lateritia, 3(b) - Sandal wood (Osyris lanceolata), 3(c) - Piper capensis, and 3(d) - Dodder plant (Cuscuta japonica)

# 4.3.7.2 Mammal Diversity

#### 4.3.7.2.1 Trapping efforts, trapping success and structure

Capture rates (C/100TN) were generally moderate in the five localities. The highest capture rates (90%) was recorded in TolTol reclaimed farmland habitat and the lowest 20% recorded in Sierra Leon reclaimed farmland (Table 4-2). The total sampling effort was 70 night traps and the overall trap success was moderate, 53% (Table 4-2). There was no statistical difference in the rate of capture of females 20(54.1%) and males 17(45.9%) in this study area ( $\chi^2 = 0.243$ , df = 1, P > 0.05). Among the trapped individuals, adult and sub-adult individuals constituted 24(64.9%) and 13(35.17%), respectively (Figure 2-1). Thus, there was statistically significant difference ( $\chi^2 = 3.27$ , df = 2, P > 0.05) in the abundance of age group of small mammals trapped.



Table 4-2: Trap success (C/100TN) of small mammals in different localities and habitat types

Locality and Habitat	Total Trapped	Trap Nights	Trap Success (%)
type			
Nkoben Forest	12	20	60
Chepalungu Forest	5	10	50
Chepalungu	2	10	20
Reclaimed Farmland			
Sierra Leon	9	20	45
Reclaimed Farmland			
Toltol Reclaimed	9	10	90
Farmland			





#### 4.3.7.2.2 Small mammal species diversity and abundance

A total of 37 small mammals (32 rodents and 5 shrews) during the survey (Table 4-3). The rodents were represented by 5 species and 1 morphospecies, and the shrews by 2 species. *Otomys typus* had the highest number of individuals (15.7%, n = 11), followed by *Mastomys natalensis* (11.4%, n = 8) and *Mus minutoides* (10%, n = 7). The lowest abundance was for *Sylvisorex* sp and Muridae morphospecies (2.7%, n = 1 each) (Table 4-3). More individuals (n = 12) were recorded from Nkoben, followed by Sierra Leon and Toltol (each n = 9). The lowest (n = 7) was from Chepalungu.





Plate 4-4: Small mammal species recorded in study sites. 4-7(a): Mus minotoides (Pigmy Mouse), 4-7(b): Crocidura sp (African Shrew), 4-7(c): Lemniscomys striatus (Striated Mouse), and 4-7(d): Otomys sp. (Soft furred Rat)

	Table 4-3: Small mammal	s recorded in	different	localities	in Maasai	Mau Water	Catchment.
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Individuals recorded in different localities							
Family and Species	NK	CH	SL	TT	Total	RA, %	IUCN Status
Rodents							
Family Muridae							
Lemniscomys striatus	2			1	3	4.29	LC
Lophuromys sikapusi				2	2	2.86	LC
Mastomys natalensis	4	2		2	8	11.43	LC
Muridae sp.			1		1	1.43	LC
Mus minutoides		1	6		7	10.00	LC

							December, 20	)19
Otomys typus	5	4		2	11	15.71	LC	
Shrews								
Family Soricidae								
Sylvisorex sp.				1	1	1.43	LC	
Crocidura nigrofusca	1		2	1	4	5.71	LC	

NK = Nkoben, CH = Chepalungu, SL= Sierra Leon, TT = Toltol, RA=Relative Abundance and LC = Least Concern

## 4.3.7.2.3 Habitat association

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The number of individuals of each of the species recorded from different habitat types is shown in Figure 4-11. *Otomys typus, Lemniscomys striatus, Lophuromys sikapusi, Mastomys natalensis, Mus minutoides,* and *Crocidura nigrofusca* were present in all habitat types. Lophuromys sikapusi and Sylvisorex sp were recorded only found in the reclaimed farmlands. *Otomys typus* was the most abundant in forest habitat types, with a total of 18.97% of the live-trapped small mammals. However, it was relatively less common in the reclaimed farmland at 10.8%. The next commonly trapped species was *Mastomys natalensis* with 16.2% in the forest habitat. Mus minutoides was the most abundant in reclaimed farmland habitats at 16.2% of the live trapped small mammals.



Figure 4-11: Proportions of individuals of each of the species recorded from different habitat types.

A total of 21 species represented by seven orders namely Rodentia (39%), Canivora (17%), Artiodactyla (13%), Primates (9%), Eulipotyphla (9%), Lagomorpha (4%), Proboscidea (4%), and Tubulidentata (1%) were recorded from the forest and the adjacent farmlands (Figure 4-



12). The Order Rodentia had the highest number of species (7) represented by one family Muridae (Table 4-3). Three mammal species, the African Leopard (*Panthera pardus*), the African Bush Elephant (*Loxodonta africana*), and the Giant Forest Hog (*Hylochoerus meinertzhageni*) categorized as "vulnerable" according to the International Union for Conservation of Nature. Most of their natural habitats in the project area have been destroyed due to the massive agricultural encroachment. The Spotted Hyena (Crocuta crocuta), Banded Mongoose (*Mungos mungo*), and Slender mongoose (*Galerella sanguinea*) are perceived as important livestock and poultry depredators by the local communities.



Figure 4-12: Species distribution by Order

# 4.3.7.2.4 Bird Species

Total numbers of 124 bird species have been identified from the rapid biodiversity assessment. Out of this, 104 bird species were recorded by Point Count method, 52 by Opportunistic sampling while sampling by mist net recorded 25 species which were ringed. The survey proved the Mau forest complex to be a haven for biodiversity despite ongoing threats level. Out of the seven Species that led Mau to be designated as an I.B.A we only recorded two Crowned Eagle Stephanoaetus coronatus and Grey-winged Robin Sheppardia polioptera which are also under I.U.C.N red list categories of Vulnerable and endangered respectively. On mist-netting, we captured 62 individuals of 25 species in the five surveyed sites, 9 forest Specialist (FF) 10 generalist (F) and 6 forest visitors (f). On Point count, we recorded 103 species only one forest generalist Yellow Whiskered Greenbul Andropadus



latirostris (F) and one forest visitor (f) Baglafecht Weaver Ploceus baglafecht. The rest of the species were recorded during opportunistic birding.



Plate 4-5: Bird species recorded in study sites. 4-9(a): African Reed Warbler, 4-9(b): Olive Thrush, 4-9(c): Banded Prinia, and 4-9(d): Montane White Eyed



								Afromontane
		TOTAL			HAB	ITA	Г	highland Biome
SITE	SPECIES	CAPTURE	MIG	RANTS	SPECIFIC			Species (AHB)
			PM	am/pm	FF	F	f	
Endepesi	4	7	0	0	2	2	0	2
Nkereta								
(Chepalungu)	9	17	0	0	4	5	2	4
Sierra Leon	7	9	0	0	0	4	1	3
Tol Tol	15	29	0	0	0	11	2	16
Complex								

#### Table 4-3: Summary of the ringed bird species.

Table 4-3 above illustrates species and individuals caught during ringing in all fragments. All migrant's species (Annex 1), were seen in points count, but none was captured during the ringing session. The variation between diversity and abundance was very minimal, which illustrated that, although there are still species existing in the ecosystem, their representative is going very low. On forest categories; forest specialist species was very few as compared to generalist and visitors. That could be linked to the state of the forest and habitat structure.

The Afromontane highland biome species had a good representation in almost every fragment. The higher we survey in term of altitudes the more biome species we capture i.e. Tol Tol was a 2400 m. a.s. l, where we captured 16 species of AHB. The ringing methods exemplify high diversity but low abundance.





#### Figure 4-13: Number of species and total individual ringed.



#### Figure 4-14: Forest habitat specific species Total individual caught per site

The forest habitat-specific species illustrated the level of degradation within the surveyed fragments. Forest specialist species, just appearing only in two fragments Endebesi and Nkereta/ Chapalungu as compared to Forest generalist which missed only in Sierra Leone.

Point count through the simple matrix, to assess the frequency of species on a transect and the entire, sampled site, we could easily assess the state of the habitat. But from the results, the



Ploceidae and Hirundinidae family dominated the point count transect where just a few are forest visitors. The forest Generalist Yellow whiskered Greenbul was recorded in Endebesi alone but the rest none of the habitat-specific species were recorded. That tells something about habitat, and surviving population, either the population is shrinking or surviving in isolation where its displays are limited by threats.

Birds are key ecological indicators to changes in our environment, habitats and other biodiversity. Their presence indicates either positive or hazardous condition within the environment. From the survey, we recorded unsustainable utilization of entire ecosystem which has tilted species diversity abundance and distribution (Table 1).

This survey revealed how rich the Mau forest complex can be for biodiversity. The accumulative curve had not reached an asymptotic plateau. That is an indication of more new species can be recorded with the same fragment with the same effort given more time. It suggests that the diversity in the mixed habitat, grassland, farmlands and parches of forest favours birds' survival, and brings out the need to carry detail survey that will give conservation direction on what bird's species and wildlife species to focus on while interlinking with the ongoing rehabilitation program.

By integrating conservation into restoration plans, the future of conserving for Mau forest will come to a realization. Out of the Globally critically threatened species previously recorded on the site, such as Ahyrs's Howk Eagle, African Crown Eagle, African grass owl, Cape Eagle Owl, Red-chested Owlet, Least Honey Guide Grey Winged Robin and Purple Throated Cuckoo Shrike. That made the site to become an IBA. If more survey is considered that can reveal if such species could start to recover and their distribution within the ecosystem.

# 4.3.7.3 Herpetofauna Diversity

A total of 18 individuals captured in the five study sites belonged to 11 species, nine families and 9 genera (Table 4-4) of amphibians (72.2%) and reptiles (27.8%), collectively known as herpetofauna. Among the amphibians, *Ptychadena anchietae* and *Amietia nutty* had the highest abundance (each 23.1%) while *Kassina senegalensis, Xenopus borealis* and *Amietia wittei* had the lowest abundance (each 7.7%). Within the reptiles, *Trachylepis striata* was the most dominant at 40% while *Philothamnus semivariegatus, Adolfus jacksonii* and *Duberria lutrix* lowest (each 20%). Most of these species were found in forest and reclaimed farmland habitats.



December, 2019

Family	Species	FA	FO	RF	Total	Species Composition (%)
Amphibia						
Bufonidae	Amietophrynus gutturalis			2	2	15.4
Hyperoliidae	Kassina senegalensis		1		1	7.7
Pipidae	Xenopus borealis		1		1	7.7
Ptychadenidae	Ptychadena anchietae	1		2	3	23.1
	Amietia angolensis		1	1	2	15.4
Pyxicephalidae	Amietia nutti		1	2	3	23.1
	Amietia wittei		1		1	7.7
Total		1	5	7	13	100
Reptilia						
Colubridae	Philothamnus semivariegatus			1	1	20
Lacertidae	Adolfus jacksonii		1		1	20
Lamprophiidae	Duberria lutrix			1	1	20
Scincidae	Trachylepis striata	1		1	2	40
Total		1	1	3	5	100

Table 4-4: Distribution of amphibian and reptile species in the sampling sites. FA=farmland, FO=Forest, RF =Reclaimed Farmland.

# 4.3.7.3.1 Herpetofauna diversity indices and species accumulation curve

Diversity indices revealed that reclaimed farmland has higher diversity followed by forest and farmlands (**Table 4-5**). In addition, reclaimed farmland has higher species richness but low evenness value as compared to forest and farmlands. The three habitats types; farmlands, forests and reclaimed farmlands have a similarity index of only 11.7%. The rarefaction curve did not plateau demonstrating that the real number of species was not reached with the sampling effort (**Figure 4-13**).

#### Table 4-5: Diversity indices of herpetofauna in the three habitat types.

Diversity indices	Farmlande	Forest	Reclaimed		
Diversity marces	Talinanus	rorest	Farmlands		
Shannon-Weiner Diversity index	0.69	1.72	1.89		
Shannon Evenness Index	1	1	0.94		
Jaccard Similarity Index	11.7%				







Figure 4-7: Mean curve of the number of species registered with increase in sampling effort (rarefaction curve) in Maasai Mau watershed.

Herpetofauna captures were generally low during the field survey. The main method of detection was mainly through visual encounters. The lack of an asymptote suggests that the effort spent per site did not sample all the herpetofauna. More sampling is required especially during the dry season to maximize the species richness. Amphibians and reptiles are exothermic organisms, which are dependent on the weather condition such as moisture and temperature. Weather conditions were generally rainy and cloudy during sampling. This partially explains the lower number of captures observed during the entire sampling period. Nonetheless, data from this study revealed higher species richness in the reclaimed farmlands and reclaimed farmland habitats but low species richness in farmlands. This may be due to the greater heterogeneity of vegetation present in forested and reclaimed farmland habitats that provide amphibians with favourable micro-habitat requirements for their survival. The similarity index of only 11.7%, implies that amphibians and reptiles have specific habitat and food requirements for their survival. Thus, the findings of this survey revealed that the type of habitat influenced the diversity and distribution of amphibians and reptiles in the area. Life history characteristic of the captured individual indicate that 4 species are found in terrestrial habitat, 6 species inhabit both terrestrial and aquatic microhabitat types while one species is arboreal. Previous studies have demonstrated that species that inhabit terrestrial and aquatic ecosystems provide good indicators of thermal and hydrologic conditions, together with good water quality and watershed condition (Warguez et al., 2013). Therefore, species encountered



during this survey may act as baseline indicators of the present condition the Maasai Mau watershed.

# 4.3.7.3.2 Conservation status of herpetofauna in Maasai Mau

Majority of the amphibians and reptiles captured in this field survey are listed as least concern according to the IUCN Red List while a few species are not known. Amphibian and reptile species are sensitive to habitat destruction and preferably inhabit undisturbed vegetation such as forested areas. The greatest threat to amphibians and reptiles inhabiting Maasai Mau Forest is habitat loss due to conversion of forest to cropland and human settlements. The proposed electric fence program is likely to benefit herpetofauna by restoring their much needed habitats that are important for their successful breeding and survival in the larger ecosystem.



Plate 1-6-Herpetofauna species observed in western side of Maasai Mau Forest. 3(a) - Amiatie nutti (Stream in Nkoben), 3(b) - Bufo gutturalis (Reclaimed Area ENSDA- Chepalungu), 3(c) - Adolfus jacksonii in the riverine in Chepalungu, and 3(d) - Xenopus borealis (Pool along stream in Chepalungu).

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# **Diversity and Composition of Invertebrate**

A total of 87 different invertebrate species were observed during the survey. Among the recorded individuals are 37 species of butterflies (Order Lepidoptera), 16 species of beetles (Order Coleoptera), 10 species of bees, wasps and ants (Order Hymenoptera), 7 species of bugs (Order Hemiptera), 5 species of crickets and grasshoppers (Order Orthoptera), 4 species of flies (Order Diptera), 2 species of spiders (Order Araneae), 2 species of the dragon flies and damsel flies (Order Odonata), 2 species of cockroaches (Order Blattodea), 1 species of termite (Order Isoptera), 1 species of crustaceans (Order Isopoda), 1 species of millipedes and 2 species of snails (see Annex 6). A combined majority (61.3%) of invertebrate species was collected from forest sites in Chepalungu and Nkoben compared to the farmlands and reclaimed sites. The distribution of various taxa at the sampling sites is presented in Figure 4-14.



Figure 4-8: Relative species abundance found in each land uses type in the Maasai Mau Water Catchment during fieldwork

The three dominant groups of invertebrates thus Lepidopterans, Coleopterans, and Hymenopterans were mainly collected from the forest. The percentage of species in each order for the habitat types and are presented in Figure 4-15. The butterflies came from five different families of Erebidae, Hesperiidae, Lycaenidae, Lycaenidae, Nymphalidae, Papilionidae and Pieridae. The moths are represented in two Sphingidae and Tortricidae. Most of the forestdependent species were recorded in relatively small numbers. For example, only two individuals of the Regal Swallowtail were observed during the survey. Other forest species that were also observed in small numbers are Green-banded Swallowtails, Jackson's



Swallowtails and Forest Pearl Charaxes. Forest destruction and fragmentation is the largest threat to Swallowtails and Forest Charaxes in Mau Forest. Similarly, one species of dragonfly (*Hadrothemis camarensis*) and dancing jewel (*Platycypha caligata*). The streams are largely impacted cutting down trees from the hill slopes to create farmlands leading reduced flows and sedimentation. The grazing of livestock in the riparian areas contributes large amounts of allochthonous organic matter in to the streams and rivers. The decomposition of these organic materials depletes the aquatic systems of its oxygen, which is vital for the survival of Odonata larvae. Fencing the forest is expected to improve the abundance and diversity of this important aquatic ecosystems indicator group by excluding human encroachment and activities inside the forest. Restoration of the forest will likely improve the water quality and the riparian microhabits that are import for the success of Odonata.



Figure 4-9: Percentage of species compositions according to orders for the land uses types in the Maasai Mau Water Catchment during fieldwork.

# **Species Accumulation Curve**

A species accumulation curve for the observed rate of capture of the 87 species collected in all the five sites shows that our efforts have not captured a majority of the estimated true invertebrate biodiversity within these areas (Figure 4-16). The non-leveling off of the curve at the far right indicates that additional biodiversity monitoring is required to yield many more species to the species inventory, especially for organisms like insects that rarely reaches an asymptote (Gotelli & Colwell, 2001). The red line curve and blue confidence interval lines



indicate the estimated rate of species accumulation for a random community with the same number of species and samples.



Figure 4-10: Species accumulation curve of invertebrate community found in Maasai Mau Water Catchment based on the rarefaction method. The red line represents all the samples pooled together, and the blue line indicates the standard deviation.





Plate 4-7: Invertebrate species recorded in study sites. 4-11(a): Green-Banded Swallotail, 4-11(b): Bulinus sp., 4-11(c): Antestia bug (Antestia ssp.), and 4-11(c): Hydrothemis sp.

#### 4.3.8 Water Quality

Water quality were measured from the small streams, springs and river located in the Reclaimed Area in western side of Maasai Mau Forest. The following water quality parameters were measured; water pH, Total Dissolved Substances (ppm), Electrical Conductivity (µS) and Temperature (°C). Two parameters, Electrical Conductivity and Total Dissolved Substances are comparable in Nkoben stream and Kass FM spring but relatively different from other sites (Figure 4-16). The parameters in Chepalungu stream are comparable with counterparts in Sierra Leone, Kass FM and Toltol. While, a relative difference in the values of EC and TDS is observed between Sierra Leone stream and Toltol spring. Water pH is comparable in streams in Nkoben, Chepalungu and Sierra Leone relatively higher than other sites; these waters are slightly alkaline. The discharged water from spring in Toltol has lower pH (slightly acidic) than all sites surveyed. Water temperature measured from Toltol spring is relatively higher than temperatures in all the sites. The temperatures in Nkoben



(stream) and Chepalungu stream are comparable. The values measured in Sierra Leone and Toltol are completely not comparable between and among other sites.

Qualitatively, clear water was observed on stream passing through Chepalungu, spring in Kass FM and Toltol. Unclear water (very turbid) was observed on river in Kass FM and streams in Sierra Leone and Nkoben area. The stream in Nkoben transcends from Chepalungu in the upstream. The water is clear in the latter but very turbid downstream. This is attributed to the adjacent farms in Nkoben that discharge runoff with soil.

Water quality parameters are normally mobilized by temperature of the water which relates with the pH. The parameters; however, influences other chemical characteristics. Increase of water temperature is associated with the strong decrease in pH (R=-0.95), but weak decrease in CEC (R=-0.35) and TDS (R=-035) in the area. The increase in pH in the water is associated with the slight increase in EC (R=0.33) and TDS (R=0.34). TDS strongly and positive associate with EC; thus, EC increases as TDS increases.









Figure 4-19- Water quality parameters measured from streams, springs and river from the western Maasai Mau Forest. 3(a) – Electrical Conductivity, 3(b) – Total Dissolved Substances, 3(c) – Water pH, and 3(d) – Water temperature



## 4.3.9 Soil Conditions

Information on soil for the western Maasai Mau covers three sectors which include the reclaimed areas that were previously under cropland, cropland (farmlands), and forests. Soil Organic Carbon and Bulk Density are generally high in Reclaimed Areas but low in farmlands occurring outside the forest boundary (Figure. 4-17, Annex 8). The highest SOC occur in previously Reclaimed Kass FM (3.34%), followed by the forest near Chepalungu area with the lowest occurring in forest sector near Nkoben area (Annex 8). The forest near Chepalungu area recorded higher BLD than its counterpart in Nkoben area (Annex 6). Relatively high average CEC occur in forest and farmland sector but low occurrence was observed in Reclaimed Areas. Nkoben forest, in particular, has very high CEC in the western Maasai Mau; almost twice the value of CEC measured in its counterpart in Chepalungu area. This is followed by CEC values in NKoben farmland. The Reclaimed Area has generally low CEC measurement; however, Chepalungu and Toltol has relatively high CEC than its counterparts in the area (Annex 8). The chemical properties of the soil sampled are relatively high in the forest than other sectors. Relatively higher pH, Nitrate, Calcium, Magnesium, occur in forest near Nkoben area; this is followed by the forest near Chepalungu area (6.76). While, Potassium and Sodium are relatively high in forest near Chepalungu followed by the forest in Nkoben are (Annex 8). Reclaimed areas generally has relatively low levels of pH, Nitrate, Calcium, Magnesium, Potassium and Sodium.

The association of soil properties was assessed on a wider landscape of the project area. The physical properties SOC correlates positively with soil Bulk Density (R=0.30) but correlates negatively with CEC (R=-0.46). The increase of BLD is associated with the decrease in CEC (R=-0.71) in the soil. However, these physical properties apparently has influence on the chemical properties of the soil on the landscape. For instance, the increase of SOC is associated with decrease in pH (R=-60), Nitrate (R=-0.24), Calcium (R=-0.49) and Magnesium (R=-0.39). However this increase relates with the increase in Potassium (R=0.56) and Sodium (R=0.39). Increase of BLD is negatively and strongly associated with Nitrate (R=-0.84), Magnesium (R=-0.81) and Calcium (R=-0.56), Potassium (R=-0.26), pH (R=-0.22) but positively and weakly by Sodium (R=-0.27). While increase of CEC is largely associated with strong increase in pH (R=0.73), Nitrate (R=0.92), Calcium (R=0.89), Magnesium (R=0.90) and weak increase in Sodium (R=0.27). While its increase is associated with the strong decrease in Potassium (R=-1.00).





Figure 4-20 – Measurements of soil physical and chemical properties in different sectors in western Maasai Mau Forest. 4(a) – Soil Organic Carbon, 4(b) – Soil Bulk Density, 4(c) – Cation Exchange Capacity, 4(d) – Soil pH, 4(e) – Soil Nitrate (NO3-N), 4(f) – Magnesium, 4(g) – Potassium, 4(h) – Sodium, and 4(i) – Calcium.



# 4.4 Socio-economic Baseline

The socio-economic baseline draws on a range of primary data collected for the purpose of the ESIA for the proposed Project, and publically available secondary data (where available). In order to provide further context to the baseline, commentary is also provided at a national and regional/district level. A combination of research methods was utilised to collect both quantitative and qualitative data and included:

- Review of secondary data;
- Key Informant Interviews (KII) with various stakeholders;
- Focus Group Discussions (FGDs);
- Barazas (stakeholder consultation meetings)
- Transect walks; and
- Examination of satellite imagery to identify areas of sensitivity.

This chapter presents an overview of the social receiving environment within the Study Area of the proposed electric fence alignment. For the purposes of this chapter, the term 'social' will include:

- Formal and informal settlements (including temporary and permanent human residents with both formal and informal tenure of land/structures);
- Population dynamics including population size, structure, settlement patterns and migration;
- Tangible and intangible cultural heritage sites and items,
- Social infrastructure including both tangible (i.e. schools, community centres, electricity and potable water services);
- Livelihoods, formal and informal businesses; and
- Community health, safety and security (including wellbeing).

# 4.4.1 *The objectives of the socio-economic baseline study are to:*

- Understand the existing environmental and socio-economic context, and provide a benchmark of pre-project conditions to help predict proposed Project induced changes and inform impact predictions (positive and negative), and assessments of the ability of social receptors to benefit from, adapt to and/or accept change;
- Provide comparative data, so that the proposed Project affected areas can be compared to national and regional/district averages and, where appropriate, each other;
- Understand the existing socio-economic development context in the Study Area and the extent to which the proposed Project supports and is aligned with conservation;
- Feed into proposed Project design and customizing of mitigation measures;
- Provide a basis for monitoring from which to evaluate actual residual impacts, and the success of mitigation measures following implementation;



- Identify individual stakeholders and stakeholder organizations that may have roles and responsibilities with regard to implementation of the proposed Project (e.g. local administrators, politicians and development NGOs) as well as stakeholders who are sensitive to the proposed Project or able to support in the implementation of information disclosure and mitigation measures;
- Inform project developers on how best to distribute information and collect feedback from stakeholders;
- Provide a context for understanding feedback from stakeholders, specifically verifying what is reported by stakeholders and beginning to understand the differences between stakeholders' perceptions of impacts and actual impacts; and
- Better understand the local context, potential vulnerabilities and stakeholder perceptions.

This section will thus present the socio-economic characteristics of the receiving environment and is structured as follows:

## 4.4.2 Location and Administrative Structure

• Formal Administrative Structure

The Government of the Republic of Kenya (GoK) is the national government of the republic of Kenya which is composed of 47 Counties, each county with its own semiautonomous governments. The current structure of government allows power to be held on two levels: the national level and the county level. This allows the Counties of Kenya a form of autonomy.<sup>2</sup>



Figure 4-20: Basic organizational Structure of a county Government

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<sup>&</sup>lt;sup>2</sup> https://en.wikipedia.org/wiki/Government\_of\_Kenya



The Counties are further divided into constituencies and wards. **Error! Reference source not ound.** shows the administrative description of the proposed fence alignment which constitutes the project area.

# 4.4.3 Land Tenure and Ownership

According to the Kenyan Constitution (Chapter 5 Sections 60 – 68), land is classified into public, private and community and that all land in Kenya belongs to the people collectively as a nation, communities and individuals.

## Public Land in Kenya

Public land in Kenya refers to land alienated by the **Kenya Government**, used or occupied by a State organ, which no individual or community ownership can be established, minerals and mineral oils, Government forests, and game reserves.

Other land in Kenya that fall into this category are water catchment areas, **national parks**, Government animal sanctuaries, **roads**, **rivers**, **lakes** and other water bodies, the territorial sea, the exclusive economic zone and the sea bed. The continental shelf, land between the high and low water marks and any land not classified as private or community land also fall in this category.

In Kenya, public land is held in trust for the people by a **county government** and administered on their behalf by the **National Land Commission**.

Other pieces of land are held by the national government in trust for the people and administered on their behalf by the National Land commission.

# Community land in Kenya

Community land in Kenya is be held by communities on the basis of ethnicity, culture or similar interest. Community land comprises land registered in the name of group representatives, transferred to a specific community and land held, managed or used by communities as community forests, grazing areas or shrines.

Other pieces of land that fall under community land are ancestral lands and those traditionally occupied by hunter – gatherer communities, held as trust land by the county governments.

# Private land in Kenya

Private Land in Kenya consists of land held by a person under freehold tenure and leasehold tenure.

# Non-citizens in Kenya and Land



A non-citizen can only hold land on leasehold tenure, and the lease cannot exceed 99 years. Any land whose lease was beyond this – like the 999 leaseholds held by some multinational companies or individuals will revert to 99-year leaseholds

# National Land Commission in Kenya

National Land Commission is established by the new Constitution and its functions are:

- Manage public land on behalf of the national and county governments
- Recommend a national land policy to the national government
- Advise the national government on a comprehensive programme for the registration of titles
- Conduct research on land and the use of natural resources.
- Investigate present or historical land injustices, and recommend redress
- Encourage the application of traditional dispute resolution mechanisms in land conflicts
- Assess tax on land and premiums on immovable property and have oversight over land use.

# 4.4.3.1 Land Tenure and Ownership

Land ownership in Narok County is categorized into three main categories namely; community land, trust land and private land. Community land refers the proportion of land held communally and registered as a group ranch. Due to population growth, this type of land ownership is rapidly diminishing.

Trust land is held by the county government on behalf of the people of Narok. This type of land is mainly in urban centres, forest reserve and in Maasai Mara game reserve.

Maasai Mau Forest Block is registered as a trust land under the Trust Land Act (Cap 288)<sup>3</sup>.

# 4.4.3.2 Water Rights

A right to water is the ability to exercise as of right the right which is available to all members of the public to use running water. None riparian owners can only exercise the right to use running water under an agreement with a riparian owner. An agreement providing for access over riparian land is known as an easement. In the absence of an easement non-riparian owner will be committing a trespass if he attempted to exercise the right to use running water. Because the right to use riparian water is shared by all riparian owners, its use must

<sup>&</sup>lt;sup>3</sup> environment.go.ke/ page\_id=6867



be reasonable. No one owner may use the water in a way which prejudices the right of other riparian owners.

The riparian owners right to quantity enables him to abstract, divert, obstruct or impound the water. The water abstracted may be used for ordinary domestic purposes such as drinking, cooking and washing or it may be used for purposes such as irrigation which the common law considers to be extraordinary purposes.

In Kenya, the law on riparian zone protection is not in a piece of a single legislation, the law is fragmented in numerous pieces of legislations like Environment Management and Coordination Act (EMCA) 1999, the Water Quality Regulations (WQR) (2006), Water Resources Management Rules (WRMR) (2007), the Agricultural Act (Cap318), Forest Act, 2005, the Land Act 2012, the Water Act, 2002 and the Wildlife (Conservation and Management) Act 2013 presenting a challenge of overlapping mandates and lack of coordination in enforcement.

# 4.4.4 Demographics in Narok County

From the 2019 population census, the population of Narok County stands at a total of 1,149,379 with 579,042 males, 578,805 females and 26 intersex. Average household size is 4.8 at County level. The density for the county as at 2019 stood at 65 persons per square kilometre, an increase from 47 persons per square kilometre recorded during the 2009 housing and population census<sup>4</sup>.

At Sub County level, population was estimated to be a total of 251,862 with 128,024 males, 123,829 females and 9 intersex in Narok North and a total of 238,472 with 118,441 males, 120,029 females and 2 intersex in Narok South. The densities of Narok North and South subcounties, which Maasai Mau Forest falls, had in 2019, population densities of 72 and 36 persons per square kilometre respectively.

# 4.4.5 Health in the project area

Health services are offered in three tiers namely: tier one which is composed of community, tier two composed of primary health care facilities i.e. dispensaries and health centers and tier three comprises of hospitals. In total, there is one county referral hospital, three sub county hospitals, 6 mission hospitals, 2 nursing homes, 36 health centers, 110 dispensaries and 47 clinics. The services offered are regulated by boards and councils such as Pharmacy

<sup>&</sup>lt;sup>4</sup> <u>https://www.knbs.or.ke/ wpdmpro=2019-kenya-population-and-housing-census-volume-i-population-by-county-and-sub-</u>

county&wpdmdl=5615&ind=Imxt6YbPqb08egvLc6dB498VI5y8GOFG4Dil3nRA6s8K\_mQ0keuV8ANI
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and Poisons Board, Nursing Council, Clinical Officers' Council, Public Health Officers and Public Health Technicians Council, Nutrition and Dieticians Council, among others.

# 4.4.6 *Water sources and sanitation*

The main drainage systems are Lake Victoria South catchment basin and Ewaso Nyiro South drainage area. Rivers in these basins include Mara, Mogor that traverse the county from Mau region through to Kenya-border and into Tanzania draining into Lake Victoria and River Ewaso Ng'iro rising from the Mau Escarpment, draining into Lake Natron respectively.

# • Water Resources and Quality

It is estimated that there are 1,684 water sources in the county among them dams, rivers, water pans, springs and boreholes which are community and private owned. In the whole county only an estimated 8.6 % of households were benefitting from treated water (KNBS 2009). In 2017, about 1,600 households were estimated to have roof catchments systems for harvesting rain water. The average distance people travel in search of water is approximately 2Km in wet seasons. The distance increases to 10 Km during the dry seasons. The areas with the longest distance to the water points are in rural areas where only 7,760 households accessed tap water mainly from protected springs and boreholes. Low flows in rivers and springs have continued to be recorded in the county mainly due to water sources and catchments degradation.

• Sanitation

Lack of a properly developed sewerage system and good drainage system in urban centres such as in Narok Town and Kiligoris is a major threat to good sanitation. Lack of these systems has exposed these towns to risk of disease outbreak especially during the rainy season. Management of waste is not properly organised making the urban centres dirty and posing health challenges. Waste products of about 10 per cent of the households are collected by the local authority, 2 per cent by private firms while 30 per cent of the households use garbage pit.

In 2017, approximately 97,010 of the households in the county used latrines (covered and uncovered) for waste disposal while about 65,360 households relieved themselves in the bush, resulting to outbreaks of water borne diseases such as cholera and diarrhea especially during the rainy seasons. Households in urban areas use pit latrines and septic tanks, which are emptied by Narok Water and Sewerage Company exhauster and private owned exhausters. This has been necessitated by lack of a sewer system, which is a major sanitation problem.

In the project area, the residents use pit latrines.

# 4.4.7 Housing/Settlement

In Narok County, 15% of residents have homes with cement floors, while 84% have earth floors. Less than 1% has tile and 1% has wood floors. Narok North constituency has the highest share of cement floors at 27%. Narok North constituency is 12 percentage points above the county average. Narok Town ward has the highest share of cement floors at 70%.



In Narok County, less than 1% of residents have homes with concrete roofs, while 49% have corrugated iron sheet roofs. Grass and makuti roofs constitute 35% of homes, and 11% has mud/dung roofs. Narok North constituency has the highest share of corrugated iron sheet roofs at 78%. Narok Town ward has the highest share of corrugated iron sheet roofs at 91%. In Narok County, 9% of homes have either brick or stone walls. 75% of homes have mud/wood or mud/cement walls. 10% have wood walls. 3% have corrugated iron walls. 1% has grass/thatched walls. 2% have tin or other walls. Narok North constituency has the highest share of brick/stone walls at 20%. Narok Town ward has the highest share of brick/stone walls at 54%.

During the site visits, it was observed that there were no housing structures within the project area except those near the fence boundary. The housing structures observed were mainly made of wooden walls and corrugated iron sheet roofing.



Plate 4-8: Housing structure observed at Sogoo

#### 4.4.8 Energy access

Just 1% of residents in Narok County use liquefied petroleum gas (LPG), and 2% use paraffin. 80% use firewood and 17% use charcoal. Firewood is the most common cooking fuel by gender with 78% in male headed households and 83% in female headed households.

Narok North has the highest level of charcoal use in Narok County at 36%, and has 19 percentage points above the county average. Narok Town ward has the highest level of charcoal use in Narok County at 69%.

#### 4.4.9 Socio-economic Activities

The main economic activities in the county include pastoralism, crop farming, tourism and trade among other activities undertaken in small scale.



# 4.4.10 Employment

The main employment and income opportunities available in the county are agriculture (crop farming and livestock rearing), trade and tourism. The three sectors dominate the economy of the county and have created income and employment opportunities for majority of youth in Narok.

The main business activities include selling and buying of livestock, produce of main crops (maize, wheat and potatoes) and small retail business. Maasai Mara National Park and Maasai Cultural work of beadwork and attire are also employment and income opportunities for the county residents. The main challenges faced in accessing these employment and income opportunities is majorly lack of capital and inadequate knowledge and skills to expand the sectors and sustain the economy.

Self-employment is the main form of employment in county accounting for more than 60 per cent of all form of employments. One of the determining factors of employment in the county is education level: 8 per cent of the residents with no formal education, 10 per cent of those with a primary education and per cent of those with a secondary level of education or above are working for pay.

Youth unemployment in the county poses a serious threat to the economy. According to Analytical report on Labour Force Dynamics (KNBS, 2012), Narok North (including Narok East), Narok South (including Narok West) and Trans Mara Sub-counties have unemployment rates of 3.8, 3.4 and 2.8 per cent respectively. The county government aims at reducing the unemployment rate in the country by creating income and employment opportunities for the youth through the youth targeted employment creation framework. The private and civil society sectors have also enhanced employment creation for young people and invested in their skills development.

# 4.4.11 Poverty setting and Livelihoods

Nationally, according to the Kenya Integrated Household Budget Survey of 2015/2016, the proportion of population living below the overall poverty line was 36.1%. Survey results showed that 32.0% of the population were living below the food poverty line while 8.6% were found to be experiencing hardcore/extreme poverty. The overall poverty head count was comparatively higher in rural areas (40.1%) than in peri-urban (27.5%) and core-urban areas (29.4%)

Out of the total population (1,078,000) in Narok County, 238,000 people are considered to be poor. Distribution of the poor was found to be 1.6 % with a Poverty Gap of 6.7 % and Severity of Poverty being 3%

The Gini index measures the extent to which the distribution of consumption expenditure among individuals or households within an economy deviates from a perfectly equal distribution. A Gini index of '0' represents perfect equality, while an index of '1' implies



perfect inequality. Narok County's Gini index is 0.315 compared with Turkana County, which has the least inequality nationally (0.283)<sup>5</sup>

Poverty in the county manifests itself in many ways including inaccessibility to health services, food insecurity, inadequate potable water, lack of good and proper clothing, inaccessibility to proper education and landlessness. The main causes of poverty in the county include the poor physical infrastructure that increases the cost of accessing and marketing of agricultural produce; and low returns from coffee, tea and milk which make it difficult for most of the agricultural community to meet their basic needs. Poverty in the county manifests itself in many ways including inaccessibility to health services, food insecurity, inadequate potable water, lack of good and proper clothing, inaccessibility to proper education and landlessness. The main causes of poverty in the county include the poor physical infrastructure that increases the cost of agricultural produce; and low returns from coffee, tea and marketing of agricultural produce; and low returns from coffee, tea and marketing of agricultural produce; and low returns from coffee, tea and marketing of agricultural produce; and low returns from coffee, tea and milk which make it difficult for most of the agricultural produce; and community to meet their basic needs.

# 4.4.12 Education

According to the Narok CIDP<sup>6</sup>, there are public 664 primary schools including 19 special schools with an enrolment of 239,948 across the County. The transition rate from primary to secondary schools stands at 11%. At this level of education, the teacher pupil ratio stands at 1:53.

There are 695 ECDE centres distributed across sub-counties with an enrolment of 69,030 learners. Currently, there are 1,388 ECDE caregivers distributed across county. The ECDE centres have registered a transition rate of 89% and literacy rate of 67%. The teacher pupil ratio currently stands at 1:50.

There is a total of 138 secondary schools; 28 schools in Narok north sub-county, 53 Narok South, 31 in Transmara East and 26 in Transmara West sub-county. The gross enrolment stands at 31,252 against a teaching force of 775. The teacher: pupil ratio stands at 1:40. Transition rate from secondary schools to university is very low at 7%.

# 4.4.13 Cultural sites

The county is host to a number of shrines, sacred places, hills and mountains that are culturally reverenced by the Maa and Ogiek people. During the stakeholder consultations, the participants reported that there were sacred sites within the Maasai Mau forest.

# 4.4.14 Indigenous People and vulnerable groups

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<sup>&</sup>lt;sup>5</sup> inequalities.sidint.net/kenya/wp-content/uploads/sites/2/2013/09/Narok.pdf

<sup>&</sup>lt;sup>6</sup> <u>http://www.narok.go.ke/component/j2store/downloads/getfreefile\_pfile\_id=1082</u>



# Indigenous People

The United Nations refers to Indigenous peoples as inheritors and practitioners of unique cultures and ways of relating to people and the environment. They have retained social, cultural, economic and political characteristics that are distinct from those of the dominant societies in which they live.

The team identified the Ogiek as indigenous people in this project areas during the site visit.

• Vulnerable Groups

According to the World Bank, a vulnerable group is a population that has some specific characteristics that make it at higher risk of falling into poverty than others living in areas targeted by a project. Vulnerable groups include the elderly, the mentally and physically disabled, at-risk children and youth, ex-combatants, internally displaced people and returning refugees, HIV/AIDS- affected individuals and households, religious and ethnic minorities and, in some societies, women.

The vulnerable people in this area were identified as the families that were relocated from the forest.

• Marginalized Communities

Marginalized communities are defined in Article 260 (in line with the World Bank's policy OP4.107) as:

(a) A community that, because of its relatively small population or for any other reason, has been unable to fully participate in the integrated social and economic life of Kenya as a whole;(b) A traditional community that, out of a need or desire to preserve its unique culture and identity from assimilation, has remained outside the integrated social and economic life of Kenya as a whole;

(c) An indigenous community that has retained and maintained a traditional lifestyle and livelihood based on a hunter or gatherer economy; or

(d) Pastoral persons and communities, whether they are – (i) Nomadic; or (ii) A settled community that, because of its relative geographic isolation, has experienced only marginal participation in the integrated social and economic life of Kenya as a whole;

From this criterion defined by the World Bank Policy, the team did not identify marginalized communities in the project areas.

# 4.4.15 Religion in the project area

The residents in the project area are primarily practice Christian religion.



# 5 CONSULTATION AND PUBLIC PARTICIPATION

### 5.1 Overview

Consultation and Public Participation (CPP), is a mandatory requirement for proposed projects as entrenched in the Constitution of Kenya, 2010 and in EMCA 1999 (Amended 2015) Section 58, pursuant to achieving sustainable development. Part III Section 17 of the Environmental (Impact Assessment and Audit) Regulations of 2003, further requires that all ESIA Studies incorporate public consultation, with an aim of ensuring that all parties interested in a proposed project are informed of anticipated project impacts and benefits, and that their views, concerns and recommendations are incorporated in project planning, design, construction, operation and decommissioning phases. The CPP process is further supported by the Kenya Public Participation Bill of 2018.

## 5.2 Objectives of the Stakeholder Consultations

Stakeholder consultations were carried out pursuant to compliance with the legal and regulatory requirements cited above. The specific objectives of the consultations were to:

- Inform the public and the key informants about the proposed electric fencing of the Maasai Mau forest block, as well as the anticipated benefits and effects of the same
- To provide an opportunity for project interested parties to air their views, concerns and recommendations for incorporation into the project designs
- To identify perceived socio-economic and environmental impacts for the various project phases as well as to capture mitigation and enhancement measures from stakeholders.

# 5.3 Stakeholder Identification

Stakeholders were identified on the basis of their interaction with the Mau Forest Complex as whole, and with Maasai Mau block specifically. Over the years, various attempts to reclaim and conserve the Mau complex, which has been termed as one of the five major water towers in Kenya, have elicited mixed reactions from various quarters. Other than the forest-adjacent and the forest-depended communities who were identified as primary stakeholders, other parties who have been involved or outspoken over the forest matters were considered as having a stake in the proposed fencing of the forest. Stakeholders identified were therefore forest-adjacent and forest-dependent communities, State Agencies including the Public Administration, line State Departments and State Corporates charged with environmental conservation and human rights groups.


The public participation process further identified specific groups which were directly dependent on the forests for their livelihoods. These groups are the former settlers who practiced farming, pastoralism, game hunting, bee keeping, and gathering of wild fruits, timber logging and small scale businesses inside the forest. Focus group discussions were held separately with all these groups including, with women and village elders, who were also determined to have been dependent on the forest ecosystem. Typically, women in the African setting are responsible for carrying out household chores and as such, interact with the forest resources directly when looking for water, fuel wood and food. Elders on the other hand are deemed to be knowledgeable on past happenings and cultural practices of their community. The elders consulted cited the forest as an important place for carrying out certain rites and rituals for instance, circumcision.

A total of five (5) public consultation meetings were held covering communities in Nkareta, Nkoben, Olo-Shapani, Sogoo and Sagamien. One stakeholder consultation workshop was convened for key informants drawn from the public sector and civil society including human rights groups. The key informants converged and discussed experiences in similar scenarios, views, approaches, considerations and gave recommendations on the proposed project.

S/No.	Administrativ	Mode of Consultation	Venue	Date	
	e Location				
1.	Nkareta & El	Public Meeting	Nkareta Chief's	6 <sup>th</sup> November,	
	Donyo Nyiro	Focus Group	Office at the	2019	
		Discussions with	Community Social		
		indigenous people	Hall		
		(ogiek), women and			
		pastoralists			
2.	Ol Shapani	Public Meeting	Full Gospel Church	7 <sup>th</sup> November,	
	(Melelo Ward)	Focus Group	Ol Megenyi Market	2019	
		Discussions with	Centre		
		farmers, business			
		persons and			
		indigenous people			
3.	Sogoo	Public Meeting	Adjacent to	8 <sup>th</sup> November,	
			Chebitet Primary	2019	
			School		
4.	Sagamian	Public Meeting	Redeemed Gospel	8 <sup>th</sup> November,	
			Church in	2019	
			Sagamian		

#### Table 5-1: Summary of Details of Stakeholder Consultation Meetings



S/No.	Administrativ	Mode of Consultation	Venue	Date	
	e Location				
5.	N/a	Stakeholders	Mara Frontier	28th November	
		Consultation	Hotel Narok Town	2019	
		Workshop			
6.	Nkoben	Public Meeting	Chepalungu	29th November	
			trading centre	2019	

# 5.4 Approach to the Public Participation

The ESIA Consultant together with the Proponent visited the office of the Narok County Commissioner. This was followed by a meeting with the Narok North and Narok South Deputy County Commissioners. The purpose of the visits was to inform the officials of the Proponent's intention to secure and reclaim the Masaai Mau forest block by way of electric fencing, and of the Environmental and Social Impact Assessment Study being carried out for the same. The team sought the guidance of the D.C.C's in identifying the geographical areas and the various groups that may be impacted by the proposed development.

The team further discussed the need for stakeholder consultations with the D.C.Cs as required by the Constitution of Kenya 2010, the Environmental Management and Coordination Act, 1999 (Amended 2015) and the EIA/EA Regulations of 2003. The Deputy County Commissioners assisted in mobilizing the public for meetings through the Area Chiefs, while ensuring that forest-adjacent and forest-dependent communities, who are primarily the former forest settlers, were part of the consultation forums. Generally, all consultation meetings were well attended (attendance lists appended in Annex).

# 5.5 Incorporation of input from Indigenous Communities

The focus group discussions with each of the various interest groups enabled the Consultant to obtain the groups views, concerns, suggestions, and to assess how the proposed electric fencing of the forest may impact on respective groups.

The nomadic Masaai pastoralists and the Ogiek (Ndorobo) community fit the definition of an indigenous community, as per the Constitution of Kenya, 2010. The interpretation clause in the Constitution defines "indigenous community" to mean a traditional community that, out of a need or desire to preserve its unique culture and identity from assimilation, has remained outside the integrated social economic life of Kenya as a whole, or an indigenous community that has retained and maintained a traditional lifestyle and livelihood based on hunter or gatherer economy; or pastoral persons and communities whether they are nomadic or a



settled community that because of its relative geographic isolation has experienced only marginal participation in the integrated social and economic life of Kenya as a whole.

Separate focus group discussions were held with the Ogiek (Ndorobo) and the Maasai pastoralists and their views in relation to the proposed electric fencing were collected and captured during the consultation exercise.

## 5.6 Summary of Outcomes of Public Consultations

The public consultation exercise yielded varied outcomes. Reactions ranged from willful acceptance and full support for the proposed intervention, to outright hostility and opposition of the project. The Consultant adopted a balanced approach by ensuring that those who supported the project and those who opposed it, both gave their reasons for doing so. It is worth noting that majority of those who opposed the project indicated that they would be willing to support under certain conditions. Since views varied from location to location, the consultation outcomes have been presented as such. For details on proceedings of the consultative meetings, please refer to the minutes and attendance list in annex.

# Key Issues in Sogoo Meeting

The key message from the public consultation meeting held in Sogoo location is that the residents who are largely former forest settlers are contesting that Maasai Mau block is forest land. The residents argued that the block is registered as trust land under the County Government of Narok; Maasai Mau block has never been gazetted as a forest; the former settlers alleged that they are in possession of title deeds which were issued by the government and the government had not revoked them; since residents claimed they hold the valid land tenure documents; it is a violation of their rights to evict them from their homes without any form of compensation. Owing to the cited reasons, the people of Sogoo location unanimously opposed the proposed fencing of the forest block.

Following the strong sentiments put forth by the Sogoo community, the Consultant sought to substantiate the afore-stated claims from the Public Administration and the Proponent. The Consultant learnt that due diligence carried out by State Agencies independent of the ESIA study shows the contrary, leading the State to conclude that the purported tenure documents are not valid. This implies that the sale and purchase of land in the Masaai Mau and issuance of titles was probably in contravention of the law. Please refer to the status document in the Annex for more details.

# Key Issues in Nkoben Meeting

The common message conveyed by the participants of the public meeting in Nkoben location is for the Proponent to consider an alternative that will serve the purpose of reclaiming the forest while also extending economic benefit to forest adjacent communities in the long-term. Nkoben residents felt that electric fencing will not benefit them and therefore proposed that



the proponent incorporates a tea buffer in addition to the fence. They otherwise supported efforts to reclaim the forest.

# Key issues in Nkareta Meeting

The Maasai and the Ogiek communities expressed concern over the benefits that will be forgone if the project is implemented. The Ogiek, reportedly relied on the forest as the primary source of food namely, honey, game meat and wild fruits. The Ogiek, further cited cultural ties with the forest in that, all their cultural rites of passage were conducted within the forest. The Maasai pastoralists on the other hand explained that they have for a long time depended on the forest for pasture for their animals and the fencing would therefore inhibit access. The two communities requested for controlled access to enable them to continue utilizing the forest resource in a sustainable manner.

# Key issues in Olo-Shapani Meeting

The reactions in Olo-Shapani were largely focused around the recently concluded eviction operation. The community alleged that they had nowhere else to go to. Residents inquired if they would be allowed into the forest to harvest their crops and honey when ready. The community called on the government to compensate landowners and to resettle the evictees to avert a humanitarian crisis. The community further requested the government to relook into the demarcation of forest boundary since they disputed where the beacons had been erected.

# Key issues in Sagamian Meeting

The meeting in Sagamian was very tense. The Sagamian community alleged that evictees were in possession of valid land tenure documents issued by the Government, and that the concluded eviction operation was therefore a violation of their human rights. The community has reportedly lodged four cases against the government in relation to land tenure and boundary issues. The community further decried the directive from the Deputy County Commissioner prohibiting them from setting up Internally Displaced Persons camps. Participants opined that public consultation should have also been conducted prior to the evictions. Most of the participants declined to register attendance of the meeting and said that they perceived the proposed project as an attempt by politicians to frustrate the area residents.

Similar to Sogoo location where locals alleged that they are bonafide owners of individual parcels in the forest and are in possession of valid land tenure documents, due diligence carried out by State Agencies independent of the ESIA study shows the contrary, leading the State to conclude that the purported tenure documents are not valid. This implies that the sale and purchase of land in the Masaai Mau and issuance of titles was probably in contravention of the law. Please refer to the status document in the Annex for more details.



## 5.7 Summary of Outcomes of Key Informant Consultations

The ESIA convened a key informant consultation workshop on the 28<sup>th</sup> November 2019 in Narok County. Participants were drawn from the Proponent, relevant State Departments, state corporates with mandate in environmental conservation, civil society organizations, including civil rights groups. The main aim of the forum was to provide a platform for key informants to share experiences in similar scenarios, give their views on the proposed project, suggest sustainable approaches and recommend impact mitigation and enhancement measures for consideration by the Consultant and the Proponent. The workshop participants unanimously supported the proposed project since they perceived it as conservation oriented with a potential of reclaiming the degraded forest and restoring the undermined ecosystem services that previously emanated from the forest. Majority opined that the intervention is long overdue and urged the Proponent to ensure that the approach is community-driven to ensure sustainability.

Additional input from the forum recommended that the proposed fencing should commence in the less problematic areas and advance towards the less receptive areas so that the idea can be bought by the communities opposing the project. The meeting urged the Proponent adopt a two-pronged approach by connecting the same power line for the fence to community facilities such as hospitals or school. This will extend the benefits to the community while instilling a sense of ownership of the fence, since any attempts to sabotage would imply interference with the community. The stakeholders called for capacity building of the community to conserve the forest by way of training on participatory forest management plans, constitution of community forest associations, hiring locals to provide labor during tree planting, procuring seedlings from local nurseries and awarding project tenders to local Contractors. The stakeholders opined that this approach will generate community buy-in and promote sustainability, without which, there is a risk of the fence being wrongly perceived as anti-community.

Stakeholders further urged the Proponent to pursue the gazettement of the Maasai Mau block to avert any future controversies. The *Ogiek* People's Development Program representatives on their part advocated for delegation of conservation responsibilities to the *Ogiek* community while arguing that the *Ogiek* way of life is harmless to the forest ecosystem and that they have embraced environmental conservation since time immemorial.



# 6 IMPACT ASSESSMENT AND MITIGATION

## 6.1 Methods for Assessing Impacts

Assessment of potential environmental and social impacts of the proposed project involves several steps that assess the manner in which the project will interact with the environmental components; physical, biological, cultural or human environment to generate impacts to receptors. The steps described below were followed in assessing the potential impacts of the proposed project.

# 6.1.1 Definition and Classification of Environmental Impacts

An impact is any change to a resource or receptor brought about by the presence of a project component or by the execution of a project related activity. The evaluation of baseline data provides crucial information for the process of evaluating and describing how the project could affect the biophysical and socio-economic environment.

For an impact to occur there must be an interaction between Project activity and a receptor. The project activity is defined as: A physical action or presence of infrastructure associated with the operation of Project plant, equipment or vehicles, or the actions of Project employees. While receptor represent someone or something that could be influenced by the Project, including human health, water resources, air quality, ecological habitats or species, cultural heritage assets, and the wider environment.

Project activities were identified through a review of the Project documents (layouts and BoQs) provided by the Proponent. The description of project including the activities to be undertaken is provided in Chapter 2 of this ESIA Report. The potential impacts were identified based on the details of Project activities and their potential interactions with the surrounding environment (and physical, ecological, and/or human receptors). This also required an understanding of the potential sources of impacts and impact pathways, and was supported by:

- An understanding of baseline conditions and potential receptors;
- The spatial and temporal extent of the Project Area of Influence;
- Information from stakeholders, including authorities, experts, and the public; and
- Professional knowledge and experience of comparable projects or developments.

Impacts are described according to their nature or type as presented below:

## Impact Nature

• *Positive impact-* An impact that is considered to represent an improvement on the baseline condition or introduces a positive change.



 Negative impact- an impact that is considered to represent a deterioration of baseline condition or introduces a negative change

#### Impact Type

- Direct impact an impacts that results from a direct interaction between a proposed project activity and the receiving environment/receptors (e.g. an effluent discharge and receiving water quality).
- Indirect impact- Impacts that result from other activities that are encouraged to happen as a consequence of the Project (e.g. in-migration for employment placing a demand on resources).
- *Cumulative Impacts-* Impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project.

## 6.1.2 Impact Assessment Scoring and Significance

In assessing significance of potential impacts, two factors; magnitude of the impact and sensitivity of the receptor were taken into consideration as shown by tables 6-1 and 6-2.

#### Impact Magnitude

The magnitude of an impact is a measure of change from the baseline condition and can be described in terms of:

- *Extent:* spatial extent (e.g. area impacted) or population extent (e.g. proportion of the population / community affected) of an impact;
- *Duration*: how long the impact will interact with the receiving environment;
- *Frequency*: how often the impact will occur; and
- *Reversibility*: how long before impacts on receptors cease to be evident

In order to provide a structured description of impact magnitude, a qualitative scale was applied, ranking the magnitude of change as negligible, low, moderate, or high developed for each of the magnitude characteristics.

The magnitude of change has been defined in Table 6-1 below.

#### Table 6-1:Magnitude of Change Scale

	Magnitude of	Description of change
	cnange	
		Minimal detectable changes in baseline resource.
1	Negligible	Changes are either of short duration or infrequent periodicity, such
		that direct control is not required to manage potential impact.
		Detectable change to the baseline conditions or resource.
2	Τ	During construction and operations there would be ongoing
2	Low	change in the underlying characteristics or quality of the baseline conditions.



3	Moderate	Degree of change is such that loss of, or adverse alteration to, the baseline conditions of a specific environmental resource would occur. Post development characteristics or quality would be partially changed during construction and operational phases.
4	High	Degree of change is such that total loss of, or adverse alteration to, the baseline conditions of a specific resource would occur. Post-development characteristics or quality would be fundamentally and irreversibly changed.

Receptor Sensitivity

Receptor sensitivity is the degree to which a particular receptor is more or less susceptible to a given impact. Receptor sensitivity takes into consideration receptor **resilience** and **value**.

**Receptor resilience** (or conversely, vulnerability) describes the ability of the receptor to withstand adverse impacts. It takes into consideration not only activity-impact-receptor pathways, but also environmental characteristics of the receptor that might make it more or less resilient to change. As such, a receptor can be considered as existing within a spectrum of 'vulnerable' to 'resilient', with the former more likely to experience significant impacts as a result of a given change.

**Receptor value** takes into consideration its quality and its importance as represented, for example, by its conservation status, its cultural importance and / or its economic value. It recognises that, for a given magnitude impact, different receptors (either directly or indirectly) may be deemed to be of greater importance and as such the significance of the impact is greater than the impact magnitude alone. Similar to the approach adopted for impact magnitude, a structured description of receptor sensitivity employed a qualitative category scale of negligible, low, moderate, and high for each of the sensitivity characteristics, resilience and value.

Receptor sensitivity has been defined in Table 6-2.

	Sensitivity of receptor	Description of receptor
1	Minor	Low importance/receptor with low sensitivity; Abundant; Local importance or scale; Resilient to change; Potential for substitution within the local area.
2	Medium	Low to medium importance/receptor with low to medium sensitivity; Relatively abundant; Regional important or scale; Reasonably resilient to change; Potential for substitution.

#### Table 6-2: Receptor Sensitivity Scale

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	Sensitivity of recentor	Description of receptor		
	orreceptor	Medium to high importance (recentor with medium to high		
		Medium to high importance/receptor with medium to high		
3	High	sensitivity; Relatively rare; National importance or scale; Fragile and		
	-	susceptible to change; Limited potential for substitution.		
		Very high importance/receptor with very high sensitivity;		
4	Very High	Extremely rare; International importance or scale; Very fragile;		
		Highly susceptible to change; Very limited potential for substitution.		
Note: the scale combines the description of the receptor together with its geographic extent				
The general descriptions used in this table have been developed for each environmental				
aspe	ct, taking into a	ccount the relevant performance standards that are applicable.		

Assessment of the impact significance was done for both pre-and post-mitigation scenarios. The significance matrix (Table 6-3) provides basic guidance for the determination of impact significance; however, the resulting significance level was also interpreted based on professional judgement and expertise, and the definitions provided in



## Table 6-4, and adjusted if necessary.

## Table 6-3: Impact Significance

		Receptor Sensitivity (Vulnerability and Value)					
		Negligible	Low	Moderate	High		
Impact Magnitude	Negligible	Not	Not significant	Not significant	Not		
(Extent,		Significant			significant/10w		
frequency, reversibility and duration)	Low	Not significant	Low	Low/moderate	moderate		
,	Moderate	Low	Low/moderate	moderate	High		
	High	Low	moderate	High	High		



#### **Table 6-4: Impact Definition**

Impact	(1) Impact Significance	(2) Description
(3) Adverse Impacts	High	(4) Impacts with a "High" significance are likely to disrupt the function and value of the resource/receptor, and may have broader systemic consequences (e.g. ecosystem or social well-being). These impacts are a priority for mitigation in order to avoid or reduce the significance of the impact.
	Moderate	(5) Impacts with a " <b>Moderate</b> " significance are likely to be noticeable and result in lasting changes to baseline conditions, which may cause hardship to or degradation of the resource or receptor, although the overall function and value of the resource or receptor is not disrupted. These impacts are a priority for mitigation in order to avoid or reduce the significance of the impact.
	Low	(6) Impacts with a " <b>Low</b> " significance are expected to be noticeable changes to baseline conditions, beyond natural variation, but are not expected to cause hardship, degradation, or impair the function and value of the resource or receptor. However, these impacts warrant the attention of decision-makers, and should be avoided or mitigated where practicable.
	Not significant	(7) " <b>Not significant</b> " impacts are Impacts that are indistinguishable from the baseline or within the natural level of variation. These impacts do not require mitigation and are not a concern of the decision-making process.

#### 6.2 Potential Physical Impacts and Mitigation Measures

#### 6.2.1 Air Quality

#### 6.1.2.1 Construction Phase Project Activity

During construction, the primary contributors to air emissions would arise from mobile and/or stationary sources, such as on- and off-road vehicles, diesel generation sets and use of heavy equipment. These sources are anticipated to generate combustion related emissions such as NOx, SOx and fine particulates. However, they will be in small quantities since light construction activities are expected, mainly associated with the construction of access road. Fugitive dust arising from land/vegetation clearing and transportation materials along unpaved access roads may impact air quality as well.

The construction of the fence and access road may result in an increase in air pollution due to site clearing, dust, and vehicular exhausts.

According to IAQM Guidance on Construction Impact (2012), the risk of dust emissions from a construction site causing loss of amenity and/or health or ecological effects is related to:



- the activities being undertaken (demolition, number of vehicles and plant etc.);
- the duration of these activity;
- the size of the site;
- the meteorological conditions (wind speed, direction and rainfall);
- the proximity of receptors to the activity;
- the adequacy of the mitigation measures applied to reduce or eliminate dust; and
- the sensitivity of the receptors to dust

The quantity of dust emitted from construction activities will be related to the area of land being worked and the level of construction activity (nature, magnitude and duration). Emissions from construction vehicles passing over unpaved ground can be particularly important. These will be related to the silt content of the soil (defined by the US Environmental Protection Agency as particles smaller than 75 micrometres [µm] in diameter), as well as the speed and weight of the vehicle, the soil moisture content, the distance covered and the frequency of vehicle movements.

The main effect of any dust emissions, if not mitigated, could be annoyance due to soiling of surfaces, particularly windows, cars and laundry. However, it is normally possible, by implementation of proper control, to ensure that dust deposition does not give rise to significant adverse effects, although short-term events may occur (for example, due to technical failure or exceptional weather conditions)

## **Impact Assessment and Significance**

The significance of air quality impacts is determined based on professional judgement taking into account the sensitivity of the receiving environment.

Sensitive receptors of air and emissions were identified by use of satellite image and observation during field visit to project site. The distances from a source that dust impacts can occur is highly site specific and will depend on the extent and nature of incorporated mitigation measures, prevailing wind conditions, rainfall and the presence of natural screening. Due to the variability of the weather, it is impossible to predict what the weather conditions will be when specific construction activities are being undertaken. Therefore, the assessment of construction dust impacts is typically qualitative.

The IAQM Guidance on the assessment of dust from demolition and construction (2014) sets out 350 m as the distance from the site boundary and 50 m from the site traffic route(s) up to 500 m of the entrance, within which there could potentially be nuisance dust and PM10 effects on human receptors. For sensitive ecological receptors, the corresponding distances are 50 m in both cases. These distances in the guidance were set to be deliberately conservative.

Receptor sensitivity to dust impacts, assuming that there is no mitigation (thereby identifying risk) is determined in accordance with the classification criteria presented in



Table 6-5.

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#### Table 6-5: Receptor Sensitivity Classification (Air Quality)

High	Moderate	Low	Negligible
Hospitals and clinics	Residential and Commercial areas, schools	Farmland	Industrial

Table 6-6 provides distance criteria upon which the receptor sensitivity to dust impacts from the construction phases have been determined.

Table 6-6: Criteria for Determining Significance (Air Quality)

		Distance to construction site						
		0-50m	50-100m	100-200m	200-500m			
Receptor	High	High	High	Moderate	Low			
Sensitivity								
Classification	Moderate	Moderate	Moderate	Low	Low			
	Low	Moderate	Low	Low	Low			
	Negligible	Negligible	Negligible	Negligible	Negligible			

Baseline

The Project will be located within Narok North and Narok South sub-counties. The subcounties are largely rural. The main land use activity in the sub-county is agriculture, mainly crop farming. Sensitive receptors within 500 meters of key construction areas have been identified using satellite imagery. Based on the observations made during walk through of the project area, all structures identified within this distance have been assumed to be residential. The ecological receptor within this distance is the MMF.

#### Construction phase impact significance

Table 6-7 below presents the significance of dust impacts anticipated from the activities associated with the proposed project during construction phase pre-mitigation.



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Activity	Potential Dust Generating Activities	Dust Raising Potential	Site	Average Distance from the receptor	Impact Magnitude	Receptor Sensitivity	Overall Significance Pre- Mitigation	Mitigation Measures	Overall Significance Post- Mitigation
Construction of the	<ul> <li>Excavation works,</li> </ul>	Medium	Nkareta	24161	Moderate	Moderate	Moderate	<ul> <li>Spraying water on soil before excavation and periodic access</li> </ul>	Negligible
electric fence	Transportation     and handling of		Sogoo	23-100	Moderate	Moderate	Moderate	road wetting to reduce nuisance dust levels.	Low
	soil and		Melelo	14-179	Moderate	Moderate	Moderate	<ul> <li>Visual inspection of dust pollution from roads and the</li> </ul>	Low
	construction materials		Olpusimoru	946	Moderate	Moderate	Moderate	construction site and appropriate intervention if dust levels are	Negligible
Con     con     cate     off     sid     dra	<ul> <li>Concrete mixing</li> <li>construction of catch-water, cut- off and side/mitre drains</li> </ul>		Olokurto	15-204	Moderate	Moderate	Moderate	<ul> <li>high.</li> <li>Speed restriction of construction vehicles to a speed of 30 km/h or less on the site and on the access roads to the site.</li> <li>Maintenance and servicing of machines and engines off-site.</li> </ul>	Low
Construction of Access	Excavation works,	High	Nkareta	24161	Moderate	Moderate	Moderate	<ul> <li>Grievance procedure for dust complaints.</li> </ul>	Negligible
Road	Transportation and handling of		Sogoo	23-100	Moderate	Moderate	Moderate	• The use of appropriate Personal Protective Equipment (PPE) such	Negligible
	soil and construction material		Melelo	14-179	Moderate	Moderate	Moderate	as dust masks, in particular, for construction workers.	Negligible
			Olpusimoru	946	Moderate	Moderate	Moderate	• All construction materials will be transported in designated trucks	Negligible
			Olokurto	50-100	Moderate	Moderate	Moderate	which will be covered.	Low

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## **Residual Impact**

As presented in table 6-7 above, it is evident that with the implementation of the proposed mitigation measures, it is expected that the overall significance of dust impacts will reduce further to range from low to negligible levels.

## 6.2.1.1 Operation Phase

The Project is not considered to have the potential to cause significant long term air quality impacts. Vehicular access to these sites for maintenance and operational purposes will be minimal, hence emissions from such vehicles will be negligible as they are not anticipated to exceed the Kenyan Ambient Air Quality Standards hence no further assessment was done. There are also no potentially significant emission sources associated with other operational elements of the fence.

## 6.2.1.2 Decommissioning Phase

The project is expected to have an operational life of over 30 years. In the event of decommissioning of the Project, it is likely that any potential air quality impacts would be similar to those in the construction phase, as broadly similar activities would be required and therefore impacts on air quality associated with this phase

## 6.2.2 Noise and Vibration

The noise levels produced by construction activities would vary widely, depending on the specific equipment being operated at the time. The potential sources of air emissions noted in section 6.2.1 above also expected to be the sources of noise and vibration.

## 6.2.2.1 Legislative Background

#### • National Legislation

In Kenya, the legal instruments related to noise are: The Environmental Management and Coordination Act, 1999 its subsidiary legislation, Noise Pollution and Excessive Vibration of 2009. The later sets the maximum permissible levels (Table 6-8) for noise from various sources and zones such as construction sites, residential and commercial areas.

Facility		Maximum Noise Level Permitted (Leq) in dB (A)		
		Day time (0700 to 2200)	Night time (2200 to0700)	
(i)	Health facilities, educational institutions, homes for disabled	60	35	
(ii)	Residential	60	35	
(iii)	Areas other than those prescribed in (i) and (ii)	75	65	

#### Table 6-8: Noise Limits for construction activities

• *WB/IFC EHS Guideline* 



The International Finance Corporation (IFC) has developed a thorough programme of pollution prevention and management techniques in order to ensure that projects funded by the organization are environmentally and socially responsible. Table 6-9below presents the noise level limit values in the IFC Environmental, Health and Safety (EHS) Guidelines that are relevant to the Project.

Table 6-9: World Bank Group /	/ International Finance	Corporation Noise Limit	Values
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Specific Environment	Noise Level (Leq) in dB			
	Day time (07:00 to 22:00)	Night time (22:00 to07:00)		
Residential educational or institutional	55	45		
Industrial or commercial	70	70		

Operation of machines, trucks during construction phase creates noise pollution. From literature, 8-12 tons loaded trucks have noise level of 91-98 dBA; excavator: 90-96 dBA; air pressed driller: 94dBA. The average noise level of machines is around 72-80dBA in the distance of 120-200m.

Construction of the will generate noise but is not expected to exceed the background noise levels, therefore the operational noise and vibration are considered negligible.

# 6.2.2.2 Assessment of Impact Significance

## • Sensitivity Criteria

Table 6-10 gives criteria used to determine the value of the noise environment at a receptor. For this assessment, it is necessary to consider how the intrinsic characteristics of a receptor define its intrinsic environmental value/sensitivity.

The vast majority of receptors that could be affected by the proposed development are dwellings that would be considered to have 'high' environmental value on the basis that:

- people in dwellings have a low ability to absorb increases in noise and vibration without affecting the enjoyment of their dwelling
- people in dwellings are particularly susceptible to increases in noise and vibration because it may stop activities permanently.

Table 6-10: Sensitivity/Environmental Value Criteria (Noise and Vibration)

Receptor Value (Sensitivity)	Receptor Type Definition
High	Health facilities educational home for disabled
lingh	riealur facilities, educational, nome for disabled
Moderate	Residential,
Low	Farmland

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## Negligible

Others (Industries)

#### • Impact magnitude

Table 6-11 below provides criteria upon which the magnitude of noise impact from the construction phases have been determined. The noise bands (i.e. change in noise) defined for short term increases have been considered for applicable to construction noise.

Table 6-11: Sensitivity	/Environmental	Value Criteria	(Noise and	Vibration)
			<b>(</b>	

Magnitude	Typical Criteria Descriptors	Short-term increase (noise
		in band in dB)
High	Loss of resource and/or quality and	+5.0
	integrity of resource; severe damage to key	
	characteristics, features or elements	
Moderate	Loss of resource, but not adversely	3.0-4.9
	affecting the integrity; partial loss	
	of/damage to key characteristics, features	
	or elements	
Low	Some measurable change in attributes,	1.0-2.9
	quality or vulnerability; minor loss of, or	
	alteration to, one (maybe more) key	
	characteristics, features or elements	
Negligible	Very minor loss or detrimental alteration	0.1-0.9
	to one or more characteristics, features or	
	elements	
No change	No loss or alteration of characteristics,	0.0
	features or elements; no observable impact	
	in either direction	

• Impact significance

The significance has been determined by the interaction between the magnitude of impacts and the sensitivity of receptors affected, as depicted in the significance matrix shown in Table 6-12. In this assessment all receptors that could be affected by the proposed development are assumed to have high environmental value. Therefore, tables describing the significance of effects are for receptors having high environmental value.



Magnitude of Impact	Sensitivity of receptors with high environmental value						
	High	Moderate	Low	Negligible			
High	High	High	Moderate	Low			
Moderate	High	Moderate	Moderate	Low			
Low	Moderate	Moderate	Low	Negligible			
Negligible	Low	Low	Negligible	Negligible			
No change	Negligible	Negligible	Negligible	Negligible			

#### Table 6-12: Criteria for Determining Significance (Noise and Vibration)

For this assessment, the categories of significance are applied to the qualitative assessment of noise impacts.

#### 6.2.2.3 Baseline

The settlement in project areas are characteristic of rural settlement, where the main sources of noise are agricultural activities. The existing ambient noise levels can be considered to be low. For this reason, the study areas are classified as being noise sensitive areas.

# 6.2.2.4 Construction Phase

#### **Project Activity**

The potential sources of air emissions noted in section 6.2.1 above are also expected to be the sources of noise and vibration. The noise levels produced by construction activities would vary widely, depending on the specific equipment being operated at the time. The likely effects of noise will depend on the following factors:

- Distance from source to receiver;
- Sound power levels of the activity
- Duration of works
- Operating times of powerhouse
- Nature and extent of mitigation measures

In addition to the above, it is generally accepted that noise effects are limited to within 200 m of the source. As such, the assessment of construction noise has been limited to receptors up to this distance.

Noise effects during the construction phases have been assessed from a qualitative perspective using a risk-based approach to determine the likelihood of emissions resulting in nuisance. This has included consideration of the construction activities proposed and the



sensitivity of local receptors. Mitigation measures will be proposed in following sections, where appropriate, based on the level of risk identified and in accordance with best practice guidance.

The following table presents calculated noise due to construction activities of the proposed project. The methodology used in the calculation is set out in ISO 9613-2:1996: Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation (ISO, 1996) contained in BS5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites.

Part 1: Noise of the British Standard 5228 (BS 5228-1) provides suitable methods for the calculation of noise from construction activities, including basic information regarding noise levels from a range of construction equipment. For the calculation of construction noise at the receptor locations the selected A-weighted sound power levels (indicating the total acoustic energy that a piece of equipment radiates to its environment) of the plant and equipment are corrected so to consider; the 'Percentage On-time' (portion of time in which the equipment is operating at its maximum power), 'Duration of Activity' (amount of time in relation to the 'Shift Duration' in which the equipment is expected to operate), distance between sound sources and receptors, percentage of soft ground and any screening corrections from obstacles between the propagation path of the sound The proposed standard working hours that have been considered for the calculations are 07:30 to 16:30 Monday to Friday only. The proposed construction hours cover nine hours of the daytime reference period. No work activity is proposed during the night-time reference period and at any time during Weekends or Public Holidays.

Construction Activity	Equipment	A-weighted SPL LAeq,10m dB for continuous operation	Utilisation during working day %	Overall construction noise level dB at 50, 100 and 200 Meters		
				50	100	200
Construction of access Road	Excavator	77	50	59	52	44
	Lorry	80	50	62	55	47
	Sub-total			63	56	48
Construction of Electric Fence	Excavator	77	50	59	52	44
	Concrete Mixer	85	50	67	60	52
	Sub-total			67	60	52

Table 6-13: Predicted Construction Noise Impact at 50, 100 and 200 meters from the Source

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Google Earth image of the project area was used to derive information on the nearest receptors to principal construction sites and is presented in the Table 7-14 below.

## Construction phase impact significance

Table 6-14 below presents the significance of noise impacts anticipated from the activities associated with the proposed project during construction phase pre and post-mitigation.



Table 6-14: Noise and Vibration Impact Significance Pre-Mitigation for Construction Phase

Activity	Potential Noise Generating Activities	Noise Raising Potential	Site	Average Distance from the receptor	Threshold	Overall noise level at the receptor	Impact Magni tude	Receptor Sensitivity	Overall Significan ce Pre- Mitigation	Mitigation Measures	Overall Significanc e Post- Mitigation
Construction of the electric fence	Construction • Excavation of the electric works,	Medium	Nkareta	946	60		Moder ate	Moderate	Moderate	Conduct construction activities	Negligible
	ion and handling of		Sogoo	23-100	60	71	Moder ate	Moderate	Moderate	during day time; • Select	Low
soil and constructio n materials		Melelo	0-50	60		Moder ate	Moderate	Moderate	equipment with lower sound power	Low	
	<ul> <li>Concrete mixing</li> <li>constructio</li> </ul>		Olpusimor u	946	60	81	Moder ate	Moderate	Moderate	<ul> <li>Install silencers for fans used by</li> </ul>	Negligible
	n of catch- water, cut- off and side/mitre drains		Olokurto	0-50	60		Moder ate	Moderate	Moderate	<ul><li>construction machinery;</li><li>Restrict engine idling of equipment</li></ul>	Low
Construction of Access Road	Excavation works,	High	Nkareta	946	60		Moder ate	Moderate	Moderate	<ul> <li>Regular maintenance of</li> </ul>	Negligible
	Transportation and handling of soil and		Sogoo	23-100	60	75	Moder ate	Moderate	Moderate	construction equipment	Negligible
			Melelo	0-50	60		Moder ate	Moderate	Moderate		Negligible

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construction	Olpusimor	946	60	85	Moder	Moderate	Moderate	Negligible
materials	u				ate			
	Olokurto	50-100	60		Moder	Moderate	Moderate	Low
					ate			

#### **Residual Impact**

Following mitigation, it is expected that residual impacts will be of low to negligible significance and will be of limited duration.

The implementation of grievance mechanism will ensure the reporting and recording of any noise impact and associated complaints in the project area. In the event of a received complaint the noise monitoring will be performed at the subject locations.





# 6.1.2.2 Operation Phase

The Project is not considered to have the potential to cause significant long-term noise quality impacts. During operation phase, the potential sources of noise are the operation vehicles. The noise from the vehicles will be intermittent occurring only when the engines are running. With the proper maintenance of operation vehicles, the noise levels reaching the nearby receptors is expected to be negligible.

# 6.1.2.3 Decommissioning Phase

The project is expected to have an operational life of over 30 years. In the event of decommissioning of the Project, it is likely that any potential noise and vibration impacts would be similar to those in the construction phase, as broadly similar activities would be required and therefore impacts on noise and vibration associated with this phase are considered to be of a similar nature.

## 6.2.3 Solid Waste

## 6.1.2.4 Construction phase <u>Project Activity</u>

Wastes will be generated in all phases of the project; construction, operational and decommissioning phases. The likely waste types from the construction phase include:

- Excavation spoil associated with construction of access road and drilling holes for the posts
- Concrete and concrete washings from concrete mixers required for the setting the posts in the holes
- wire scrap associated with fence
- Non-ferrous scrap associated with fencing and other construction
- Waste oil and lubricants from turbine installation and vehicle maintenance / repair
- Oil contaminated cloths from turbine installation and vehicle maintenance / repair
- Packaging and pallets from deliveries
- Domestic waste, including glass, plastics, paper and cardboard
- Batteries
- Broken posts



## **Impact Assessment and Significance**

Impact significance as a result of waste arising from the Project has been determined based on a function of the expected sensitivity of the receiving environment / receptor(s) to waste related impacts and the resultant magnitude of any identified impact on the receiving environment / receptor(s).

Impacts of waste on the environment occurs due to mismanagement. The sensitivity and magnitude approach has been adopted in order to demonstrate the different expected outcomes and impacts associated with waste arising in the non-management / management strategy scenarios.

The criteria for determining sensitivity and magnitude are defined in Table 6-14 and Table 6-15 respectively.

Sensitivity	Definition
High	Waste and / or materials handling related incident impacts on a vulnerable
	receptor (human or ecological) with little or no capacity to absorb proposed
	changes or minimal opportunities for mitigation.
Moderate	Waste and / or materials handling related incident impacts on a vulnerable
	receptor (human or ecological) with limited capacity to absorb proposed
	changes or limited opportunities for mitigation.
Low	Waste and / or materials handling related incident impacts on a vulnerable
	receptor (human or ecological) with some capacity to absorb proposed
	changes or moderate opportunities for mitigation.
Negligible	Waste and / or materials handling related incident impacts on a vulnerable
	receptor (human or ecological) with good capacity to absorb proposed
	changes or good opportunities for mitigation.

#### Table 6-14: Criteria for Determining Sensitivity (Solid Waste)

#### Table 6-15: Criteria for Determining Magnitude (Solid Waste)

Magnitude	Definition
High	Mismanagement of waste arising and / or materials results in a significant
	environmental conditions assessed resulting in long term or permanent
	change, typically widespread in nature (regional national and international),
	would require significant intervention to return to baseline; exceed national
	standards and limits.
Moderate	Mismanagement of waste arising and / or materials results in a significant
	incident which potentially causes a fundamental change to the specific
	environmental conditions assessed resulting in long term or permanent
	change, typically widespread in nature (regional national and international),
	would require significant intervention to return to baseline; exceed national
	standards and limits.

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Low	Waste and / or materials handling related incident impacts on a vulnerable
	receptor (human or ecological) with some capacity to absorb proposed
	changes or moderate opportunities for mitigation.
Negligible	Waste and / or materials handling related incident impacts on a vulnerable
	receptor (human or ecological) with good capacity to absorb proposed
	changes or good opportunities for mitigation.

The potential impacts and their significance which can arise from the generation of waste from construction phase pre and post mitigation are presented in table 6-17 below:

## Mitigation Measures and Residual Impact

Detailed construction phase waste management plan, which will form part of the construction phase ESMP, will be developed and implemented. Specific measures for the respective waste types is presented in Table 6-16. With the implementation of the mitigation measures, residual impacts associated with waste generation are expected to reduce from high to between moderate and insignificant levels.



#### Table 6-16: Solid Waste Impact Significance Pre-Mitigation for Construction Phase

Waste type	Potential Impact	Impact Magnitude	Receptor	Receptor Sensitivity	Overall Significance Pre-Mitigation	Mitigation Measures	Overall Significance Post Mitigation
Excavation Spoil	<ul> <li>Contamination of receiving environments</li> <li>Fugitive emissions</li> <li>Disposal of spoil and excavation material which results in land take</li> </ul>	Low	Land and water body	Low	Low	<ul> <li>Cover all exposed soil as soon as they are exposed;</li> <li>Stockpile and used in profiling and rehabilitation of borrow pits</li> </ul>	Not Significant
Concrete and concrete washings	<ul> <li>Fugitive emissions</li> <li>The use of disposal sites where waste re-use or recovery is not feasible</li> </ul>	Low	Air and land	Low	Not significant	<ul> <li>Avoid ordering significantly more concrete and mortar than can be realistically used before setting.</li> <li>Use specifically designed wash area which contains all waste water in a sealed pond, tank or lined pit for re-use as concrete make up water or for equipment washing;</li> <li>Divert run-off to grassed areas</li> <li>Avoid washing concrete products where waste will drain into the storm water drain or the river</li> </ul>	Not Significant





Waste type	Potential Impact	Impact Magnitude	Receptor	Receptor Sensitivity	Overall Significance Pre-Mitigation	Mitigation Measures	Overall Significance Post Mitigation
Wire scrap	<ul> <li>The use of disposal sites where waste re-use or recovery is not feasible</li> <li>Visual amenity impacts associated with poor storage of waste</li> </ul>	Low	Land	Low	Not significant	<ul> <li>Segregate and store in a designated waste management area,</li> <li>Deliver to licensed recyclers</li> </ul>	Not Significant
Non-ferrous scrap	<ul> <li>The use of disposal site, where waste re-use or recovery is not feasible</li> <li>Visual amenity impacts associated with poor storage of waste</li> </ul>	Low	Land	Low	Low	<ul> <li>Segregate and store in a designated waste management area,</li> <li>Deliver to licensed recyclers</li> </ul>	Not Significant
Oils and lubricant	<ul> <li>Contamination of the receiving environment</li> <li>The use of disposal site, where waste re-use or recovery is not feasible</li> </ul>	High	Land and Water bodies	High	High	<ul> <li>Fuels will be stored on site in temporary aboveground storage tanks placed on a bunded area.</li> <li>Trucks and construction vehicles will be serviced off site</li> <li>Recovery and re-use to be explored and where it is not feasible they should be disposed in a NEMA</li> </ul>	Low
General domestic waste	<ul> <li>The use of disposal sites where waste re-use or recovery is not feasible</li> <li>Visual amenity impacts associated with poor storage of waste</li> </ul>	Low	Land	Medium	Low	<ul> <li>Segregate and store in a designated waste management area,</li> <li>Deliver to licensed recyclers</li> </ul>	Not Significant

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Waste type	Potential Impact	Impact Magnitude	Receptor	Receptor Sensitivity	Overall Significance Pre-Mitigation	Mitigation Measures	Overall Significance Post Mitigation
Broken posts	• Visual amenity impacts associated with poor storage of waste	Not significant	Land	Low	Not significant	<ul> <li>Segregate and store in a designated waste management area,</li> <li>Deliver to licensed recyclers</li> </ul>	
Packaging and pallets from deliveries	<ul> <li>The use of disposal site, where waste re-use or recovery is not feasible</li> <li>Visual amenity impacts associated with poor storage of waste</li> </ul>	Low	Land	Low	Low	<ul> <li>Segregate and store in a designated waste management area</li> <li>Eliminate excess packaging</li> <li>Repair items such as pallets so that they can be re-used</li> </ul>	





# 6.1.2.5 Operation phase

During operational phase, the waste generated are expected to emanate primarily from the maintenance related activities. Table 7-18 presents potential impacts of waste envisaged to be generated as a result the operational phase of the Project. It further presents their significances pre- and post –mitigation.

## Mitigation Measures and Residual Impacts

The proponent should consider adopting best management practices in waste management which follows the principles of waste hierarchy; reduce the quantity of waste generated and maximize the amount that can be re-used or recycled.

An operation phase material storage, handling and use procedures together with site specific waste management plan (WMP) should be developed and implemented and can include inter alia:

- Re-using materials where possible;
- Maintaining good housekeeping and operating practices including inventory controls to reduce the amount of waste resulting from obsolete materials, excess or damage;
- Design a procurement process to reduce waste; it should ensure ordering the correct amount of materials; reducing over packaging of materials and establishing take back system by suppliers
- Reducing raw materials consumption through efficiency audit

In addition, the waste generated and disposed should be tracked in accordance with the EMC (Waste Management) Regulations 2006 and waste tracking sheets maintained at the site.

Following mitigation, it is expected that residual impacts will reduce from high to between moderate and insignificant levels.



Waste type	Source	Potential Impact	Impact Magnitude	Receptor	Receptor Sensitivity	Significance – Pre-Mitigation	Mitigation Measures	Significant post -mitigation
Waste electrical and electronic equipment	Maintenance and replacement of redundant electrical and electronic equipment	Potential contamination of receiving environment	Low	Land and water bodies	Medium	Moderate	<ul> <li>Segregate and store in a designated waste management area,</li> <li>Deliver to licensed recyclers</li> </ul>	Not significant
Waste oil and oil contaminated cloths/rugs	From routine maintenance of operation vehicles	Contamination of the receiving environment	Low	Land and water bodies	High	Moderate	<ul> <li>Segregate and store in a designated waste management area,</li> <li>Deliver to licensed recyclers</li> </ul>	Not significant
wire scrap	From routine maintenance	Contamination of the receiving environment	Low	Land	Low	Low	<ul> <li>Segregate and store in a designated waste management area,</li> </ul>	Not significant
Non-ferrous scrap	From routine maintenance	Contamination of the receiving environment	Low	Land	Low	Low	Deliver to licensed recyclers	Not significant
General domestic waste	From routine maintenance	Contamination of the receiving environment	Low	Land and water bodies	Low	Low	Segregate and store in a designated waste management area,	Not significant

 Table 6-18: Solid Waste Impact Significance Pre- and Post-Mitigation for Operational Phase)

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Waste type	Source	Potential Impact	Impact Magnitude	Receptor	Receptor Sensitivity	Significance – Pre-Mitigation	Mitigation Measures	Significant post -mitigation
Batteries	From routine maintenance	<ul> <li>Contamination of the receiving environment</li> <li>The use of disposal site, where waste re- use or recovery is not feasible</li> </ul>	Low	Land and water bodies	High	Moderate	<ul> <li>Segregate and store in a designated waste management area,</li> <li>Recovery and re-use to be explored and where it is not feasible they should be disposed in a NEMA</li> </ul>	Not significant
Packaging and pallets from deliveries	From routine maintenance	<ul> <li>Contamination of the receiving environment</li> <li>The use of disposal site, where waste re- use or recovery is not feasible</li> </ul>	Low	Land	Low	Low	<ul> <li>Segregate and store in a designated waste management area</li> <li>Eliminate excess packaging</li> <li>Repair items such as pallets so that they can be re-used</li> </ul>	Not significant





## 6.1.2.6 Decommissioning Phase

The major components used in the fence are expected to last for over 30 years. The practice of demolition of the fence and components are very uncommon for the reason of renovation. However, in the event the proposed fence is to be decommissioned, the following infrastructure will be removed as part of this phase:

- Posts
- Wires (plain and mesh)
- Energizers
- Insulators
- Earth Pegs
- Lightening arrestors/diverters
- Strainers
- Solar panels and batteries
- Access steel gate
- Concrete used embedding the posts in the holes

Prior to decommissioning, at least three months earlier, a Decommissioning Environmental Management Plan (DEMP) will be prepared and submitted to NEMA Kenya for approval. This will document current best practice at the time for decommissioning the fence. The DEMP will need to include a section on waste management detailing the environmental protection controls which will be put in place for the storage, safe handling arrangements of each waste stream and the recovery / re-use / recycling pathways, or disposal methods for those wastes which cannot be recovered, reused or recycled.

Table 6-19 below presents significance of the impacts of waste generated during decommissioning phase prior to mitigation.

#### **Residual Impacts**

Following mitigation, it is expected that residual impacts will be negligible. A summary of the expected residual impacts associated with waste generation is provided in Table 7-19.



Waste Type	Potential Impact	Magnitude	Sensitivity	Significance Pre-mitigation	Mitigation	Overall Significance Post- Mitigation
Concrete waste	<ul> <li>Fugitive emissions, such as dust, associated with the demolition structures and handling and storage of resultant concrete streams</li> <li>Visual amenity impacts associated with poor storage of waste</li> </ul>	Moderate	Moderate	Moderate	<ul> <li>Development and implementation of DEMP which shall cover inter alia;</li> <li>Suitable facilities for the collection, segregation and safe disposal of the waste, and ensuring wastes are not blown off site by winds.</li> <li>Waste collection by approved waste contractors and transferred to an appropriately NEMA licensed) waste management facility</li> </ul>	Not Significant
Redundant equipment	Visual amenity impacts associated with poor storage of waste	Low	Low	Low	<ul> <li>Dispose them offsite through approved waste contractors and transferred to an appropriately NEMA licensed) waste management facility</li> </ul>	Not significant
Waste electrical and electronic equipment	Contamination of the receiving environment	Moderate	Moderate	Moderate	Deliver to licensed recyclers	Low
Wire and steel scrap	Contamination of the receiving environment	Low	Low	Low	Deliver to licensed recyclers	Not significant
General domestic waste	Contamination of the receiving environment	Low	Low	Low	Dispose them offsite through approved waste contractors and transferred to an appropriately NEMA licensed) waste management facility	Not significant

#### Table 7-19: Solid Waste Impact Significance Pre and Post-Mitigation for Decommissioning Phase





# 6.2.4Surface water6.1.2.7Construction Phase

## Project Activity

Soil pollution, erosion and sedimentation have potential to impact on the quality of surface water in the project area. Soil pollution could arise from spillage of fuels, lubricants and other toxic materials at the construction site. Storage and handling of construction materials such as concrete, oil and fuel at the construction site could lead to spills on site, along roads and in surrounding areas. Contaminated run-off from spill sites could adversely affect soils, vegetation and water quality. The extent of impact will depend on the size, frequency and timing of spills in relation to flow conditions in the receiving waters and the nature of the materials involved including their toxicity and possible for bio-magnification or bioaccumulation.

Construction activities could lead to increased soil erosion in and around work sites. Storm water runoff over eroded areas could carry silt into the nearby river increasing its turbidity. These impacts are expected to be short term and of low significance. Appropriate mitigation measures would reduce the impact significance to negligible levels.

During construction phase, sediments could be realized into the river system from on the river bank especially construction of the access road and deposition of construction wastes. However, owing to its limited footprint, the proposed project is not anticipated to modify the sediment regime or quality of rivers.



#### **Impact Assessment and Significance**

Impact significance as a result of soil pollution, erosion and sedimentation arising from the Project has been determined based on a function of the expected sensitivity of the receiving environment / receptor(s) and the resultant magnitude of any identified impact on the receiving environment / receptor(s).

The criteria for determining sensitivity and magnitude are defined in Table 6-20 and Table 6-21 respectively.

Sensitivity	Characteristics
High	Receptor at high risk of pollution; Receptor provides urban water supplies, major industrial abstraction or large irrigation supplies
Moderate	Receptor at medium risk of pollution. Receptor used for local village water supply source, small industrial abstraction or minor irrigation scheme
Low	Receptor already significantly modified from some aspect of natural condition Receptor used for water supply to individual dwellings or farms
Negligible	Receptor already significantly modified from natural condition

Table 7-20: Criteria for Determining Sensitivity (Surface Water)

Table 7-21: Criteria for Determining Magnitude (Surface Water)

Magnitude	Definition
Major	Fundamental change to water quality resulting in long term or permanent change, typically widespread in nature. Would require significant intervention to return to baseline; exceed national standards and limits.
Moderate	Detectable change to the water quality, resulting in non-fundamental temporary or permanent change
Low	Detectable but minor change to the water quality
Negligible	No perceptible change to the specific environmental conditions assessed

#### Baseline

The inflows of the project rivers are provided by rain and groundwater. The primary input is rainfall which is the main source of river water inflow. There are no glaciers in the catchment. The river systems are very active with erosion, transport and deposition of sediment creating a wide range of channel morphology along the length of the Rivers.

There is no historical data on water quality for the rivers. As discussed in Chapter 4 on baseline information, water quality was tested in situ at the project rivers for the following parameters; electrical conductivity, temperature, pH and dissolved oxygen using Hansatech Instruments.

The objective was to establish baseline quality of the river water prior to construction phase of the project.

During construction of the Project the potential effects could include:


- Increased risk of localised pollution events due to use of construction vehicles affecting adjacent watercourses or springs;
- Sediment release into the river system during construction of access road;
- Sediment release into the river system resulting from the depositing of construction waste into the river;
- Reductions in water quality in the river system resulting from potential release of contaminants into the river as well as localised water quality issues due to discharges from construction equipment;

The potential water quality impacts and their significance during construction phase preand post-mitigation are presented in table 6-23 below:

# **Mitigation Measures**

- The design of the project to incorporate measures to avoid or minimise impacts on the water quality.
- Minimize works during rainy season
- Development and implementation of Surface Water Erosion and Sediment Control Plan
- Installing Best Management Practices

# **Residual Impacts**

Following mitigation, it is expected that residual impacts not be significant. A summary of the expected residual impacts associated with waste generation is provided in Table 6-23.



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 Table 7-23:
 Surface Water Impact Significance Pre- and Post-Mitigation for Construction Phase

Construction	Construction Activity	Potential Impact	Receptor	Sensitivity	Magnitud	Mitigation	Significance	Significance Post
works					e		pre- mitigation	Mitigation
Construction of electric fence	<ul> <li>Excavations/earthworks,</li> <li>Disposal of construction waste</li> <li>Concrete mixing</li> </ul>	<ul> <li>Temporary increase of in sediments load in the river system</li> <li>Erosion of materials during rainy season could increase sediment transport into river</li> </ul>	River	Low	Low	<ul> <li>Minimise works during rainy season</li> <li>Excavated materials to be removed and disposed at designated disposal facility</li> </ul>	Low	Not significant
Construction camp	<ul> <li>Excavations/earthworks</li> <li>Disposal of construction waste</li> <li>Fuel/chemical storage</li> </ul>	<ul> <li>Erosion of materials during rainy season could increase sediment transport into river</li> <li>Fuel/chemical contamination of soil and water</li> </ul>	River	Low	moderate	<ul> <li>Excavated materials to be removed and disposed at designated disposal facility</li> <li>Fuel and other chemicals storage area to be paved and bunded to avoid leakage and contamination of surface or ground waters</li> </ul>	Low/ Moderate	Low/ not significant
Access roads	<ul><li>Clearing of the access roads</li><li>Earthworks</li><li>Culverts</li></ul>	<ul> <li>Erosion of materials during rainy season could increase sediment transport into river</li> <li>Alteration of drainage paths</li> </ul>	River	Moderate	Moderate	<ul> <li>Restore and seed temporary access road</li> <li>Maintain erosion controls</li> </ul>	Moderate	Low





# 6.1.2.8 Operation Phase

The impact of the fence on surface water resources in the areas is expected to be positive. The quantity and quality of the water in the rivers will be improve. The river flows are likely to increase and will be less turbulent due to reduction in sedimentation from the human activities.

Increase in river flows is likely to have a direct effect on the aquatic ecosystem and ecosystem services.

# 6.3 Ecological Impact Identification and Assessment

### **Impact Identification**

Fencing of the western side of Maasai Mau Forest will likely create impact on biodiversity. The activities of the proposed fencing project will affect ecological units and process. Biodiversity will be affected positive and negatively directly and indirectly during the construction and operation phase of the project. Positive impacts will majorly take place during the operation of the project and they are likely to occur in the medium to long-term projections. Impact identification is conducted through linkage of impact with the proposed project activities (or components) in the two phases of the project.

Project Activity/Hazard	Impact/Risk	Nature of Impact	Phase of the Project
Fence	Restoration of vegetation cover on the reclaimed landscape	Positive	Operation
Fence	Protection of threatened plant species inside the forest from illegal logging	Positive	Operation
Fence	Enabled seed dispersal over the reclaimed landscape by birds and mammal species	Positive	Operation
Fence	Improved physical and chemical properties of soil (SOC, pH, BLD, and CEC)	Positive	Operation

 Table 6-17: Impact identification matrix for the proposed electric fencing on biodiversity in Maasai Mau Forest.



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Fence	Improved sustainable water discharge and quality from spring and streams	Positive	Operation
Fence	Expanded ecological range for small mammals and birds – foraging and breeding grounds	Positive	Operation
Fence	Controlled envisaged human- wildlife conflict	Positive	Operation
Fence	Improvement of biodiversity hotspot		
Clearing vegetation and levelling of ground	Destruction of vegetation (cover, species and population)	Negative	Construction
Clearing vegetation	Potential destruction of population of threatened plant species	Negative	Construction
Excavation soil and grading of ground level	Smothering of terrestrial plants and stream beds by loose soil	Negative	Construction
Excavating holes and trenches	Pitfalling of small mammals, herpetofaunal and crawling invertebrates	Negative	Construction
Fence	Fatal electrocution of small mammals and birds	Negative	Operation
Introduction of excavating machine and personnel	Introduction of Alien Invasive Plant Species along the fence alignment	Negative	Construction and Operation



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Fence	Fragmentation of habitats	Negative	Operation
Fence	Restricted movement across the landscape (long-term)	Negative	Operation
Road (leveled ground)	Disruption of natural seed dispersal along the slopes	Negative	Operation

#### Impact Assessment and mitigation

Impacts which are assessed are mainly the ones with the negative impact on biodiversity during the construction and operation phase of the project. Mitigation measures are proposed for impacts which are rated low/moderate to high impacts in the assessment.

### Impacts during construction phase

### 6.3.1 Destruction of vegetation (cover, species and population)

Approximately an area estimated at 6m x 50,000m will be cleared of vegetation during the construction of the fence. The process will involve cutting of trees, shrubs and herbs. Removal of large tree which are unique in conserving soil and providing micro-habitat for invertebrates and herpetofauna (skinks and lizards) will adversely affect their ecological services. The Reclaimed Areas consist of larger section of the area that will be fenced from human encroachment and access for resource exploitation. These areas do not have high distribution of trees. This, therefore, implies relatively moderate to low potential impacts are expected on tree stands on the landscape. However, where the forest boundary alignment is near riverine, it will affect the riverine forest trees which are preserved in the river valley.

Table 6-18: impacts of vegetation destruction during Construction Phase (pre-mitigation)

Unmitigated impacts of vegetation destruction during Construction Phase		
Magnitude	Moderate	
Sensitivity	Moderate	
Significance of Impact	Moderate	
Mitigation Measures/Comment:		
Minimal clearing of trees should be practiced		
Avoid felling large trees where necessary		
• Avoid using heavy mechanization which would easily cause severe clearing of vegetation		
Residual Impact		
Magnitude	Low	
Sensitivity Low		
Significance of Impact Low		



**Mitigation Measures/Comment**: Continue with mitigation measures as proposed

# 6.3.2 **Potential destruction of population of threatened plant species**

There are three identified plant species of conservation, listed as threatened species in the IUCN red list database. These species include the *Polyscias stuhlmannii* (Endangered), *P. kikuyuensis* (Near Threatened), *Warbugia ugandensis* (Vulnerable), *Prunus africana* (Vulnerable) and Olea europeae (Near Threatened). The population of *Polyscias stuhlmannii* is deemed extinct in Kenya. Only very low population is found in protected montane forests. Polyscias species are threatened by exploitation of their timber, P. Africana and Warburgia ugandensis are threatened by exploitation for their medicinal value. The populations of this group are generally low and are normaly congregant in the wild. Their distribution on the landscape is by random chance and that might affect some of their population lieing on the gazette boundary. Clearing of trees but felling to provide Right of Way of 6 m width would probably affect the standing population on the forest boundary alignment.

Table 6-19: impacts of	destruction of threatened	plant species	during	Construction	Phase

Unmitigated impacts of des	struction of threatened plant species during			
<b>Construction Phase</b>				
Magnitude	Moderate			
Sensitivity	High			
Significance of Impact	High			
Mitigation Measures/Comm	ient:			
• Totally avoid felling larg	ge trees listed in the the red list of threatened			
species.	species.			
• Avoid using heavy mechanization which would easily cause severe				
clearing of tree species threatened to conservation				
Residual Impact				
Magnitude	Low			
Sensitivity	Low			
Significance of Impact	Low			
Mitigation Measures/Comment:				
Continue with mitigation measures as proposed				

# 6.3.3 Pitfalling of small mammals, herpetofaunal and crawling invertebrates

Construction activities of the project that will involve excavation of trenches and pitholes will cause a pitfall effect on small mammals, herpetofaunal species, and crawling insects. Normally, the crawling insects has high probability of falling on the pit holes due to their high population on the landscape. These invertebrates consequently attracts small mammas like the African Black Shrews (*Crocidura nigrofusca* and Forest shrew (Sylviroserox sp.) and Lizards



and Skinks for food. During field survey, these group of animals were trapped using pitfall traps. This is an indication on how severe pitholes and trenches excavated would be to the animals. Out of 20 pitfall traps laid on a 1 km transect 2 individual shrews were caught. Therefore, on a stretch of the fence alignment along the forest boundary alignment approximately 100 individual shrews or more will be trapped to death by the excavated trenches and pit holes.

Table 6-20: impacts of pit falling of crawling invertebrates, small mammals and herpetofaunal during Construction Phase (Pre-mitigation)

Unmitigated impacts of p	itfalling of crawling invertebrates, small		
mammals and herpetofaunal during Construction Phase			
Magnitude	High		
Sensitivity	High		
Significance of Impact	High		
Mitigation Measures/Comm	ient:		
• Conduct search and resc	• Conduct search and rescue of Shrews, lizards and skinks trapped by		
trenches and pitholes eve	ery day in the morning		
• Establish a ramp for the s	species to climb outside from trenches		
• Trenches and pitholes should be not be left unattended for long to			
avoid			
Residual Impact			
Magnitude	Low		
Sensitivity	Low		
Significance of Impact	Low		
Mitigation Measures/Comment:			
Continue with mitigation measures as proposed			

### 6.3.4 Introduction of Alien Invasive Plant Species along the fence alignment

The alien plant species will be introduced during excavation and grading of the 6 width Way Leave and construction of the fence. The propagules of AIPS normally sticks on body of vehicles and earth moving machines, and human shoes or clothes. Other sources of introduction are through transported gravels used for compaction and leveling roads. AIPS is feared because they displace indigenous plant species and does not provide good habitat and forage to the native animal species. In areas where AIPS is introduced the landscape in the terrestrial habitat changes significantly with other plant species displaced or suppressed. AIPS are normally introduced during construction phase but will be detected months or a year later after construction. Potential spreading of AIPS will take place in areas of construction and adjacent areas where AIPS propagules can be dispersed by agents such as water, wind and animals.



Table 6-21: impacts of introduction of Alien Invasive Plant Species along the fence alignment during Construction Phase (pre-mitigation)

Unmitigated impacts of introduction of Alien Invasive Plant Species			
along the fence alignment d	uring Construction Phase		
Magnitude	Moderate		
Sensitivity	moderate		
Significance of Impact	Moderate		
Mitigation Measures/Comm	ient:		
• The earth moving machin	The earth moving machines should be cleaned by cleaning them before		
they leave their departur	they leave their departure points.		
• Monitoring of AIPS shou	• Monitoring of AIPS should be observed closely to identify and control		
their population before they start reproducing			
Residual Impact			
Magnitude	Low		
Sensitivity	Low		
Significance of Impact	Low		
Mitigation Measures/Comment:			
Continue with mitigation measures as proposed			

#### Impacts during operation phase

#### 6.3.5 *Fatal electrocution of small mammals and birds*

The voltage operation of electric fence is normally high for small to medium mammals and large birds. Electrocution of these groups has been observed in other projects and this is envisaged for this particular project. The layering of the electric wires at the bottom to the level of these animals are normally dangerous causing electrocution, the edge effect of electric fence. Birds species which are likely to be affected are the Guinea Fowl and the southern Ground Hornbill which stocks on the ground. Mammal species which would be vulnerable to electrocution are the African Hare, wild pigs, monkeys (Colobus, Blue monkey), and rodents.

Table 6-22: Unmitigated impacts of fatal electrocution of small mammals and birds during operation Phase (pre-mitigation)

Unmitigated impacts of fatal electrocution of small mammals and birds		
during operation Phase		
Magnitude	Moderate	
Sensitivity	High	
Significance of Impact	High	
Mitigation Measures/Comment:		



- Vary voltage of lower layers of wires to levels that only excite the medium size birds (CP)
  Creating a ground clearance (without electric wire) for ground
- movement by some bird species in between the forest and outside (CP)

Residual Impact		
Magnitude	Low	
Sensitivity	Low	
Significance of Impact	Low	
Mitigation Measures/Comment:		
Continue with mitigation measures as proposed		

# 6.3.6 *Restricted movement across the landscape*

Movement of animals across the landscape between the forest and farmlands will be restricted by the electric fence. These are normally mammal species which occur along the riverines which runs from the forest to the farmland throughout to downstream. This movement provide connection of habitats downstreams population influxes. The Nyangores riverine is accounted for by the locals to be used by elephant movements between Maasai Mau Forest and Transmara Forest block. Fencing across this riverine and others should be partial to take care of movements of large mammals.

#### Table 6-23: impacts of Restricted movement across the landscape

Unmitigated impacts of Restricted movement across the landscape			
during Operation Phase			
Magnitude	High		
Sensitivity	High		
Significance of Impact	High		
Mitigation Measures/Comment:			
• Complete fencing across riverine should be avoided to allow for			
movements of elephants and other large mammals across the			
landscape			
Residual Impact			
Magnitude	Low		
Sensitivity	Low		
Significance of Impact	Low		
Mitigation Measures/Comment:			
Continue with mitigation measures as proposed			

### 6.3.7 Disruption of connectivity and seed dispersal on the landscape



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The connectivity of habitats on landscape is an important ecological process that support various ecological units. There are ecological processes that would be affected adversely due to the barrier created by the fence, and grading of the Way Leave. One of such processes is the seed dispersal, and interactions of small to medium mammal populations. Prevented movement of the herbivore species which disperse seeds would significantly reduce natural regeneration of indigenous plants in the farmland. The herbivores that visit farmlands at night from the forest contribute to effective seed dispersal and natural regeneration in the surrounding forest areas. Thus, the prevented movements of this group will destroy the natural replenishment of farmland with forest plant species. In sloppy or steep areas, seeds that drop on the ground are transported away by runoffs and mass movement of materials. The road or graded Way Leave would act as barrier to downslope movements of these seeds. This impact is likely to occur in areas where Way Leave (road) would intersect the slope.

Unmitigated impact of disru	uption of connectivity and seed dispersal on		
the landscape during Opera	tion Phase		
Magnitude	Low		
Sensitivity	Moderate		
Significance of Impact	Low/moderate		
Mitigation Measures/Comm	nent:		
• Grading should be avo	ided in sloppy (steep) areas to allow free		
movement of seeds down	nslopes		
• The bottom wire should	• The bottom wire should be spaced considerably high to allow cross-		
movements of small to medium mammals that disperse seeds.			
• Controlled grazing of livestock should be allowed to enhance dispersal			
of forest plant species into farmland.			
Residual Impact			
Magnitude	Low		
Sensitivity	Low		
Significance of Impact	Low		
Mitigation Measures/Comment:			
Continue with mitigation me	easures as proposed		

Table 6-24: impact of disruption of connectivity and seed dispersal on the landscape during Operation Phase



### 6.4 Potential Social Impact Assessment and Mitigation Measures

# Construction and Operation Phase

# 6.4.1 Labor and Working Conditions

The project site is predominantly in a rural setting and the population distribution of the immediate forest adjacent areas are sparse. The number of employees to be engaged in the various project phases has not yet been established. Nonetheless, the construction of the electric is expected to create direct employment opportunities across different skills levels, from unskilled to highly skilled labour, as well as, indirect employment opportunities.

The Kenya labour laws are aligned to international labour laws including the core ILO conventions of which Kenya has ratified the following:

- Right to Organise and Collective Bargaining Convention, 1949 (No. 98);
- Forced Labour Convention, 1930 (No 29);
- Abolition of Forced Labour Convention, 1957 (Mo 105);
- Minimum Age Convention, 1973 (No 138);
- Worst Forms of Child Labour Convention, 1999 (No 182); and
- Equal Remuneration Convention, 1951 (No 100); and Discrimination (Employment and Occupation) Convention, 1958 (No 111).

Whilst a robust labour regulatory framework exists, there have been gaps in implementation in the general labour sphere. There is therefore the risk that the Contractor may not operate in conformance with the provisions and in line with international best practice. Forced labour, child labour and discrimination is unlikely to occur if relevant standards on Labour and Working Conditions are adhered to. Employees who are ignorant of the legal provisions and of their labour rights can however be susceptible to manipulation in any work environment.

Labour and working conditions, including occupational health and safety, will need to be factored to avoid occupational incidents and/or injuries. Issues that need to be considered include: fair treatment of workers, transparency in recruitment, non-discrimination, equal opportunities, as well as the provision of a safe and healthy working environment. This section focuses on both **construction** and **operational** phases of the Project due to the applicability of the labour conditions throughout the Project cycle.

### Significance of Impact (Pre-mitigation)

Based on the analysis provided above, impacts to exposure of the workforce to poor labour and working conditions will be a "<u>Moderate Negative Impact</u>" pre-mitigation (refer to Table 6-25).



Table 6-25: Rating of Impacts to Exposure of Workforce to Poor Labour and Working Conditions (Pre-Mitigation)

		Type of Impact
Direct Negative Impact		
		Rating of Impacts
Characteristic	Designation	Summary of Reasoning
Extent	Local	The impact is only relevant for the workforce (mainly contractors) all of whom will be at a local level (although they may come from elsewhere in Kenya or globally).
Duration	Long-term	Without mitigation and management measures the impact may continue for the duration of the proposed Project.
Scale	Medium	The implications of poor health and safety practices can be severe including loss of life which can significantly affect households and communities ability to support their livelihoods.
Frequency	Intermittent	Impact is likely to recur / occur intermittently and potentially for prolonged periods of time.
Extent	Local	The impact is only relevant for the KWTA workforce (including the main contractors) all of whom are at a local level (although they may come from elsewhere in Kenya).
Magnitude		

Medium Magnitude Sensitivity/Vulnerability/Importance of the Resource/Receptor High Sensitivity

Receptors to this impact may include those contracted or subcontracted to work on the Project. Receptors with heightened sensitivity may include employees who are ignorant of the requirements of OHS standards or limited choices regarding employment options.

Significant Rating Before Mitigation Moderate Negative Impact

### Mitigation/Management Measures

- The Project should develop and implement an Occupational Health and Safety Management System in line with good industry practice. These systems should include consideration of hazard identification, risk assessment and control, use of Personal Protection Equipment (PPE), incident investigation and reporting, reporting and tracking of near misses, incidents etc. The management system should also include emergency response plans. Roles and responsibilities should be clearly defined.
- In contract documents for the Contractor, KWTA should make explicit reference to the need to abide by Kenyan law, international best practice and the ratified ILO conventions and KWTA's policies in relation to health and safety, labour and welfare standards.
- In selection of a Contractor, KWTA should refer to past performance in similar assignments as an indicator of future performance with respect to worker management, worker rights, health and safety as outlined in Kenyan law and international standards.
- Regular checks by KWTA should be undertaken to ensure the relevant labour laws and occupational health and safety plans are adhered to at all times.
- All project workers should, as part of their induction, receive training on health and safety.



- KWTA will put in place mechanism to ensure no employee or job applicant is discriminated against on the basis of his or her gender, marital status, nationality, ethnicity, age, religion or sexual orientation.
- All workers will have contracts which clearly state the terms and conditions of their employment and their legal rights. Contracts will be verbally explained to all workers where this is necessary to ensure that workers understand the provisions. Contracts must be in place prior to workers reporting to duty for the first time. The contract document will be enhanced by the Code of Conduct that will be provided by the Proponent.
- The Proponent and the Contractor will put in place a worker grievance redress mechanism accessible to all workers, whether permanent or casual, directly or indirectly employed. The Proponent worker grievance mechanism shall be open to the Contractor workforce in the event that their grievance is not adequately resolved by their direct employer. The Proponent will then have the authority to act to resolve this grievance.
- All project workers should have access to training on communicable diseases and STDs and community interactions in general. This training will be developed in collaboration with local health institutions.
- Carry out surveillance to ensure that no children are employed in the project, and to the extent possible by third parties related to the project and primary suppliers where such risk may exist

#### Residual Impact (Post-Mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the residual impact related to exposure of the workforce to adverse labour and working conditions will be a "<u>Minor Negative</u>" post mitigation (refer to Table 6-26).

		Rating of Impacts
Characteristic	Designation	Summary of Reasoning
Extent	Local	The impact is only relevant for the construction all of whom are at a
		local level (although they may come from elsewhere in Kenya or
		globally).
Duration	Temporary	It is expected that once the system is implemented the workforce
		exposure to health and safety incidents will be managed and therefore
		the potential for accidents to occur will be minimised.
Scale	Low	While the implications of accidents in the workplace can be severe
		including loss of life which can significantly affect households' ability to
		support their livelihoods, following mitigation it is not expected for this
		impact to be severe.
Frequency	Intermittent	Impact is likely to occur intermittently and potentially during
		construction and operation.
Magnitude		
Small Magnitude		
Significant Rating After Mitigation		
Minor Negative Impact		

Table 6-26: Rating of impacts (Post-Mitigation)

#### 6.4.2 Impacts on Cultural Heritage



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During the Focus Group Discussions, members of the indigenous communities indicated that the forest is a venue for cultural rituals and ceremonies including rites of passage such as circumcision. The circumcision ceremonies are usually conducted inside the forest for members of a particular age set who are being initiated into adulthood among the Ogiek and the Maasai communities. The Ogiek community indicated that they have derived their living from the forest through a hunter-gatherer way of life which entails bee keeping, game hunting and harvesting of forest wild fruits. Maasai pastoralists on the other hand have depended on the forest to supply them with fodder for their livestock more so, during the dry seasons when feed is scarce outside the forest. Both groups also indicated that there are particular medicinal plants found within the forest, which they have other years used to treat various ailments without the need of visiting a hospital.

Some of the local communities claimed that they buried their dead within the forest. Attempts to substantiate these claims from local authorities however revealed that there are no grave yards within the Maasai Mau forest. It is possible that, given the long period of human habitation of the forest, that there are undetected cultural or archaeological resources that could fall within the footprints of proposed project site. Significance of Impact (Pre-mitigation)

Based on the analysis provided above, impacts on cultural heritage during the construction phase will be "Minimum Negative" pre-mitigation (refer to Table 6-27). This impact is not applicable for the operation phase.

Type of Impact		
Direct Negative Impact		
		Rating of Impacts
Characteristic	Designation	Summary of Reasoning
Extent	Local	Anywhere there will be ground disturbance
Duration	Permanent	Previously unidentified cultural archaeological resources may be destroyed by ground works.
Scale	Any place where ground disturbing activities will take place	The scale is as large as the area where ground works will take place is within a 6 metre wide reserve along fence alignment
Frequency	Alongside ground disturbing activities	This type of impact would occur as a result of ground works during phase of the proposed Project.
Magnitude		
		Minimum Magnitude
	Sensitivity/\	/ulnerability/Importance of the Resource/Receptor
		Minimum Sensitivity
There is a poss width.	ibility that there may	be cultural or archaeological material along the fence alignment of 6 metres

#### Table 6-27: Rating of Impacts on Cultural Heritage (Pre-Mitigation)

**Significant Rating Before Mitigation** 

**Minimum Negative** 



#### Mitigation/Management Measures

Execution of a Chance Find Procedure:

- In order to minimize the potential for impact to sub-surface cultural archaeological material, the proponent should establish a Chance Find Programme which includes the following provisions:
  - A chance find can be reported by any member of the Project. Accordingly, if a chance find is encountered, the first course of action is to stop work in the vicinity of the find. Then the following steps will be undertaken:
  - Inform site supervisor/foreman.
  - Install temporary site protection measures (warning tape and keep off signs).
  - Inform all personnel of the Chance Find if access to any part of the work area is restricted.
  - Establish a localized no-go area needed to protect the Chance Find.
  - The National Museum of Kenya will be contacted to perform a preliminary evaluation to determine whether the Chance Find is cultural heritage and if so, whether it is an isolate or part of a larger site or feature.
  - Artefacts will be left in place when possible; if materials are collected they will be placed in bags and labelled by an archaeologist and handed over to the National Museum of Kenya; no Project personnel are permitted to take or keep artefacts as personal possessions.
  - Document find through photography, notes, GPS coordinates, and maps (collect spatial data) as appropriate.
  - If the Chance Find proves to be an isolated find or not cultural heritage, the specialists brought in from the National Museum of Kenya will authorize the removal of site protection measures and activity in the vicinity of the site can resume.
  - If the archaeological specialists from National Museum of Kenya confirm the Chance Find is a cultural heritage site, they will inform the project team and initiate discussions with the latter about treatment.
  - Prepare and retain archaeological monitoring records including all initial reports whether they are later confirmed or not.
  - Develop and implement treatment plans for confirmed finds using the services of qualified cultural heritage experts.
  - If a Chance Find is a verified cultural heritage site, prepare a final Chance Finds report once treatment has been completed.
  - While investigation is on-going, co-ordinate with on-site personnel keeping them informed as to status and schedule of investigations, and informing them when the construction may resume.
  - If mitigation is required, then expedient rescue excavations will be undertaken by the National Museum of Kenya specialist, except in the case that the chance find is of



international importance (i.e. Critical Cultural Heritage). If an archaeological site of international importance is encountered special care will be taken and archaeologists with the appropriate expertise in addressing the find will be appointed.

# Residual Impact (Post-Mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact related to loss of cultural heritage will be a "<u>Negative</u>" post mitigation (refer toTable 6-28).

Rating of Impacts		
Characteristic	Designation	Summary of Reasoning
Extent	Local	The impacts remain local.
Duration	Permanent	The impacts to those sites that cannot be avoided and are therefore
		permanent.
Scale	Any place where	The implementation of Chance Finds Procedures will serve to lessen the
	ground disturbing	total impact to undiscovered subsurface sites.
	activities will take	
	place	
Frequency	Periodic	The implementation of the recommended schemes will reduce the
		frequency for impacts to sub-surface sites.
		Magnitude
		Negligible Magnitude
Significant Rating After Mitigation		
Negligible Negative Impact		

#### Table 6-28: Rating of Impacts on Cultural Heritage (Post-Mitigation)

### 6.4.3 Increased transmission of HIV/AIDS and Other STIs

The fencing project is expected to create a demand for labour from various skill groups which may cause some influx into the project area for positions which may not be filled locally. Owing to the income from construction activities, project workers may be appealing to locals and if proper caution is not taken, it is possible for workers to engage with local community in high risk sexual behaviour which can lead to transmission of venereal disease.

In the event of existence of opportunistic infections associated with venereal diseases such as tuberculosis among the workers, areas visited by infected workers and people who interact with them will also become susceptible to these communicable diseases. The low number of health care facilities in the project area may also contribute to increased transmission of diseases as infected persons will have a challenge accessing health care in a timely manner leading to adverse health outcomes.

# Significance of Impact (Pre-mitigation)

Based on the analysis provided above, impacts on disease transmission during the construction phase will be "<u>Moderate - Negative</u>" pre-mitigation (Refer to Table 6-29).



#### Table 6-29: Rating of Impacts on HIV/AID and other STIs Transmission (Pre-Mitigation)

		Type of Impact
Direct Negative Impact		
		Rating of Impacts
Characteristic	Designation	Summary of Reasoning
Extent	Local	It is anticipated that the potential impacts of increased social
		disturbance factors will have impacts at the local level i.e. communities
		along the road.
Duration	Short-term	The impacts identified are expected to be largely linked to the
		construction period and therefore short-term.
Scale	Medium - High	Communities have limited access to health care as such, an increase in
		prevalence of disease transmission will result in a decline in quality of
		life
Frequency	Intermittent	The incidence of communicable disease is likely to recur in the absence
		of mitigation and monitoring measures.
		Magnitude
		Medium Magnitude
	Sensitivity/V	ulnerability/Importance of the Resource/Receptor
		High Sensitivity
Vulnerability of	receptors is dictated	d by the behavioural practices and tendencies, the current prevalence of
disease, the heal	th status of receptors	as well as the limited access to health facilities.
Low Significant Rating Before Mitigation		
Moderate Negative		

#### Mitigation/Management Measures

The purpose of mitigation is to limit, where possible, the anticipated impact of increase in prevalence of HIV/AIDS and other STIs as consequence of construction of the proposed fencing. Furthermore, mitigation should ensure that Contractors manage their workers in such a way that the impacts are limited.

Specific proposed measures include:

- The Contractor should develop and implement pre-employment screening measures for workers, which should include applicable diseases. Individuals found to be suffering from these diseases will need to be sensitized on prevention of transmission to others and management of the disease prior to mobilisation to site.
- The Contractor should develop and implement a HIV/AIDS and other STIs policy and an information document for all workers directly related to the Project. The information document should address factual health issues as well as behaviour change issues around the transmission and infection of HIV/AIDS and other STIs.
- The Contractor will make condoms available to employees and communities neighbouring the site office during construction.



- All project personnel should be inducted on a Code of Conduct that gives guidelines on worker-worker interactions, worker-community interactions and development of personal relationships with members of the local communities.
- As part of the Code of Conduct, the Proponent should explicitly forbid all Project personnel as well as the Contractor staff from engaging in illicit activities including procuring of commercial sex workers which could affect the reputation of the Agency and or its relationship with communities. Anyone caught engaging in illegal activities should be subject to disciplinary action.
- If workers are found to be in contravention of the Code of Conduct, which they will be required to sign at the commencement of their contract, they will face disciplinary action including dismissal from duty.

### Residual Impact (Post-Mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact related to increased transmission of HIV/AIDs and other STIs will be a "<u>Minor</u> <u>Negative</u>" post mitigation (refer to Table 6-30*Error! Reference source not found.*).

Rating of Impacts		
Characteristic	Designation	Summary of Reasoning
Extent	Local	This impact may be experienced by community members along the fence alignment.
Duration	Short	With mitigation measures implemented there is less chance of transmission and receptors are more likely to be informed on preventive and management measure; however, this is dependent on the nature of the disease.
Scale	Low	Communities' exposure to diseases will be rare and while their ability to prevent or seek treatment will be enhanced, it is unlikely that there will be significant changes from the baseline.
Frequency	Rare	The incidence of venereal diseases is likely to decrease and occur only rarely.
Magnitude		
Small Magnitude		
Significant Rating After Mitigation		
		Minor Negative Impact

#### Table 6-30: Rating of Impacts on HIV/AID and other STIs Transmission (Post-Mitigation)

# 6.4.4 Impacts on Employment, Procurement and the Economy

The predominant economic activities in the forest block and its surrounding areas were found to be agriculture, mainly crop farming, livestock keeping and bee keeping. Most of the communities in these areas practice farming for subsistence production, surplus is however ferried to nearby markets of Narok and Mulot. A number of small scale retail outlets dealing in household commodities have been set up in the market centres.



Receptors in the SAoI that may be able to make the most of the direct and indirect employment opportunities in the project are those who have some level of experience in formal employment, as well as those who have gained a basic education.

Educational attainment and experience in formal employment in the forest adjacent areas is fairly low. The locals in this area are however capable of carrying out manual work and under some level of apprenticeship and supervision; they can take one the more challenging semi-skilled roles in the project. It is therefore assumed that the majority of local labour sourced from the Project area will be unskilled or semi-skilled. Furthermore, based on the material and the type and quality of equipment required for the construction of the fence, it is unlikely that local communities will have the capacity to supply all the goods and equipment. In the event that all material and equipment needed cannot be sourced from the community, then these should be sourced from Narok County, before considering the wider region or the National level.

Given the typical role of women in African societies, particularly in the highly reserved indigenous communities, there may be restrictions on the roles they can take up in the project. Roles that are traditionally are preserve for men and likely to be left as such. Women should however be encouraged and incentivised by deliberately setting aside roles such as housekeeping of the site camp, and supplying food to project workers.

The number of personnel to be employed by the Project has not been confirmed, however, the construction of the electric fence will create direct employment opportunities across different skills levels, from unskilled to highly skilled labour.

Anticipated benefits of the Project include:

- Direct employment opportunities mainly during construction of the fence
- Indirect employment generated by the procurement of goods and services for the Project.
- Induced employment related to jobs ensuing from the expenditure of incomes associated with direct and indirect Project related jobs.
- Direct and indirect business opportunities to the local population. Individual and small businesses are expected to benefit from selling goods and services to workers.

### Significance of Impact (Pre-mitigation)

The number of people who will be hired from the SAoI will be limited due to the scope of the Project activities. However, the Project will hire where possible from the local population which will lead to benefits to local households. Based on the analysis provided above, the creation of direct and indirect employment opportunities will have a positive impact during construction phase pre-mitigation (refer to Table 6-31*Error! Reference source not found.*).



#### Table 6-31: Rating of Impacts on Employment, Procurement and the Economy

Type of Impact
Positive Impact
Direct and indirect employment opportunities and the procurement of goods and services and combined
multiplier effect of this economic growth will result in increased incomes for successful candidates and their
local communities: promoting some degree of increase in standards of living

#### Mitigation/Management Measures

In order to enhance this positive impact, the following management measures will be required:

- The Project should prioritise the employment of labour from the local villages in the first instance especially for unskilled and semi-skilled positions. In the event the position cannot be filled from the project area, labour should be sourced in order of preference from neighbouring communities within the Counties.
- The Proponent should adopt a fair and transparent employment and procurement strategy to avert any potential favouritism. The strategy should be well understood by local communities.
- Employment should be fairly distributed among the local ethnic representations to avoid any conflict over the project.
- KWTA should notify identified representatives of the County Government and Public Administration (i.e. the County Commissioner's office) of the specific jobs and the skills required for the Project, prior to the commencement of construction. This will give the local population time, prior to the commencement of construction, to identify persons with the relevant skillset to be employable in the Project.
- The Project should prioritise the procurement of goods and services from within Narok County. In the event that goods and services cannot be procured from within the Counties, then preference should be given to regional companies. The Contractor should however aim at procuring locally available materials where feasible and use local suppliers where appropriate.
- Job advertisements on employment and procurement opportunities during construction phase should be placed at the Public Administration notice board and applications to be done through this office. In the event that the position cannot be filled from within these villages and towns it should be advertised further afield (County-wide in Narok then nationally).

### 6.4.5 Loss of Property and Livelihood Sources

Anthropogenic activities in the Masaai Mau forest block have resulted in alteration of natural forest ecosystem into an agricultural land-use utilized for crop cultivation, pasture for livestock, bee keeping, small-scale businesses and retail shops. For indigenous communities accustomed to a hunter-gatherer way of living, the fencing of the forest would imply restricted access to game meat, wild fruits and medicinal plants.

The reclamation of the forest saw the former settlers salvage as much property as practically possible. During the community engagement, the Consultant learnt that some of the farm-produce was not ready for harvest and was left inside the forest. Discussions with the Public Administration revealed that the Government of Kenya has through the Public Administration made provisions to allow the former settlers to harvest their crop when ready in a well-coordinated and guided manner. This will help lessen the sense of loss among affected communities.

Bee keepers left beehives inside the forest. While some indicated they would request to be allowed access to harvest their honey, others chose to consider it a foregone. Structure owners on the other hand recounted how they demolished their buildings and salvaged all construction material they could, but it was not logically possible to salvage everything and they ultimately incurred losses. It is worth noting that the proposed fencing will be constructed along the forest boundary and will not result in any destruction of private property or further loss of livelihood sources.

Receptors in the SAoI that will be affected include indigenous hunter-gatherer communities, nomadic pastoralist communities, households and businesses that had encroached into the forest ecosystem. Some of the affected groups will experience a significant impact from the loss of livelihood depending on the economic, emotional value or otherwise of the livelihood source that has been lost. The affected group may face a challenge in obtaining suitable alternative sites; they may lose clients, and, upon relocation, may incur additional costs to re-establish themselves.

Although locals alleged that they are *bonafide* owners of individual parcels in the forest and are in possession of valid land tenure documents, due diligence carried out by State Agencies independent of the ESIA study shows the contrary, leading the State to conclude that the purported tenure documents are not valid. This implies that the sale and purchase of land in the Maasai Mau and issuance of titles was probably in contravention of the law. Please refer to the status document in the Annex for more details.

# Significance of Impact (Pre-mitigation)

Based on the analysis provided above, impacts caused by loss of livelihoods as a result of the restricted access to the forest from the fencing will be "<u>Major-Negative</u>" pre-mitigation (refer *to* Table 6-32).



Table 6-32: Rating of Loss of Livelihoods Sources (Pre-Mitigation)

		Type of Impact
		Direct Negative Impact
		Rating of Impacts
Characteristic	Designation	Summary of Reasoning
Extent	Local	It is anticipated that the potential impacts of loss of livelihoods factors will have impacts at the local level within the Project Area
Duration	Medium-term	The impacts identified are expected to be permanent but <b>medium-term</b> . The duration of impact will however largely depend on the livelihood restoration strategies that are adopted
Scale	High	The scale will be <b>high</b>
Frequency	Constant	This impact would be constant as impacts to livelihoods will be permanent
		Magnitude
		Large Magnitude
	Sensitivity/	Vulnerability/Importance of the Resource/Receptor
		High Sensitivity
Sensitive receptor	ors to this impact inc	ludes the existing development within the Road Corridor,
		Significant Rating Before Mitigation
		Major Negative Impact

#### Mitigation/Management Measures

- An inventory of affected properties including cost of purchase of land, land acreage under crop production and expected amount of crop harvest should be prepared to determine the level of loss and enable costing/valuation.
- Further the process should identify persons who have been affected in this regard, with an aim of generating their socio-economic profile to determine which alternative intervention can be suitable to help them cope with their loss.
- Consider implementing suitable alternative livelihood options as supported by local conditions and as proposed by the affected communities would entail: job opportunities in the project, setting up tree nurseries, tea farming, bamboo plantation, bee keeping for honey production, dairy farming, establishing medicinal herb garden etc.
- The local leaders including special interest groups such as village elders, women, youth and indigenous peoples should be involved and consulted in identification of interventions and restoration of community livelihoods
- The proponent should purpose to build the capacity of local communities in sound forest management by way of training on participatory forest management, constitution of a Community Forest Association; offering apprenticeship to instil basic skills that can be employed in project implementation; hire local youth to work as forest scouts for income and as well as to portray community involvement in conservation and for sustainability.
- Positive interventions geared towards capacity building and restoration of livelihoods may attract those who were not affected and these may in turn lead to competition for



limited slots in the various opportunities. For this reason, the Proponent should work closely with the local leaders to ensure a fair, transparent and inclusive process.

• Establish a community grievance redress mechanism to address concerns arising from the community and to avoid conflict.

# Residual Impact (Post-Mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impacts caused by loss of livelihood sources will be a "<u>Moderate Negative</u>" post mitigation (refer to *Error! Reference source not found.*).

Rating of Impacts		
Characteristic	Designation	Summary of Reasoning
Extent	Local	The loss of livelihoods impact is localised since effect is expected on communities who previously derived a living from the forest
Duration	Medium Term	The mitigation measures are based on the assumption that alternative livelihood interventions will be implemented over the medium-term to enable full recovery
Scale	Medium	The mitigation measures are based on the assumption that alternative livelihood strategies will be implemented to mitigate loss of livelihoods
Magnitude		
Medium Magnitude		
Significant Rating After Mitigation		
Moderate Negative Impact		

#### Table 6-33: Rating of Loss of Livelihood Sources Impacts (Post-Mitigation)

# 6.4.6 Insecurity

Inter-ethnic rivalry within the Sai occurs mainly between the two predominant ethnic communities in the North and South Sub-Counties. No major events or incidences were noted on this front. There were however one or two reports of minor clashes between the law-enforcers and the local communities following reclamation of the forest block. These incidences were attributed to conflict over access to the forest, even though the entire reclamation process was voluntary following the government directive. Based on these occurrences, it would be prudent to ensure that there are adequate security provisions during construction and operation phase, and that attempts to sabotage the proposed project do not succeed.

Consultations with the community alluded to a low-scale incidence of human-wildlife conflict in the area. Examples were cited of stray hyenas which worry locals by attacking their livestock. Discussions with Kenya Wildlife Service and findings of the biodiversity assessment revealed that there are several wildlife migratory corridors along the forest boundary. The proposed fence was perceived by factions of the community as a solution to the human-



wildlife conflict since it will deter wild animals from leaving the forest and coming to settled areas.

# Significance of Impact (Pre-mitigation)

Based on the analysis provided above, the impacts of insecurity during the construction phase will be "<u>Major -Negative</u>" pre-mitigation (refer to Table 6-34*Error! Reference source not found.*).

#### Table 6-34: Rating of Insecurity Impacts (Pre-Mitigation)

		Type of Impact
		Indirect Negative Impact
		Rating of Impacts
Characteristic	Designation	Summary of Reasoning
Extent	Local	It is anticipated that the potential security risk will be at the <b>local</b> level.
Duration	Long Term	The impacts identified are expected to be <b>long-term</b> as they will last for
		the construction and operations phase
Scale	Medium	The intensity will be <b>medium</b>
Frequency	Recurrent	The frequency of this impact will be recurrent during the Project Cycle.
		Magnitude
		Severe Magnitude
	Sensitivity/	Vulnerability/Importance of the Resource/Receptor
		High Sensitivity

Whereas the project area is generally not perceived as volatile, the community emotions can be aggravated in a short time, which can lead to conflict

Significant Rating Before Mitigation
Major Negative

#### Mitigation/Management Measures

- Employment should also be equal between all local communities, especially between the Maasai and Kipsigis ethnicities to avoid any conflict within the Project Area.
- KWTA and the Contractor will need to liaise with the local security operatives and develop a security plan to protect the Project material, equipment and workers.
- The Proponent should continue to undertake engagement and consultation, with the local stakeholders, in line with its stakeholder engagement strategy
- During construction, an Emergency Preparedness and Response Plan should be prepared and implemented by the Contractor.

### Residual Impact (Post-Mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact related to insecurity will be a "<u>Moderate Negative</u>" post mitigation (refer to Table 6-35).



Rating of Impacts						
Characteristic Designation Summary of Reasoning						
Extent	Local	It is anticipated that the potential risk of insecurity will impact at the				
local level.						
Duration	Long Term	The impacts identified are expected to be <b>long-term</b> as they will last for				
the construction and operations phase.						
Scale	Minor	The intensity will be <b>medium</b>				
Frequency	Recurrent	The frequency of this impact will be recurrent during the Project Cycle.				
		Magnitude				
	Small Magnitude					
		Significant Rating After Mitigation				
		Moderate Negative Impact				

#### Table 6-35: Rating of Impacts on Insecurity (Post-Mitigation)

#### 6.5 Cumulative Impacts

The assessment of cumulative effects is an integral part of the ESIA process and ensures that all aspects of potential effects from the proposed Electric Fence have been, or will be, addressed. Cumulative impacts are a result of effects that act together (including those from concurrent or planned future third-party activities) to affect the same resources and/or receptors as the project under consideration (e.g. the combined effect of other similar projects in the general area). An effect to a resource in itself may not be considered significant but may become significant when added to the existing and potential effects eventuating from similar or diverse developments in the area.

In most instances, past and present developments will have been captured in the baseline assessments presented in Chapter 4 of the ESIA. For the future reasonably foreseeable developments 'adding' impacts to the impact's assessment for the Electric Fence to the baseline will assess the cumulative effect.

The cumulative assessment methodology is based on a consideration of the approval status or existence of the reasonably foreseeable future developments and the nature of information available to aid in predicting the magnitude of impact from the other activity.

During this ESIA Study, it was however noted that there is no specific development or Project proximal to the project footprint that has been made public or which has been made explicit in meetings with Stakeholders and/or County Authorities.



# 7 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

#### 7.1 Introduction

The purpose of the Environmental and Social Management and Monitoring Plan (ESMMP) is to ensure that social and environmental impacts and risks identified during the ESIA process are effectively managed during the construction, operation and decommissioning phases of the Project. The ESMMP specifies the mitigation and management measures to which the Proponent is committed to and shows how the Project will mobilize organizational capacity and resources to implement these measures. The ESMMP also shows how mitigation and management measures will be scheduled and will ensure that the Project complies with the applicable laws and regulations within Kenya, as well as the International Financial Institutions' requirements such as the World Bank Performance Standards on Environmental and Social Sustainability.

The key objectives of the ESMMP are to:

- Formalize and disclose the program for environmental and social management; and
- Provide a framework for the implementation of environmental and social management initiatives.

Best practice principles require that every reasonable effort is made to reduce and preferably to prevent negative impacts while enhancing the benefits. These principles have guided the ESIA process.

Overall responsibility for the ESMMP lies with the Proponent; however, a number of specific activities will be carried out by the Contractor. The Contractor's activities will therefore be supervised by the Proponent to ensure the implementation is performed as planned.

### 7.2 Environmental and Social Management and Monitoring Plan (ESMMP)

The ESMMP covers information on the management and/or mitigation measures that will be taken into consideration to address impacts with respect to:

- Pre-construction and construction activities;
- Operation; and
- Decommissioning.

Table 7-1 summarizes the ESMMP for the Project. It describes parameters that can be monitored, and suggests how monitoring should be done, how frequent, and who should be responsible for monitoring and action.



# Table 7-1:Environmental and Social Management and Monitoring Plan (ESMMP)

Issue	Mitigation/Enhancement Measure	Applicable Project	Responsibility	Compliance Indicator(s)	Frequency of Monitoring	Cost
155uc	Whitgationy Emilancement witabute	Phase (Construction.	for		frequency of Monitoring	Cost
		Operation and	Implementation			
		Decommissioning)	1			
1. Physical				•		L
Impacts on Local Air	Spraying water on soil before excavation and periodic access road wetting to reduce	Construction Phase;	Contractor	No dust related grievances from the	Daily	No additional cost
Quality	nuisance dust levels.	Operation Phase		community members		
	• Visual inspection of dust pollution from roads and the construction site and appropriate			• Very low prevalence of Respiratory Tract		(Contractor's cost)
	intervention if dust levels are high.			Infections (RTIs) among the Project		
	• Speed restriction of construction vehicles to a speed of 30 km/h or less on the site and on the			workers		Costs of PPE (dust
	access roads to the site.			No visible excessive dust emissions		masks) is minimal
	<ul> <li>Maintenance and servicing of machines and engines off-site.</li> </ul>			during construction		
	Grievance procedure for dust complaints.			<ul> <li>No over-speeding of project vehicles</li> </ul>		
	• The use of appropriate Personal Protective Equipment (PPE) such as dust masks, in			Appropriate use of PPE		
	particular, for construction workers.					
	• All construction materials will be transported in designated trucks which will be covered.					
Noise and Vibration	Conduct construction activities during day time;	Construction Phase	Contractor	No recorded incidents or grievances to	Monthly	No additional cost
	<ul> <li>Select equipment with lower sound power levels;</li> </ul>			surrounding land users		
	<ul> <li>Install silencers for fans used by construction machinery;</li> </ul>			Appropriate use of PPE		(Contractor's cost)
	<ul> <li>Restrict engine idling of equipment and vehicles;</li> </ul>			No excessive noise emissions		
	Regular maintenance of construction equipment					
Solid Waste	Segregate and store in a designated waste management area,	All	Contractor	An effective WMP in place	Weekly	No additional cost
	Deliver to licensed recyclers			Water transfer Manifests		
	<ul> <li>Segregate and store in a designated waste management area,</li> </ul>			Records of audits/visual inspection		(Contractor's cost)
	Deliver to licensed recyclers			indicating no improper waste and		
	• Fuels will be stored on site in temporary aboveground storage tanks placed on a bunded			effluent handling		
	area.					
	<ul> <li>Trucks and construction vehicles will be serviced off site</li> </ul>					
	Recovery and re-use to be explored and where it is not feasible they should be disposed in a					
	NEMA					
	<ul> <li>Segregate and store in a designated waste management area,</li> </ul>					
	Deliver to licensed recyclers					
	<ul> <li>Segregate and store in a designated waste management area,</li> </ul>					
	Deliver to licensed recyclers					
	<ul> <li>Segregate and store in a designated waste management area</li> </ul>					
	Eliminate excess packaging					
	Repair items such as pallets so that they can be re-used					
Surface water	Minimise works during rainy season	Construction and	KWTA and	Water quality tests indicating no	Water quality tests	No additional cost
	<ul> <li>Excavated materials to be removed and disposed at designated disposal facility</li> </ul>	Decommissioning	Contractor	significant deviation from the current	conducted monthly and	
	Fuel and other chemicals storage area to be paved and bunded to avoid leakage and	Phases		quality results.	the rest undertaken weekly	(Contractor's cost)
	contamination of surface or ground waters			Visual observations indicating that water		
	<ul> <li>Restore and seed temporary access road</li> </ul>			downstream has remained colourless		
	Maintain erosion controls			Good housekeeping at the project site		
				Well drained project site		
				Areas used for temporary construction		
				activities tully restored		



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Issue	Mitigation/Enhancement Measure	Applicable Project	Responsibility	Compliance Indicator(s)	Frequency of Monitoring	Cost
		Phase (Construction,	for			
		Operation and	Implementation			
Wastes and Effluents	Preparation and implementation of a Waste Management Plan (WMP)	All	Contactor	• An effective WMP in place	Weekly	No additional cost
vvastes and Emidents	Store fuels on site in temporary aboveground storage tanks	111	Contactor	Water transfer Manifests	Weekiy	i vo additional cost
	<ul> <li>Store rules on site in temporary aboveground storage tanks.</li> <li>Service trucks and construction vahicles off site</li> </ul>			Records of audits /visual inspection		(Contractor's cost)
	<ul> <li>Adhere to Kenvan laws and regulations applicable to waste management and the MSDS</li> </ul>			indicating no improper waste and		
	<ul> <li>Provide temporary ablution facilities and ensure treatment and/or removal of sewage</li> </ul>			effluent handling		
	wastes off site					
2. Biological			1			
Destruction of	Minimal clearing of trees should be practiced	Construction Phase	Contractor	Intact vegetation cover where possible	Daily	No additional cost
vegetation (cover,	Avoid felling large trees where necessary			0 1		
species and population)	Avoid using heavy mechanization which would easily cause severe clearing of vegetation					(Contractor's cost)
Potential destruction of	Totally avoid felling large trees listed in the red list of threatened species.		Contractor	• Intact inventory of trees listed in the red	Daily	No additional cost
population of	• Avoid using heavy mechanization which would easily cause severe clearing of tree species	Construction Phase		list of threatened species along the fence		
threatened plant species	threatened to conservation			alignment		(Contractor's cost)
Pit falling of small	• Conduct search and rescue of Shrews, lizards and skinks trapped by trenches and pitholes	Construction Phase	Contractor	Presence of ramps along trenches	Daily	No additional cost
mammals,	every day in the morning	Construction r hase				
herpatofaunal and	Establish a ramp for the species to climb outside from trenches					(Contractor's cost)
crawling invertebrates	Trenches and pitholes should be not be left unattended for long to avoid					
Introduction of Alien	• The earth moving machines should be cleaned by cleaning them before they leave their	Construction Phase	• KWTA	Monitoring records	Daily	No additional cost
Invasive Plant (AIP)	departure points.	Construction i nase	Contractor			
species along the fence	Monitoring of AIPS should be observed closely to identify and control their population					(Contractor's cost)
alignment	before they start reproducing					
Disruption of	Grading should be avoided in sloppy (steep) areas to allow free movement of seeds	Operation Phase	KWTA	Slopes free of grading	Bi-annually	As per approved BoQ
connectivity and seed	downslopes					
dispersal on the	• The bottom wire should be spaced considerably high to allow cross-movements of small to					
landscape	medium mammals that disperse seeds.					
	Controlled grazing of livestock should be enhanced					
Fatal electrocution of	• Vary voltage of lower layers of wires to levels that only excite the medium size birds (CP)	Operation Phase	KWTA	Voltage monitoring records	Weekly	Contractor costs
small mammals and	• Creating a ground clearance (without electric wire) for ground movement by some bird					
birds	species in between the forest and outside (CP)					
Restricted movement	• Complete fencing across riverines should be avoided to allow for movements of elephants	Operation Phase	KWTA	• Riverines free of restrictions for animals	One-off	No additional costs
across the landscape	and other large mammals across the landscape					
3. Socioeconomic						



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Issue	Mitigation/Enhancement Measure	Applicable Project	Responsibility	Compliance Indicator(s)	Frequency of Monitoring	Cost
		Phase (Construction,	for			
		Operation and	Implementation			
		Decommissioning)				
Impacts on Cultural	In order to minimize the potential for impact to sub-surface cultural archaeological material,	Construction and	• KWTA	Chance find reports during construction.	Weekly	No additional cost
Heritage	the proponent should establish a Chance Find Programme which includes the following	Operation phase	Contractor			
	provisions:					(Contractor's cost)
	• A chance find can be reported by any member of the Project. Accordingly, if a chance find is					
	encountered, the first course of action is to stop work in the vicinity of the find. Then the					
	following steps will be undertaken:					
	• Inform site supervisor/ foreman.					
	• Install temporary site protection measures (warning tape and keep off signs).					
	• Inform all personnel of the Chance Find if access to any part of the work area is restricted.					
	• Establish a localized no-go area needed to protect the Chance Find.					
	• The National Museum of Kenya will be contacted to perform a preliminary evaluation to					
	part of a larger site or feature					
	<ul> <li>Artefacts will be left in place when possible if materials are collected they will be placed in</li> </ul>					
	bags and labelled by an archaeologist and handed over to the National Museum of Kenya:					
	no Project personnel are permitted to take or keep artefacts as personal possessions					
	<ul> <li>Document find through photography notes GPS coordinates and mans (collect spatial)</li> </ul>					
	data) as appropriate					
	<ul> <li>If the Chance Find proves to be an isolated find or not cultural heritage, the specialists</li> </ul>					
	brought in from the National Museum of Kenva will authorize the removal of site protection					
	measures and activity in the vicinity of the site can resume.					
	• If the archaeological specialists from National Museum of Kenya confirm the Chance Find is					
	a cultural heritage site, they will inform the project team and initiate discussions with the					
	latter about treatment.					
	Prepare and retain archaeological monitoring records including all initial reports whether					
	they are later confirmed or not.					
	• Develop and implement treatment plans for confirmed finds using the services of qualified					
	cultural heritage experts.					
	• If a Chance Find is a verified cultural heritage site, prepare a final Chance Finds report once					
	treatment has been completed.					
	• While investigation is on-going, co-ordinate with on-site personnel keeping them informed					
	as to status and schedule of investigations, and informing them when the construction may					
	resume.					
	• If mitigation is required, then expedient rescue excavations will be undertaken by the					
	National Museum of Kenya specialist, except in the case that the chance find is of					
	international importance (i.e. Critical Cultural Heritage). If an archaeological site of					
	international importance is encountered special care will be taken and archaeologists with					
	the appropriate expertise in addressing the find will be appointed.					



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Issue	Mitigation/Enhancement Measure	Applicable Project	Responsibility	Compliance Indicator(s)	Frequency of Monitoring	Cost
		Phase (Construction,	for			
		Operation and	Implementation			
Increased Transmission	• The Contractor should develop and implement are employment erroring measures for	Decommissioning)	Contractor	• No ingrosso in transmission of	Monthly	Contractor's cost
Increased Transmission of HIV/AIDS and STIs	<ul> <li>The Contractor should develop and implement pre-employment screening measures for workers, which should include applicable diseases. Individuals found to be suffering from these diseases will need to be sensitized on prevention of transmission to others and management of the disease prior to mobilisation to site.</li> <li>The Contractor should develop and implement a HIV/AIDS and other STIs policy and an information document for all workers directly related to the Project. The information document should address factual health issues as well as behaviour change issues around the transmission and infection of HIV/AIDS and other STIs.</li> <li>The Contractor will make condoms available to employees and communities neighbouring the site office during construction.</li> <li>All project personnel should be inducted on a Code of Conduct that gives guidelines on worker-worker interactions, worker-community interactions and development of personal relationships with members of the local communities.</li> <li>As part of the Code of Conduct, the Proponent should explicitly forbid all Project personnel as well as the Contractor staff from engaging in illicit activities including procuring of commercial sex workers which could affect the reputation of the Agency and or its relationship with communities. Anyone caught engaging in illegal activities should be subject to disciplinary action.</li> <li>If workers are found to be in contravention of the Code of Conduct, which they will be</li> </ul>	Construction phase	Contractor	<ul> <li>No increase in transmission of HIV/AIDS among project workers</li> </ul>	Monthly	Contractor's cost
	required to sign at the commencement of their contract, they will face disciplinary action					
	including dismissal from duty.					
Impacts on Employment, Procurement and the Economy	<ul> <li>The Project should prioritise the employment of labour from the local villages in the first instance especially for unskilled and semi-skilled positions. In the event the position cannot be filled from the project area, labour should be sourced in order of preference from neighbouring communities within the Counties.</li> <li>The Proponent should adopt a fair and transparent employment and procurement strategy to avert any potential favouritism. The strategy should be well understood by local communities.</li> <li>Employment should be fairly distributed among the local ethnic representations to avoid any conflict over the project.</li> <li>KWTA should notify identified representatives of the County Government and Public Administration (i.e. the County Commissioner's office) of the specific jobs and the skills required for the Project, prior to the commencement of construction. This will give the local population time, prior to the commencement of goods and services from within Narok County. In the event that goods and services cannot be procured from within the Counties, then preference should be given to regional companies. The Contractor should however aim at procuring locally available materials where feasible and use local suppliers where appropriate.</li> <li>Job advertisements on employment and procurement opportunities during construction phase should be placed at the Public Administration notice board and applications to be done through this office. In the event that the position cannot be filled from within these villages and towns it should be advertised further afield (County-wide in Narok then</li> </ul>	Construction and Operation Phases	KWTA     Contractor	<ul> <li>Requirements for local employment included in contract established with Maintenance Contractor</li> <li>Percentage of local community members employed on the Project</li> <li>Percentage of locally purchased goods and services</li> </ul>	Weekly	No additional cost (Contractor's cost)



Icento		Mitigation/Enhancement Measure	Applicable Broken	Rosponsibility	Compliance Indicator(a)
issue			Applicable Project	for	Compliance indicator(s)
			Phase (Construction)		
			Operation and	Implementation	
I (	1		Decommissioning)		
Loss of property ar	nd	• An inventory of affected properties including cost of purchase of land, land acreage under	Construction Phase	KWIA	An inventory of affected properties
livelihood sources		crop production and expected amount of crop harvest should be prepared to determine the			A community grievance redress
		level of loss and enable costing/valuation.			mechanism
		• Further the process should identify persons who have been affected in this regard, with an			
		aim of generating their socio-economic profile to determine which alternative intervention			
		can be suitable to help them cope with their loss.			
		Consider implementing suitable alternative livelihood options as supported by local			
		conditions and as proposed by the affected communities would entail: job opportunities in			
		the project, setting up tree nurseries, tea farming, bamboo plantation, bee keeping for honey			
		production, dairy farming, establishing medicinal herb garden etc.			
		• The local leaders including special interest groups such as village elders, women, youth and			
		indigenous peoples should be involved and consulted in identification of interventions and			
		restoration of community livelihoods			
		The property should purpose to build the capacity of local communities in sound forest			
		<ul> <li>The proponent should purpose to build the capacity of local communities in sound forest management by your of training on participatory forest management, constitution of a</li> </ul>			
		General to be a set of the set of			
		Community Forest Association; offering apprenticeship to instil basic skills that can be			
		employed in project implementation; hire local youth to work as forest scouts for income			
		and as well as to portray community involvement in conservation and for sustainability.			
		• Positive interventions geared towards capacity building and restoration of livelihoods may			
		attract those who were not affected and these may in turn lead to competition for limited			
		slots in the various opportunities. For this reason, the Proponent should work closely with			
		the local leaders to ensure a fair, transparent and inclusive process.			
		Establish a community grievance redress mechanism to address concerns arising from the			
		community and to avoid conflict.			
Insecurity		Employment should also be equal between all local communities, especially between the	Construction and	• KWTA	• Emergency Preparedness and Response
		Maasai and Kipsigis ethnicities to avoid any conflict within the Project Area.	Operation Phases		Plan
		• KWTA and the Contractor will need to liaise with the local security operatives and develop a		Contractor	
		security plan to protect the Project material, equipment and workers.			
		• The Proponent should continue to undertake engagement and consultation, with the local			
		stakeholders, in line with its stakeholder engagement strategy			
		During construction an Emergency Prenaredness and Response Plan should be prenared			
		and implemented by the Contractor			
All impacts	_	Prenare a comprehensive decommissioning plan prior to the commencement of the	Decommissioning	KWTA	A fully developed decommissioning plan
All illipacis		decommissioning activities and implement it during the conduct of the decommissioning	Decontinussioning	KWIA	A fully developed decontinussioning plan
		activities. In particular, the decommissioning plan should address the management of electrics	, mase		All populities impacts accorded with the
		activities. In particular, the decommissioning plan should address the management of electrica			All negative impacts associated with the
		equipment including recycling or reuse where possible and the provisions already identified for			conduct of decommissioning phase
		the construction phase. The decommissioning phase management plan will be informed by the			activities effectively managed and kept
		prevailing environmental and social information at the time and advances in technology.			within acceptable limits.

	Frequency of Monitoring	Cost
	Weekly	Contractor cost
nse	Weekly	Contractor costs
an	Decommissioning	As per the
	management plan	decommissioning plan
the	prepared prior to the	6 Piuli
hase	commencement of	
kept	decommissioning phase	
-	activities.	
	Thereafter, monitoring	
	conducted as per the	
	recommendations of the	
	decommissioning	
	management plan	

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Issue	Mitigation/Enhancement Measure	Applicable Project Phase (Construction, Operation and Decommissioning)	Responsibility for Implementation	Compliance Indicator(s)	Frequency of Monitoring	Cost
Solid Waste	<ul> <li>Development and implementation of DEMP which shall cover inter alia;</li> <li>Suitable facilities for the collection, segregation and safe disposal of the waste, and ensuring wastes are not blown off site by winds.</li> <li>Waste collection by approved waste contractors and transferred to an appropriately NEMA licensed) waste management facility</li> <li>Dispose them offsite through approved waste contractors and transferred to an appropriately NEMA licensed) waste management facility</li> <li>Deliver to licensed recyclers</li> <li>Dispose them offsite through approved waste contractors and transferred to an appropriately NEMA licensed) waste management facility</li> </ul>	Decommissioning     Phase	Contractor	A Waste Management Plan	Thereafter, monitoring conducted as per the recommendations of the decommissioning management plan	As per waste management plan



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# 7.3 Roles and Responsibilities

# 7.3.1 *Contractual Obligation*

In order to ensure that this ESMMP and/or derivatives thereof are enforced and implemented, these documents must be given legal standing. This shall be achieved through incorporating the ESMMP and/or derivative documents as an addendum to the contract documents for the particular project contractors and specifying under particular conditions of the contract for the tender that the requirements of this ESMMP and/or derivative documents apply and must be met. This will ensure that the obligations are clearly communicated to contractors and that submitted tenders have taken into account and budgeted for the environmental requirements specified in this ESMMP and/or its derivatives. The successful tender ultimately becomes the signed contract, thereby ensuring that the included ESMMP becomes legally binding.

# 7.3.2 Responsibilities and Duties

# 7.3.2.1 The Project Proponent

The KWATA has overall responsibility for ensuring that the construction and development of the Project is undertaken in an environmentally sound and responsible manner, and in particular, reflects the requirements and specifications of the ESMMP and recommendations from the relevant authorities.

The responsibilities of the Project Proponent will include:

- Appointing or designating a suitably qualified Project Manager to manage the implementation of the proposed project;
- Appointing the suitably qualified and experienced Contractor;
- Establishing and maintaining regular and proactive communications with the designated/ appointed Project Manager Contractor(s) and Environmental Compliance Officer (ECO); and
- Ensuring that the ESMMP is reviewed and updated as necessary.

Reporting Structure:

The Project Proponent will liaise with the following:

- Government/ regulatory authorities such as KFS and KWS; and
- General Public.



### 7.3.2.2 Contractor

The Project Proponent will appoint a Contractor(s) to implement the development. The Contractor(s) will be contractually required to undertake their activities in an environmentally responsible manner, as described in the ESMMP.

The role of the Contractor shall be to:

- Ensure that the environmental specifications of this document (including any revisions, additions or amendments) are effectively implemented. This includes the on-site implementation of steps to mitigate environmental impacts;
- Preserve the natural environment by limiting any destructive actions on site;
- Ensure that suitable records are kept and that the appropriate documentation is available for review;
- Take into consideration the legal rights of the individual landowners, communities and Project Proponent's staff;
- Ensure quality in all work done, technical and environmental;
- Underwrite the Project Proponent's Environmental Policy at all times, and
- Ensure that all sub-contractors and other workers appointed by the Contractor are complying with and implementing the ESMMP during the duration of their specific contracts.

The responsibilities of the Contractor will be to:

- Discuss implementation of and compliance with this document with staff at routine site meetings;
- Designate, appoint and/or assign tasks to personnel who will be responsible for managing all or parts of the ESMMP. The Contractor must appoint or designate a Safety, Health, Environment and Quality Officer (SHEQO) to monitor daily implementation of the ESMMP on the Contractor's behalf as a minimum;
- Monitor environmental performance and conformance with the specifications contained ٠ in this document during site inspections;
- Report progress towards implementation of and non-conformances with this document at site meetings with the Proponent;
- Advise the Proponent of any incidents or emergencies on site, together with a record of action taken;

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- Report and record all accidents and incidents resulting in injury or death;
- Resolve problems and claims arising from damage immediately to ensure a smooth flow of operations; and
- The Contractor will be required to provide for the appropriate Environmental Training and awareness as described in this ESMP in his costs and programming.

Reporting Structure:

The Contractor will report to the Proponent, as and when required.

#### 7.3.2.3 Subcontractors

The Contractor may from time to time appoint Sub-contractors. The role of the Subcontractors shall be to:

- Perform certain services and/or provide certain products on behalf of the Contractor. The Sub-contractors will be contractually required to undertake their activities in an environmentally responsible manner, as described in the ESMMP; and
- Ensure environmental awareness among employees so that they are fully aware of and understand the Environmental Specifications and the need for them.

The responsibilities of the Sub-contractor will be to:

- Be familiar with the contents of the ESMMP, and his/her roles and responsibilities as defined therein;
- Comply with the Environmental Specifications in the ESMMP and associated instructions issued by the Contractor to ensure compliance;
- Notify the Contractor verbally and in writing, immediately in the event of any accidental infringements of the Environmental Specifications and ensure appropriate remedial action is taken; and
- Notify the Contractor, verbally and in writing at least 10 working days in advance of any activity he/she has reason to believe may have significant adverse environmental impacts, so that mitigation measures may be implemented timely.

Reporting Structure:

Sub-contractors will report to and receive instructions from the Main Contractor.

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# 7.3.2.4 Environmental Control Officer (ECO)

The Project Proponent will appoint an independent ECO to monitor and oversee implementation of the ESMMP for the proposed construction works. The ECO is independent from the Project Proponent and Contractor(s). The ECO is given authority to ensure that the ESMMP is fully implemented and that appropriate actions are undertaken to address any discrepancies and non-compliances.

The role of the ECO shall be to:

- Act as site 'custodian' for the implementation, integration and maintenance of the ESMMP in accordance with the contractual requirements;
- Ensure successful implementation of the ESMMP; and
- Ensure that the Contractor, his employees and/or Sub-contractors receive the appropriate environmental awareness training prior to commencing activities.

The responsibilities of the ECO will be to:

- Update the Proponent on the level of compliance with the ESMMP achieved by the Contractor on a regular basis for the duration of the contract;
- Advise the Proponent on the interpretation and enforcement of the Environmental Specifications (ES), including evaluation of non-compliances;
- Supply environmental information as and when required;
- Review and approve Method Statements produced by the Contractor, in conjunction with the PM;
- Demarcate particularly sensitive areas (including all No-Go areas) and to pass instructions through the PM concerning works in these areas;
- Monitor any basic physical changes to the environment as a consequence of the construction works according to an audit schedule;
- Attend regular site meetings and project steering committee meetings;
- Undertake regular monthly audits of the construction works and to generate monthly audit reports. These reports are to be forwarded to the PM who will communicate the results and conclusions with the Project Proponent;
- Communicate frequently and openly with the Contractor and the PM to ensure effective, proactive environmental management, with the overall objective of preventing or

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reducing negative environmental impacts and/or enhancing positive environmental impacts;

- Advise the PM on remedial actions for the protection of the environment in the event of any accidents or emergencies during construction, and to advise on appropriate clean-up activities;
- Review complaints received and make instructions as necessary; and
- Identify and make recommendations for minor amendments to the ESMMP as and when appropriate.

Reporting Structure:

The ECO will report to the PM, who in turn will report to the Project Proponent.

### 7.4 Monitoring

### 7.4.1 Undertaking Audits

The PM shall appoint a qualified and experienced ECO to ensure implementation of and adherence to the ESMMP.

The ECO shall conduct audits to ensure that the system for implementation of the ESMMP is operating effectively. The audit shall check that a procedure is in place to ensure that:

- The ESMMP and the Method Statements being used are the up to date versions.
- Variations to the ESMMP, Method Statements and non-compliances and corrective actions are documented.
- Emergency procedures are in place and effectively communicated to personnel.

The audit programme shall consist of the following at a minimum:

- First audit no later than 1 month after construction commences;
- Thereafter audits at monthly intervals, at a minimum;
- An audit one week prior to practical completion of the project is granted; and
- A post construction audit within 1 week after the contractor has moved off site.



### 7.4.2 Compliance with the ESMMP

The Contractor and/or his agents are deemed not to have complied with the ESMMP and remedial action if:

- There is evidence of contravention of the ESMMP clauses within the boundaries of the site or extensions;
- Environmental damage ensues due to negligence; and
- The Contractor fails to comply with corrective or other instructions issued by the PM, within a time period specified by the PM.





# 8 CONCLUSION AND RECOMMENDATION

#### 8.1 The Report

This ESIA highlights the social and environmental impacts associated with the proposed fencing of Maasai Mau Forest Block. In line with existing national legislation and international practice, an Environmental Assessment entailing detailed analysis of social and environmental impacts of the project was undertaken leading to preparation of an Environmental and Social Management and Monitoring Plan (ESMMP).

#### 8.2 Study methodology leading to preparation of this report

The ESIA Study was undertaken in compliance with Section 58 of (EMCA) 1999 and its amendments of 2015 which requires that an Environmental Impact Assessment (EIA) conducted in line with Legal Notice 101 of EMCA (Kenya Gazette Supplement No. 56 of 13th June 2003), precede all development activities proposed to be implemented in Kenya. As well, and in appreciation that EMCA is a framework legislation coordinating close to 77 Sectoral laws, the Study closely collaborated with other relevant sectors to ensure that the proposed project does not contradict reigning Sectoral policies. Thus, conduct of the Study was preceded by focused review of relevant literature to determine the project's Area of Influence followed by a series of visits to the field. Further, in line with requirements of EMCA 1999, stakeholders to the project were sampled and contacted to provide views on the proposed project.

### 8.3 Findings of the Study

This ESIA study for the proposed electric fencing project has identified various positive and adverse negative impacts (as presented in chapter 6). The majority of adverse impacts identified are short-term in nature, of low significance and will cease once the construction phase is completed. Further, other impacts can be managed through mitigations recommended.

#### 8.4 The mitigation program

An ESMMP to guide resolution of adverse impacts has been developed as part of the ESIA in which case, the burden of mitigation largely lies with the Project Contractor under supervision by the Project Manager through the Supervisor of Works. Key observations are that most adverse impacts are short-term and will disappear once civil works ends. The Contract should bear



relevant clauses binding the contractor to institute environmental mitigation as recommended in this study. Thus, in this case, the core monitoring strategy for this project will be through site meetings, in which case, it is recommended that the County Environmental Officers be invited to such meetings. Other stakeholders such as the County Labour Officer should also initially attend such meetings to ascertain that measures towards securing the health and safety of workers have been put in place.

It is the duty of NEMA to consider licensing the project subject to annual environmental audits once it has been commissioned. This will be in compliance with the Environmental Management and Coordination Act, EMCA of 1999 and the Environmental Impact Assessment and Audit Regulations, Legal Notice No. 101 of 2003.

When completed, the fencing project will be subjected to statutory environmental and quality audits during the defect liability period and the Contractor will be liable to repair all defects including those pertaining to environmental mitigation.

### 8.5 Recommendation

The Consultant recommends that every effort be made by the Proponent to accommodate the mitigation measures recommended during the ESIA process to the extent that is practically possible, without compromising the economic viability of the Project. The implementation of the mitigation measures detailed in Chapter 6 and listed in the ESMMP (Chapter 7) will provide a basis for ensuring that the potential positive and negative impacts associated with the establishment of the development are enhanced and mitigated to a level which is deemed adequate for the development to proceed.

In summary, based on the findings of this assessment, the study team find no reason why the Project should not be authorized, contingent on the mitigations and monitoring for potential environmental and socio-economic impacts as outlined in the ESMMP.





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## ANNEXES

ANNEX	Description
Annex 1:	Checklist of plant species recorded during the rapid biodiversity survey on western side of Maasai Mau Forest from October 31st to November 8th 2019
Annex 2:	Checklist of mammal species recorded during the rapid biodiversity survey on western side of Maasai Mau Forest from October 31st to November 8th 2019
Annex 3:	Bird biometric Assessment from mist netting generated from the rapid biodiversity survey on western side of Maasai Mau Forest from October 31st to November 8th 2019
Annex 4:	Checklist of bird species recorded during the rapid biodiversity survey on western side of Maasai Ma u Forest from October 31st to November 8th 2019
Annex 5:	Bird biometric Assessment from mist netting generated from the rapid biodiversity survey on western side of Maasai Mau Forest from October 31st to November 8th 2019
Annex 6:	Checklist of invertebrate species recorded during the rapid biodiversity survey on western side of Maasai Ma u Forest from October 31st to November 8th 2019
Annex 7:	Location where water quality parameters were measured in the western side of Maasai Mau Forest during the rapid





	biodiversity survey on from October 31st to November 8th 2019
Annex 8:	Water quality parameter measurements from streams in the western side of Maasai Mau Forest during the rapid biodiversity survey on from October 31st to November 8th 2019
Annex 9:	Laboratory measurements of soil physical and chemical parameter collected from the western side of Maasai Mau Forest during the rapid biodiversity survey on from October 31st to November 8th 2019
Annex 10:	Photo Gallery
Annex 11:	Participants' Lists
Annex 12:	Minutes of Stakeholder Meetings





Annex 1: Checklist of plant species recorded during the rapid biodiversity survey on western side of Maasai Mau Forest from October 31st to November 8th 2019

		Fore	st	Farmland	Recl	aimed A	Irea	
Family, Species	Life Form	Nkoben	Chepalung	Nkoben	Chepalung	Sierra Leone	Kass FM	Toltol
Family: Acanthaceae								- E
Acanthus sp.	Shrub		$\checkmark$			$\checkmark$	$\checkmark$	
Barleria acanthoides	Herb	$\checkmark$			$\checkmark$			
Dyschoriste radicans	Herb			$\checkmark$	$\checkmark$			
Hypoestes aristata	Herb	$\checkmark$	$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$
Hypoestes forskahlii	Herb	$\checkmark$			$\checkmark$			
Isoglossa gregorii	Herb	$\checkmark$	$\checkmark$		$\checkmark$		$\checkmark$	
Justicia bracteata	Herb	$\checkmark$	$\checkmark$					$\checkmark$
Thurnbergia alata	Herb			$\checkmark$		$\checkmark$		
Thurnbergia gibsonii	Herb					$\checkmark$		
Justicia flava	Herb	$\checkmark$	$\checkmark$					
Family: Amaranthaceae								
Achyranthes aspera	Herb	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$		$\checkmark$
Amaranthus hybridus	Herb				$\checkmark$	$\checkmark$		$\checkmark$
Centrostachys aquatica	Herb		$\checkmark$					
Cyathula polycephala	Herb			$\checkmark$	$\checkmark$			$\checkmark$
Family: Amaryllidaceae								
Scadoxus multiflorus	Herb					$\checkmark$	$\checkmark$	
Family: Anacardiaceae								
Rhus natalensis	Shrub			$\checkmark$	$\checkmark$			
Rhus vulgaris	Shrub			$\checkmark$	$\checkmark$		$\checkmark$	
Family: Apiaceae								
Alepidea peduncularis	Herb							
Centella asiatica	Herb			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Family: Apocynaceae								
acokanthera oppositifolia	Shrub				$\checkmark$			
Carissa edulis	Shrub			$\checkmark$	$\checkmark$			

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Gomphocarpus physocarpus	Herb				$\checkmark$	$\checkmark$		
Periploca linearifolia	Herb	$\checkmark$	$\checkmark$					$\checkmark$
Family: Araliaceae								
Polyscias kikuyuensis	Tree	$\checkmark$	$\checkmark$					
Polyscias stuhlmannii	Tree							
Hydrocotyle ranunculoides	Herb					$\checkmark$	$\checkmark$	
Cussonia holstii	Tree			$\checkmark$				
Cussonia spicata	Tree							$\checkmark$
Family: Asparagaceae								
Asparagus racemosus	Herb			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
Dracaena sp.	Shrub	$\checkmark$	$\checkmark$					
Family: Asphodelaceae								
Aloe kilifiensis	Herb			$\checkmark$	$\checkmark$			
Aloe secundiflora	Herb			$\checkmark$	$\checkmark$			
Family: Aspleniaceae								
Asplenium macrophlebium	Herb							
Asplenium rutifolium	Herb				$\checkmark$		$\checkmark$	
Asplenium stuhlmannii	Herb				$\checkmark$		$\checkmark$	$\checkmark$
Family: Asteraceae								
Acmella caulirhiza	Herb			$\checkmark$	$\checkmark$			
Biden pilosa	Herb			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
Circium vulgare	Herb			$\checkmark$		$\checkmark$		
Galinsoga parviflora	Herb		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
Gerbera viridifolia	Herb							
Grangae maderaspatana	Herb				$\checkmark$			
Helichrysum foetidum	Herb				$\checkmark$	$\checkmark$		
Launaea cornuta	Herb				$\checkmark$		$\checkmark$	$\checkmark$
Psiada punctulata	Shrub	$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$	
Psiadia arabica	Shrub			$\checkmark$	$\checkmark$			
Senecio hediensis	Shrub			$\checkmark$	$\checkmark$			
Sonchus asper	Herb			$\checkmark$	$\checkmark$			$\checkmark$
Sphaeranthus bullatus	Herb			$\checkmark$	$\checkmark$			$\checkmark$
Sphaeranthus suaveolus	Herb			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Tagetes minuta	Herb				$\checkmark$			

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Tarchonanthus camphratus	Shrub			$\checkmark$	$\checkmark$			
Bothriocline longipes	Shrub				$\checkmark$	$\checkmark$	$\checkmark$	
Dichrocephala integrifolia	Herb				$\checkmark$	$\checkmark$		$\checkmark$
Conyza floribunda	Herb			$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$
Conyza bonareiensis	Herb			$\checkmark$	$\checkmark$			
Crassocephalum manii	Herb		$\checkmark$			$\checkmark$		
Crassocephalum picridifolium	Herb			$\checkmark$	$\checkmark$			
Conyza newii	Herb						$\checkmark$	
Family: Balsaminaceae								
Impatiens hoehnelii	Herb	$\checkmark$	$\checkmark$					
Impatiens hochstetteri	Herb	$\checkmark$	$\checkmark$					
Family: Basellaceae								
Bassela alba	Herb	$\checkmark$	$\checkmark$					$\checkmark$
Family: Bignoniaceae								
Tecoma stans	Shrub					$\checkmark$	$\checkmark$	
Family: Boraginaceae								
Cordia monoica	Tree							
Heliotropium indicum	Herb		$\checkmark$			$\checkmark$		
Family: Brassicaceae								
Brassica oleracea	Herb					$\checkmark$		
Brassica oleracea acephala	Herb			$\checkmark$		$\checkmark$		
Family: Callitrichaceae								
Callitriche oreophilia	Herb			$\checkmark$	$\checkmark$			
Family: Campanulaceae								
Lobelia giberroa	Shrub	$\checkmark$	$\checkmark$				$\checkmark$	$\checkmark$
Family: Canellaceae								
Warbugia ugandensis	Tree	$\checkmark$						
Family: Cannabaceae								
Celtis africana	Tree	$\checkmark$	$\checkmark$					
Family: Capparaceae								
Cleome schimpheri	Herb							
Cleome hirta	Herb	$\checkmark$						
Maerua decumbens	Shrub		1		$\checkmark$			
Family: Celastraceae								

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Maytenas heterophylla	Shrub							$\checkmark$
Family: Celastraceae								
Maytenus senegalensis	Shrub				$\checkmark$			
Family: Commelinaceae								
Commelina diffusa	Herb			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Commelina benghalensis	Herb			$\checkmark$	$\checkmark$			
Family: Compositae								
Berkheya spekeana	Herb							
Carduus chamaecephalus	Herb			$\checkmark$				
Ethulia conyzoides	Herb			$\checkmark$	$\checkmark$	$\checkmark$		
Helichrysum nandense	Herb			$\checkmark$	$\checkmark$		$\checkmark$	
Solanecio mannii	Shrub	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Vernonia auriculata	Shrub			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Vernonia biafrae	Shrub					$\checkmark$		$\checkmark$
Vernonia brachycalyx	Shrub			$\checkmark$		$\checkmark$	$\checkmark$	
Vernonia galamensis	Shrub							$\checkmark$
Family: Connaraceae								
Rourea thomsonii	Shrub						$\checkmark$	$\checkmark$
Family: Convolvulaceae								
Dichondra repens	Herb			$\checkmark$	$\checkmark$			$\checkmark$
Family: Convolvulaceae								
Ipomoea fulvicaulis	Herb			$\checkmark$	$\checkmark$	$\checkmark$		
Family: Crassulaceae								
Crassula alsinoides	Herb		$\checkmark$		$\checkmark$			
Kalonchoe nyikae	Herb						$\checkmark$	$\checkmark$
Family: Cucurbitaceae								
Cucumis sp.	Herb			$\checkmark$	$\checkmark$			$\checkmark$
Cucurbita pepo	Herb							
Lagenaria sphaerica	Herb	$\checkmark$		$\checkmark$				$\checkmark$
Momordica foetida	Herb	$\checkmark$	$\checkmark$					
Oreosyce africana	Shrub	$\checkmark$	$\checkmark$				$\checkmark$	$\checkmark$
Family: Cupressaceae								
Cupressus lusitanica	Tree							
Juniperus procera	Tree			$\checkmark$				

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Family: Cyatheaceae								
Cyathea manniana	Shrub							
Family: Cyperaceae								
Cyperus rotundus	Sedge			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Kyllinga bulbosa	Sedge			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Family: Dennstaedtiaceae								
Blotiella glabra	Herb			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Family: Ebenaceae								
Euclea divinorium	Shrub			$\checkmark$				
Family: Euphorbiaceae								
Acalypha racemosa	Herb							
Clutia abyssinica	Shrub		$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Clutia kilimandscharica	Shrub							
Croton macrostachyus	Tree	$\checkmark$	$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$
Erythrococa bongensis	Shrub							
Phylanthus fischeri	Shrub	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$			
Phyllanthus amara	Shrub			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
Ricinus communis	Shrub					$\checkmark$		
Croton megalocarpus	Tree						$\checkmark$	
Croton sylvicatus	Tree					$\checkmark$	$\checkmark$	
Euphorbia candelubrum	Shrub						$\checkmark$	
Family: Fabaceae								
Albizia gummifera	Tree	$\checkmark$		$\checkmark$				
Caesalpinia decapitala	Shrub				$\checkmark$	$\checkmark$	$\checkmark$	
Clitoria ternata	Herb		$\checkmark$	$\checkmark$				
Desmodium sp.	Herb		$\checkmark$		$\checkmark$			
indigofera indicta	Shrub	$\checkmark$				$\checkmark$		
indigofera brevycalyx	Shrub	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	
Mellitia leucantha	Tree	$\checkmark$	$\checkmark$					$\checkmark$
Milletia dura	Tree		$\checkmark$					
Neonotonia wightii	Herb	$\checkmark$	$\checkmark$					
Neptunia oleraceae	Herb				$\checkmark$			
Phaseolus vulgaris	Herb			$\checkmark$			$\checkmark$	
Pisum sativum var. saccharatum	Herb			$\checkmark$				

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Rhynchosia minima	Herb			$\checkmark$			$\checkmark$	
Senna didymobotrya	Shrub					$\checkmark$	$\checkmark$	$\checkmark$
Senna septemtrionalis	Shrub		$\checkmark$					
Sesbania sesban	Shrub				$\checkmark$	$\checkmark$		
Trifolium burchelianum	Herb	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Vigna parkeri	Herb	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Vigna vexillata	Herb	$\checkmark$	$\checkmark$					
Crotolaria agatiflora	Herb							
Crotolaria incana	Herb							
Family: Francoaceae								
Bersama abyssinica	Tree						$\checkmark$	$\checkmark$
Family: Hamamelidaceae								
Trichocladia ellipticus	Tree	$\checkmark$	$\checkmark$					$\checkmark$
Family: Hypericaceae								
Hypericum roperanum	Herb			$\checkmark$	$\checkmark$			
Family: Lamiaceae								
Ajuga remota	Herb				$\checkmark$			
Leonotis ocymifolia	Herb			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Leucas bracteosa	Herb	$\checkmark$			$\checkmark$		$\checkmark$	$\checkmark$
Ocimum americanum	Herb						$\checkmark$	$\checkmark$
Ocimum gratissimum	Herb	$\checkmark$						
Plectranthus albovidaceus	Herb	$\checkmark$	$\checkmark$					
Plectranthus barbatus	Herb					$\checkmark$		$\checkmark$
Plectranthus comosus	Herb	$\checkmark$	$\checkmark$				$\checkmark$	
Plectranthus otostegeioides	Herb	$\checkmark$	$\checkmark$					
Leonotis nepotifolia	Herb	$\checkmark$				$\checkmark$	$\checkmark$	$\checkmark$
Leucas urticifolia	Herb					$\checkmark$	$\checkmark$	$\checkmark$
Family: Laraceae								
Persea americana	Tree			$\checkmark$		$\checkmark$	$\checkmark$	
Family: Leguminosae								
Acacia abyssinica	Tree			$\checkmark$	$\checkmark$			
Acacia mangium	Tree							
Acacia kirkii	Tree							
acacia mearnsii	Shrub					$\checkmark$	$\checkmark$	

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Acacia nilotica	Shrub							
Family: Loranthaceae								
Englerina woodfordiodes	Shrub	$\checkmark$						
Phragmanthera usuiensis	Shrub				$\checkmark$		$\checkmark$	
Family: Malvaceae								
Abutilon mauritiana	Shrub	$\checkmark$	$\checkmark$					
Abutilon sp.	Shrub							
Color greewayi	Shrub							
Dombeya burgessiae	Tree					$\checkmark$		
Dombeya torrida	Tree							$\checkmark$
Grewia bicolor	Shrub	$\checkmark$	$\checkmark$		$\checkmark$			
Grewia holstii	Shrub				$\checkmark$			
Hibiscus diversifolius	Shrub							
Hibiscus fuscus	Shrub							
Sida tenuicarpa	Herb			$\checkmark$	$\checkmark$			
Urena lobata	Shrub			$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$
Sida rhombifolia	Herb			$\checkmark$	$\checkmark$			
Family: Meliaceae								
Trichelia emetica	Tree							
Ekerbergia capensis	Tree					$\checkmark$		$\checkmark$
Family: Menispermaceae								
Cissampelos pareira	Shrub							
Stephania abyssinica	Herb	$\checkmark$	$\checkmark$			$\checkmark$		
Family: Moraceae								
Ficus sycomorus	Tree							
Ficus thonningii	Tree		$\checkmark$				$\checkmark$	
Ficus natalensis	Tree						$\checkmark$	
Family: Musaceae								
Musa sapientum	Shrub			$\checkmark$		$\checkmark$		
Family: Myrsinaceae								
Maesa lanceolata	Tree	$\checkmark$	$\checkmark$					
Family: Myrtaceae								
Eucalyptus globulus	Tree						$\checkmark$	$\checkmark$
Eucalyptus saligna	Tree			$\checkmark$			$\checkmark$	

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Family:Ochnaceae								
Ochna ovata	Shrub					$\checkmark$	$\checkmark$	
Family: Oleaceae								
Jasminum fluminense	Shrub	$\checkmark$	$\checkmark$					$\checkmark$
Olea africana	Tree	$\checkmark$	$\checkmark$			$\checkmark$		$\checkmark$
Olea europeae	Tree	$\checkmark$	$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$
Family: Onagraceae								
Epilobium hirsutum	Herb			$\checkmark$	$\checkmark$			$\checkmark$
Eulophia speciosa	Herb							
Polystachya cultiformis	Herb		$\checkmark$					
Family: Oxalidaceae								
Oxalis anthelmintica	Herb					$\checkmark$	$\checkmark$	$\checkmark$
Oxalis latifolia	Herb			$\checkmark$	$\checkmark$	$\checkmark$		
Family: Passifloraceae								
Passiflora mollissima	Shrub		$\checkmark$					
Family: Phyllanthaceae								
Bridelia micrantha	Tree						$\checkmark$	
Family: Phytolaccaceae								
Phytolacca octandra	Herb		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Family: Piperaceae								
Piper capensis	Shrub	$\checkmark$	$\checkmark$					
Family: Poaceae								
Arundinaria alpina	Grass				$\checkmark$			
Chloris pycnothrix	Grass			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Cynodon dactylon	Grass							
Echinochloa stagnina	Grass				$\checkmark$		$\checkmark$	
Eleusine coracana	Grass					$\checkmark$		
Hordeum vulgare	Grass							
Pennisetum glaucum	Grass			$\checkmark$		$\checkmark$		
Pennisetum purpureum	Grass							
Saccharum officinarum	Grass							
Sorghum bicolor	Grass							
Triticum aestivum	Grass							
Zea mays	Grass						$\checkmark$	

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Dactyloctenium aegypticum	Grass				$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Family: Podocarpaceae								
Podocarpus latifolius	Tree		$\checkmark$					$\checkmark$
Family: Polygonaceae								
Persicaria senegalensis	Herb			$\checkmark$	$\checkmark$	$\checkmark$		
Polygonum senegalense	Herb							
Rumex crispus	Herb				$\checkmark$	$\checkmark$		$\checkmark$
Rumex ruwenzoriensis	Shrub			$\checkmark$	$\checkmark$	$\checkmark$		
Rumex steudelii	Shrub				$\checkmark$	$\checkmark$		$\checkmark$
Oxygonum sinuatum	Herb							$\checkmark$
Persicaria nepalensis	Herb				$\checkmark$			
Family: Proteaceae								
Protea caffra	Shrub	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$			
Family: Pteridaceae								
Pellaea viridis	Herb	$\checkmark$	$\checkmark$				$\checkmark$	$\checkmark$
Pteris cretica	Herb	$\checkmark$	$\checkmark$					
Family: Putranjivaceae								
Drypetes gerrardii	Tree							
Family: Rhamnaceae								
Scutia myrtina	Shrub	$\checkmark$	$\checkmark$					
Family: Rhizophoraceae								
Cassipourea malosana	Shrub							$\checkmark$
Family: Rosaceae								
Hagenia abyssinica	Tree		$\checkmark$					
Prunus africana	Tree	$\checkmark$	$\checkmark$					$\checkmark$
Rubus apetalus	Shrub	$\checkmark$	$\checkmark$				$\checkmark$	$\checkmark$
Rubus steudneri	Shrub	$\checkmark$						
Rubus volkensi	Shrub	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$			
Eryobotria japonica	Tree						$\checkmark$	
Family: Rubiaceae								
Keetia guinenzii	Shrub							
Psychotria sp.	Tree							
Rothmannia fischeri	Tree						$\checkmark$	$\checkmark$
Rubia cordifolia	Shrub	$\checkmark$	$\checkmark$				$\checkmark$	$\checkmark$

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Vangueria infausta	Shrub	$\checkmark$						
Vangueria madagascariensis	Shrub	$\checkmark$		$\checkmark$	$\checkmark$			
Family: Rutaceae								
Calodendron sp.	Tree	$\checkmark$						$\checkmark$
Teclea nobilis	Tree	$\checkmark$	$\checkmark$					
Toddalia asiatica	Shrub	$\checkmark$						$\checkmark$
Family: Salicaceae								
Dovyalis abyssinica	Shrub	$\checkmark$	$\checkmark$				$\checkmark$	
Dovyalis macrocalyx	Shrub	$\checkmark$			$\checkmark$			
Flacourtia indica	Shrub							
Family: Santalaceae								
Osyris lanceolata	Shrub				$\checkmark$			
Family: Sapindaceae								
Dodonaea angustifolia	Shrub			$\checkmark$	$\checkmark$			
Family: Sinopteridaceae								
Cheilanthes inaequalis	Herb				$\checkmark$		$\checkmark$	$\checkmark$
Family: Solanaceae								
Solanum mauritanium	Shrub	$\checkmark$	$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$
Solanum sessilistellum	Shrub						$\checkmark$	$\checkmark$
Solanum scabrum	Shrub			$\checkmark$	$\checkmark$	$\checkmark$		
Solanum incanum	Shrub							
Solanum mauritanium	Shrub							
Solanum nigrum	Shrub			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Solanum tuberosum	Herb			$\checkmark$		$\checkmark$	$\checkmark$	
Datura stramonium	Herb					$\checkmark$		
Datura suaveolens	Shrub						$\checkmark$	
Family: Stilbaceae								
Nuxia congesta	Tree							$\checkmark$
Halleria lucida	Tree					$\checkmark$	$\checkmark$	$\checkmark$
Family: Thelypteridaceae								
Cyclosorus interruptus	Herb					$\checkmark$	$\checkmark$	
Family: Tiliaceae								
Triumfetta tomentosa	Shrub	$\checkmark$						
Triumffeta brachycerus	Shrub	$\checkmark$	$\checkmark$		$\checkmark$			

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Family: Urticaceae								
Laportea alatipes	Herb	$\checkmark$	$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$
Pilea johnstonii	Herb	$\checkmark$	$\checkmark$					
Pilea tetraphylla	Herb	$\checkmark$	$\checkmark$					
Urtica massaica	Herb	$\checkmark$	$\checkmark$					
Family: Verbenaceae								
Clerodendrum johnstonii	Shrub	$\checkmark$	$\checkmark$					
Clerodendrum eriophyllum	Shrub	$\checkmark$	$\checkmark$					
Lantana trifolia	Shrub		$\checkmark$				$\checkmark$	$\checkmark$
Lantana viburnoides	Shrub	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$			
Lippia javanica	Shrub	$\checkmark$						
Vitex strickeri	Tree		$\checkmark$					
Family: Vitaceae								
Cyphostema kilimandscharica	Shrub						$\checkmark$	
Cyphostema maraguens	Shrub			$\checkmark$				$\checkmark$

Appendix 2: Checklist of mammal species recorded during the rapid biodiversity survey on western side of Maasai Mau Forest from October 31st to November 8th 2019

Site	Sector	Common	Species	<b>Observation Method</b>
		Multimammate		
Nkoben	Forest	Mouse	Mastomys sp.	Sherman trapped
Nkoben	Forest	African Vleis Rat	Otomys sp.	Sherman trapped
		African black		
Nkoben	Forest	Shrew	Crocidura nigrofusca	Sherman trapped





		Stripped Grass		
Nkoben	Forest	Rat	Lemniscomys striatus	Sherman trapped
		Mau Forest	Colobus guereza	
Nkoben	Forest	Guereza	matschiei	Observed
			Cercopithecus mitis	
Nkoben	Forest	Blue Monkey	stuhlmanni	Observed
		Crested		
Nkoben	Forest	Porcupine	Hystrix cristata	Quills sign
				Foot print sign and
Nkoben	Forest	Common Duiker	Sylvicapra grimmia	dung pile
Nkoben	Forest	Spotted Hyaena	Crocuta crocuta	Foot print
Nkoben	Forest	Aardvark	Orycteropus afer	Burrow signs
Chepalulu		Multimammate		
ngu	Forest	Mouse	Mastomys sp.	Sherman trapped
Chepalulu				
ngu	Forest	African Vlei Rat	Otomys sp.	Sherman trapped
Chepalulu		African Pygmy		
ngu	Forest	Mouse	Mus minutoides	Sherman trapped
Chepalulu		Mau Forest	Colobus guereza	
ngu	Forest	Guereza	matschiei	Locals information
Chepalulu			Cercopithecus mitis	
ngu	Forest	Blue Monkey	stuhlmanni	Locals information
Chepalulu				
ngu	Forest	Common Duiker	Sylvicapra grimmia	Locals information
Chepalulu				
ngu	Forest	Spotted Hyena	Crocuta crocuta	Foot print
Chepalulu				
ngu	Forest	Aardvark	Orycteropus afer	Locals information
Chepalulu				
ngu	Forest	African Leopard	Panthera pardus	Locals information
Chepalulu	Reclaimed			
ngu	Area	African Vlei Rat	Otomys sp.	Sherman trapped
Sierra	Reclaimed	African Pygmy		
Leone	Area	Mouse	Mus minutoides	Sherman trapped



Sierra	Reclaimed			
Leone	Area	Mouse	Mus sp.	Sherman trapped
Sierra	Reclaimed	African black		
Leone	Area	shrew	Crocidura nigrofusca	Sherman trapped
Sierra		African bush		
Leone	Forest	elephant	Loxodonta africana	Locals information
	Reclaimed	Multimammate		
Toltol	Area	Mouse	Mastomys sp.	Sherman trapped
	Reclaimed	Brush-furred		
Toltol	Area	Mouse	Lophuromys sp.	Sherman trapped
	Reclaimed	Stripped Grass		
Toltol	Area	Rat	Lemniscomys striatus	Sherman trapped
	Reclaimed	African black		
Toltol	Area	Shrew	Crocidura nigrofusca	Sherman trapped
	Reclaimed			
Toltol	Area	Forest Shrew	Sylvisorex sp.	Pitfall trapped
	Reclaimed	Mau Forest	Colobus guereza	
Toltol	Area	Guereza	matschiei	Observed
	Reclaimed		Cercopithecus mitis	
Toltol	Area	Blue Monkey	stuhlmanni	Observed
	Reclaimed	Crested		
Toltol	Area	Porcupine	Hystrix cristata	Locals information
	Reclaimed			
Toltol	Area	Common Duiker	Sylvicapra grimmia	Locals information
	Reclaimed	Banded		
Toltol	Area	Mongoose	Mungos mungo	Locals information
	Reclaimed		Hylochoerus	
Toltol	Area	Forest Hog	meinertzhageni	Locals information
	Reclaimed			
Toltol	Area	Bushbuck	Tragelaphus scriptus	Locals information
	Reclaimed			
Toltol	Area	African Hare	Lepus sp.	Locals information
		African bush		
Toltol	Forest	elephant	Loxodonta africana	Locals information



Annex 3: Bird biometric Assessment from mist netting generated from the rapid biodiversity survey on western side of Maasai Mau Forest from October 31st to November 8th 2019

							Length (cm)			
Site	Sector	Species Name	Weigh t (g)	Sex	Age	Reproductiv e Condition	Bod y	Tai 1	Left Hin d	Left Ear Lob
Mishan	Forest	Otomus on	EQ	Mala	٨ ما و ال	ТА	14.0	15	Foot	e
INKODEN	Forest	Otomys sp	58	Iviale	Adult	IA	14.2	1.5	2.2	1.5
Nkoben	Forest	Otomys sp	48	Femal e	Adult	L,VO	14.5	1.3	1.9	1.7
			19	Femal						
Nkoben	Forest	<i>Otomys</i> sp	40	e	Adult	L,VO	14.7	1.3	2	1.8
			20		Sub-					
Nkoben	Forest	<i>Otomys</i> sp	28	Male	Adult	ТА	15.7	5.4	2.1	1.2
Nkoben	Forest	Mystomys natalensis	50	Male	Sub- Adult	TS	25.8	14.5	2.5	2.2
			(0)	Femal						
Nkoben	Forest	Mystomys natalensis	60	e	Adult	GR,VO	25.5	13.3	2.3	1.5
Nkoben	Forest	Crocidura sp	25	Femal e	Adult	VO	12.9	5	1.1	0.9
		Lemniscomys	19							
Nkoben	Forest	striatus	יד)	Male	Adult	ТА	23.5	12.9	2.1	1.8
		Lemniscomys	36	Femal	Sub-					
Nkoben	Forest	striatus	50	e	Adult	VO	24.1	12.2	2.3	1.2

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			27		Sub-					
Nkoben	Forest	Mastomys natalensis	27	Male	Adult	ТА	22.1	12	2.3	1.2
			()	Femal						
Nkoben	Forest	<i>Otomys</i> sp	62	e	Adult	VO	19.5	7.3	2.2	1.3
			24.2		Sub-					
Nkoben	Forest	Mastomys natalensis	34.2	Male	Adult	TS	21.4	11.6	2.3	2
Chepalung			40							
u	Forest	Mastomys natalensis	40	Male	Adult	TS	24.2	12.3	2	1.9
Chepalung			(7		Sub-					
u	Forest	Mus minutoides	6.7	Male	Adult	ТА	7.8	1.2	1.2	0.8
Chepalung			64							
u	Forest	<i>Otomys</i> sp	04	Male	Adult	ТА	19.1	6.3	2.1	1.4
Chepalung			27	Femal	Sub-					
u	Forest	<i>Otomys</i> sp	27	e	Adult	VC	15.6	5.7	2	1
Chepalung	Reclaimed		20		Sub-					
u	Farmland	<i>Otomys</i> sp	29	Male	Adult	ТА	15.8	5.7	2.2	1.4
Chepalung	Reclaimed		(7	Femal						
u	Farmland	<i>Otomys</i> sp	67	e	Adult	GR	14.2	1.5	2.2	1.3
	Reclaimed		4.2		Sub-					
Sierra Leon	Farmland	<i>Crocidura</i> sp	4.2	Male	Adult	ТА	9.5	3.7	1.2	0.5
	Reclaimed		7	Femal						
Sierra Leon	Farmland	<i>Crocidura</i> sp	/	e	Adult	VC	11.2	5.1	1.4	0.5

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	Reclaimed		10.4	Femal						
Sierra Leon	Farmland	Mus minutoides	10.4	e	Adult	VC	10.8	4.5	1.2	0.6
	Reclaimed		5.6		Sub-					
Sierra Leon	Farmland	Mus minutoides	5.6	Male	Adult	ТА	9.6	4.9	1.4	0.5
	Reclaimed		10.6	Femal						
Sierra Leon	Farmland	Mus minutoides	10.0	e	Adult	VC	10.5	5.2	1.6	0.4
	Reclaimed		65	Femal	Sub-					
Sierra Leon	Farmland	Mus minutoides	0.5	e	Adult	VC	11.5	5.4	1.2	0.5
	Reclaimed		6.6							
Sierra Leon	Farmland	Mus minutoides	0.0	Male	Adult	ТА	5.5	4.7	1.4	0.4
	Reclaimed		96							
Sierra Leon	Farmland	Mus minutoides	9.0	Male	Adult	TS	10.8	4.2	1.5	0.9
	Reclaimed		20.3	Femal						
Sierra Leon	Farmland	Mus sp	20.5	e	Adult	GR	12.1	5.1	1.6	0.5
	Reclaimed		73	Femal						
Toltol	Farmland	Crocidura sp	7.5	e	Adult	VO	10.9	5.9	0.8	0.4
	Reclaimed		6	Femal						
Toltol	Farmland	Crocidura sp	0	e	Adult	VC	8.2	3.6	1.1	0.4
	Reclaimed	Lemniscomys	63.1	Femal						
Toltol	Farmland	striatus	05.1	e	Adult	GR, L	23.4	11.7	2.5	1.1
	Reclaimed		70							
Toltol	Farmland	Lophuromys sikapusi	70	Male	Adult	TS	19.8	6.8	2.4	1.2

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	Reclaimed		70.6							
Toltol	Farmland	Lophuromys sikapusi	70.6	Male	Adult	ТА	21.9	7.8	2.2	1.9
	Reclaimed		25.5		Sub-					
Toltol	Farmland	Mastomys natalensis	55.5	Male	Adult	TS	22.6	11.7	2.9	1.8
	Reclaimed		40	Femal						
Toltol	Farmland	Mastomys natalensis	40	e	Adult	VO	24.5	13.4	2	1.5
	Reclaimed		61.2	Femal						
Toltol	Farmland	<i>Otomys</i> sp	01.5	e	Adult	L,VO	14.5	1.3	2.2	1.8
	Reclaimed		62.1	Femal						
Toltol	Farmland	Otomys sp	02.1	e	Adult	GR,VO	18.8	6.3	1.8	1.6



Annex 4: Checklist of bird species recorded during the rapid biodiversity survey on western side of Maasai Ma u Forest from October 31st to November 8th 2019

The bird list has been arranged according to checklist of the Birds of Kenya 5<sup>5h</sup> Ed, EANHS 2019. Location is within Mau forest complex forest fragment;

**MIGRANTS CATEGORY (AM =** Afro tropic migrant **PM =** Palearctic migrant **am, pm =**occurs alongside resident birds)

I.U. C.N ATEGORY (NT= nearly threatened, V=Vulnerable = Endangered); FOREST CATEGORY; FF= Forest Specialist F = Forest generalist, f = forest visitors; BIOME SPECIES; Afromontane highland biome species (AH);

				IUCN	BIOME	FOREST
NO		SCIENTIFIC	MIGRATI	STATU	SPECIE	CATEGO
•	COMMON NAME	NAME	ON	S	S	RY
	Numididae: guineafowl					
		Guttera				
1	Crested Guineafowl	pucherani		LC		F
	Ciconiidae: storks					
		Leptoptilos				
2	Marabou Stork	crumeniferus				
	Threskiornithidae: ibises					
	and spoonbills					
		Bostrychia				
3	Hadada Ibis	hagedash		LC		
	Ardeidae: herons, egrets					
	and bitterns					
4	Grey Heron	Ardea cinerea	am pm	LC		
	Scopidae: Hamerkop					
5	Hamerkop	Scopus umbretta		LC		
	Falconidae: falcons					
6	Lanner Falcon	Falco biarmicus		LC		
		Falco				
7	Common Kestrel	tinnunculus		LC		
	Accipitridae: diurnal birds					
	of prey other than falcons					
	African Black-shouldered					
8	Kite	Elanus caeruleus		LC		
9	Black Kite	Milvus migrans	am pm	LC		
		Polyboroides				
10	African Harrier Hawk	typus		LC		f



·						
11	Mountain Buzzard	Buteo oreophilus		NT	AH	FF
12	Augur Buzzard	Buteo augur		LC		
	-	Lophaetus			1	
13	Long-crested Eagle	occipitalis		LC		F
		Stephanoaetus				
14	Crowned Eagle	coronatus		NT		
	Columbidae: pigeons and					
	doves					
15	Speckled Pigeon	Columba guinea		LC		
	Eastern Bronze-naped	Columba				
16	Pigeon	delegorguei		LC		FF
17	Lemon Dove	Aplopelia larvata		LC		FF
		Streptopelia				
18	Dusky Turtle Dove	lugens		LC		f
		Streptopelia				
19	African Mourning Dove	decipiens		LC		f
		Streptopelia				
20	Red-eyed Dove	semitorquata		LC		
		Streptopelia				
21	Ring-necked Dove	capicola		LC		f
	Emerald-spotted Wood	Turtur				
22	Dove	chalcospilos		LC		f
		Turtur				
23	Tambourine Dove	tympanistria		LC		F
24	African Green Pigeon	Treron calvus		LC		F
	Psittacidae: lovebirds and					
	parrots					
		Poicephalus				
25	Red-fronted Parrot	gulielmi		LC		FF
	Musophagidae: turacos					
		Tauraco				
26	Hartlaub's Turaco	hartlaubi		LC	AH	F
	Cuculidae: cuckoos and					
	coucals					
		Cuculus				
27	Red-chested Cuckoo	solitarius	am	LC	1	F



		Chrysococcyx			
28	Klaas's Cuckoo	klaas	LC		f
		Ceuthmochares			
29	Chattering Yellowbill	aereus	LC		F
		Centropus			
30	White-browed Coucal	superciliosus	LC		
	Apodidae: swifts				
		Tachymarptis			
31	Mottled Swift	aequatorialis	LC		F
32	Nyanza Swift	Apus niansae	LC	AH	
33	African Black Swift	Apus barbatus			
34	White-rumped Swift	Apus caffer	LC		
-	Coliidae: mousebirds				
35	Speckled Mousebird	Colius striatus	LC		
	Meropidae: bee-eaters				
36	Little Bee-eater	Merops pusillus	LC		
	Cinnamon-chested Bee-				
37	eater	Merops oreobates	LC	AH	F
	Bucerotidae: hornbills				
		Tockus			
38	Crowned Hornbill	alboterminatus	LC		F
39	African Grey Hornbill	Tockus nasutus	LC		
	Black-and-white Casqued	Bycanistes			
40	Hornbill	subcylindricus	LC		F
	Bucorvidae: ground				
	hornbills				
		Bucorvus			
41	Southern Ground Hornbill	leadbeteri	VU		
	Capitonidae: barbets and				
	tinkerbirds				
		Gymnobucco			
42	Grey-throated Barbet	bonapartei	LC		
40	Nullana and Tigladia	Pogoniulus	IC		г
43	renow-rumped linkerbird	vuineatus Deseniulus		_	F
	1	rogoniulus		1	
	Rod fronted Tinkerbird	nucilluc	IC		F
44	Red-fronted Tinkerbird	pusillus	LC		F



45	Lesser Honeyguide	Indicator minor	LC		f
	Picidae: wrynecks and				
	woodpeckers				
		Campethera			
46	Nubian Woodpecker	nubica	LC		
	Malaconotidae:				
	helmetshrikes,				
	bushshrikes, tchagras and				
	pullbacks	Tehaara			
47	Black-crowned Tchagra	senegalus	IC		
-1/	black crowned Tenagra	Druosconus	LC		
48	Black-backed Puffback	cubla			
		Laniarius			
49	Tropical Boubou	aethopicus	LC		
	Laniidae: shrikes				
50	Long-tailed Fiscal	Lanius cabanisi	LC		
51	Common Fiscal	Lanius collaris	LC		
	Oriolidae: orioles				
52	Montane Oriole	Oriolus percivali	LC	AH	
	Dicruridae: drongos				
		Dicrurus			
53	Forked-tailed Drongo	adsimilis	LC		
	Monarchidae: monarch				
	flycatchers				
		Terpsiphone			
54	African Paradise Flycatcher	viridis	LC		
		Elminia	1.0		
55	Dusky Crested Flycatcher	nıgromitrata	LC		
	Corvidae: crows and allies				
56	Pied Crow	Corvus albus	LC		
	Hirundinidae: saw-wings,				
	swallows and martins	De 11 Januaria			
57	Black Cour wing	Psanaoprocne	IC		£
57	Diack Saw-wing	pristopteru Cacronic			1
58	Lesser Strined Swallow	ahussinica	IC		
00	Lesser Surpea Swanow	иодобинси			



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		Pseudoalcippe			
77	African Hill Babbler	abyssinica	LC	AH	FF
	Zosteropidae: white-eyes				
		Zosterops			
78	Montane White-eye	poliogastrus	LC	AH	F
	Sturnidae: starlings and				
	oxpeckers				
		Lamprotornis			
79	Greater Blue-eared Starling	chalybaeus	LC		
		Lamprotornis			
80	Rüppell's Starling	purpuroptera	LC		
		Lamprotornis			
81	Superb Starling	superbus	LC		
		Onychognathus			
82	Red-winged Starling	morio	LC		f
83	Sharpe's Starling	Pholia sharpii	LC	AH	FF
		Buphagus			
84	Red-billed Oxpecker	erythrorhynchus	LC		
	Turdidae: thrushes				
85	Olive Thrush	Turdus olivaceus	LC		
	Muscicapidae: chats,				
	wheatears and Old World				
	flycatchers				
86	Cape Robin Chat	Cossypha caffra	LC		
		Cossypha			
87	Rüppell's Robin Chat	semirufa	LC	AH	F
-		Cossypha			
88	White-browed Robin Chat	heuglini	LC		f
		Saxicola			
89	Common Stonechat	torquatus	LC		
		Oenanthe			
90	Abyssinian Wheatear	lugubris			f
		Melaenornis			
91	White-eyed Slaty Flycatcher	fischeri	LC	AH	
		Bradornis			
92	African Grey Flycatcher	microrhynchus	LC		
		Muscicapa			
93	African Dusky Flycatcher	adusta	LC		

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		Sheppardia			
94	Grey-winged Robin	polioptera	LC		
	Nectariniidae: sunbirds				
		Hedydipna			
95	Collared Sunbird	collaris	LC		
		Cyanomitra			
96	Green-headed Sunbird	verticalis	LC		
		Chalcomitra			
97	Amethyst Sunbird	amethystina	LC		
		Nectarinia			
98	Bronze Sunbird	kilimensis	LC	AH	
		Drepanorhynchu			
99	Golden-winged Sunbird	s reichenowi	LC	AH	
100		Cinnyris			
100	Variable Sunbird	venustus	LC		
	Passeridae: sparrow				
	weavers, Old World				
	sparrows and petromas	Daggar			
101	Kenya Rufous Sparrow	rufocinctus	IC		
101	Grow-boaded Sparrow	Passar origans			
102	Ploceidae: weavers	russer griseus			
	hishops and widowhirds				
		Ploceus			
103	Baglafecht Weaver	baylafecht	LC	AH	f
104	Holub's Golden Weaver	Ploceus xanthons	LC		
105	Speke's Weaver	Ploceus snekei			
100		Ploceus			
106	Village Weaver	cucullatus	LC		
107	Red-headed Ouelea	Ouelea eruthrops	LC		
107		Eunlectes			
108	Yellow Bishop	capensis	LC		FF
	1	Euplectes			
109	Yellow-mantled Widowbird	macroura	LC		
110	Red-collared Widowbird	Euplectes ardens	LC		
111	Long-tailed Widowbird	Euplectes progne	LC		
	Estrildidae: waxbills	, , 0			



		Nigrita				
112	Grey-headed Negrofinch	canicapillus	LC	2		F
		Cryptospiza	I			
113	Abyssinian Crimsonwing	salvadorii				
114	Black-crowned Waxbill	Estrilda nonnula	LC	2		
		Granatina				
115	Purple Grenadier	ianthinogaster	LC	2		
		Lagonosticta				
116	Red-billed Firefinch	senegala	LC	2		
		Spermestes				
117	Bronze Mannikin	cucculatus	LC	2		
	Motacillidae: wagtails,					
	longclaws and pipits					
118	Mountain Wagtail	Motacilla clara	LC	5		F
		Motacilla				
119	African Pied Wagtail	aguimp	LC	2		
		Anthus				
120	Grassland Pipit	cinnamomeus	LC	2		
	Fringillidae: canaries,					
	citrils, seedeaters and					
	relatives					
		Crithagra				
121	African Citril	citrinelloides	LC	2	AH	
		Crithagra				
122	Reichenow's Seedeater	reichenowi	LC	2		f
		Crithagra				
123	Yellow-fronted Canary	mozambica	LC	2		f
		Crithagra				
124	Streaky Seedeater	striolata	LC	2		F
		Crithagra				
125	Thick-billed Seedeater	burtoni	LC	2	AH	





Annex 5: Bird biometric Assessment from mist netting generated from the rapid biodiversity survey on western side of Maasai Mau Forest from October 31st to November 8th 2019

SITE	Sector	SPECIES	RING NO	AGE/SEX	WING	HEAD	TARSUS	WEIGHT
Nkoben	Forest	African Hill Babbler	X60715	4	69	32.8	26.5	31
Nkoben	Forest	Yellow Whiskered Greenbul	AA33982	4	86	36	25	34.4
Nkoben	Forest	Uganda Woodland Warbler	X60716	4	64	29.2	25.1	
Nkoben	Forest	African Hill Babbler	X60717	4	74	32.6	27.8	19.3
Nkoben	Forest	Cabanis Greenbul	AA33983	4	89	38.9	28.7	28.5
Nkoben	Forest	Cabanis Greenbul	AA33984	4	78	36.5	25.2	23.2
Nkoben	Forest	Uganda Woodland Warbler	X60718	4	56	28.1	22.3	15
Chepalungu	Forest	Banded Prinia	T67450	4	56	32.6	27.3	13.2
Chepalungu	Forest	Olive Thrush	BB 5175	4	115	48	32.8	56.2
Chepalungu	Forest	Yellow Whiskered Greenbul	AA33985	3	92	36.8	25.4	29
Chepalungu	Forest	African Hill Babbler	X60719	4	70	37	30	24.6
Chepalungu	Forest	Banded Prinia	T67451	3	52	30.4	24.7	10.3
Chepalungu	Forest	African Hill Babbler	X60720	4	76	38	30.7	25.2
Chepalungu	Forest	Hunters Cisticola	X60721	4	63	31.4	28	15
Chepalungu	Forest	Hunters Cisticola	X60722	3	58	31	27	13.4
Chepalungu	Forest	Tambourine Dove	BB 5176	4	118	39.1	25	75.4
Chepalungu	Forest	Tambourine Dove	BB 5177	4	115	37	24	72.4
Chepalungu	Forest	Montane White-eye	T67452	4	62	32	21	15
Chepalungu	Forest	Montane White-eye	T67453	4	63	30	21	13.3
Chepalungu	Forest	Montane White-eye	T67454	4	63	29	20	12
Chepalungu	Forest	Lesser Swamp Warbler	X60723	4	60	32	24	17.4





Chepalungu	Forest		Baglafetcht Weaver	AA33986	4	84			34
Chepalungu	Forest		Baglafetcht Weaver	AA33987	4	84			33
Chepalungu	Forest		YellowWhiskered Greenbul	AA33988	4	89			28
	Reclaimed	Area							
Siera Leone	(Riverine)		Black Crowned Waxbill	T67455	4	49	22	17	8.5
Siera Leone	Reclaimed	Area							
	(Riverine)		Golden Winged Sunbird	T67456	3	55	30.4	17.5	6.5
Siera Leone	Reclaimed	Area							
	(Riverine)		African Reed Warbler	X 60724	3	64	34	26.7	18.2
Siera Leone	Reclaimed	Area							
	(Riverine)		Dark Capped Yellow Warbler	X 60725	3	60	30	22	10.4
Siera Leone	Reclaimed	Area							
	(Riverine)		Grey headed Nigrofinch	X 60726	4	68	28	22	16.3
Siera Leone	Reclaimed	Area							
	(Riverine)		Streaky Seedeater	X60727	4	69	27	21	19
Siera Leone	Reclaimed	Area							
	(Riverine)		Streaky Seedeater	X60728	4	70	30	24	21.8
Siera Leone	Reclaimed	Area							
	(Riverine)		Streaky Seedeater	X60729	4	71	30	21	20.1
Siera Leone	Reclaimed	Area							
	(Riverine)		Baglafetcht Weaver	AA33989	4	81	38	30	34.3
Toltol	Reclaimed	Area							
	(Riverine)		African Reed Warbler	X60730	4	54	28	21	14.8
Toltol	Reclaimed	Area							
	(Riverine)		Abyssinian Crimson wing	T67457	3	56	25	19	11.1

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Toltol	Reclaimed	Area							
	(Riverine)		Mountain White eye	T67458	4	61	27	21	11.2
Toltol	Reclaimed	Area							
	(Riverine)		Streaky Seedeater	X60731	4	91	26	23	20
Toltol	Reclaimed	Area							
	(Riverine)		Black Crowned Waxbill	T67460	4	49	22	22	8.5
Toltol	Reclaimed	Area							
	(Riverine)		Baglafetcht Weaver	AA33990	4	85	37	27	31.4
Toltol	Reclaimed	Area							
	(Riverine)		Green Headed Sunbird	T67460	4	71	42	21	
Toltol	Reclaimed	Area							
	(Riverine)		Black Crowned Waxbill	T67461	4	50	21	16	7.3
Toltol	Reclaimed	Area							
	(Riverine)		Golden Winged Sunbird	T67462	4	70	40	20	12.5
Toltol	Reclaimed	Area							
	(Riverine)		Streaky Seedeater	X60732	4	69	27	22	19.3
Toltol	Reclaimed	Area							
	(Riverine)		Thick billied Seedeater	X60733	4	85	33	26	38.8
Toltol	Reclaimed	Area							
	(Riverine)		African Slaty Flycatcher	X60734	4	91	32	24	26.4
Toltol	Reclaimed	Area							
	(Riverine)		Golden Winged Sunbird	T67462	4	80	42	20	13.5
Toltol	Reclaimed	Area							
	(Riverine)		Streaky Seedeater	X60735	4	70	28	23	18.1




Toltol	Reclaimed	Area							
	(Riverine)		Golden Winged Sunbird	T67464	4	80	41	21	13.4
Toltol	Reclaimed	Area							
	(Riverine)		Streaky Seedeater	X60736	4	70	28	22	19.2
Toltol	Reclaimed	Area							
	(Riverine)		Hunters Cisticola	X60737	4	60	32	29	16.4
Toltol	Reclaimed	Area							
	(Riverine)		Hunters Cisticola	X60738	4	56	30	26	14.4
Toltol	Reclaimed	Area							
	(Riverine)		Streaky Seedeater	X60739	3	70	29	24	19.5
Toltol	Reclaimed	Area							
	(Riverine)		Golden Winged Sunbird	T67465	4	73	41	18	12.7
Toltol	Reclaimed	Area							
	(Riverine)		Common Bulbul	AA33991	4	94	38	23	24.6
Toltol	Reclaimed	Area							
	(Riverine)		Mountain Greenbul	AA33992	4	90	38	28	31.1
Toltol	Reclaimed	Area							
	(Riverine)		Olive Thrush	BB5178	4	105	47	37	60.2
Toltol	Reclaimed	Area							
	(Riverine)		Sharp's Starling	AA33993	4	107	37	24	39.1
Toltol	Reclaimed	Area							
	(Riverine)		Sharp's Starling	AA33994	3	100	37	26	40.1
Toltol	Reclaimed	Area							
	(Riverine)		Golden Winged Sunbird	T67466	4	70	41	18	11.3





Toltol	Reclaimed	Area							
	(Riverine)		Sharp's Starling	AA33995	4	104	37	27	43.1
Toltol	Reclaimed	Area							
	(Riverine)		Streaky Seedeater	X60740	4	72	28	23	22.6
Toltol	Reclaimed	Area							
	(Riverine)		Baglafetcht Weaver	AA33996	3	80	34	27	28.2



Annex 6: Checklist of invertebrate species recorded during the rapid biodiversity survey on western side of Maasai Ma u Forest from October 31st to November 8th 2019

Type of Trap	Order	Family	Species Name	Common Names	Site	Sector	IUCN
Drift Pitfall	Isopoda	Armadillidiidae	Armadillidiidae sp	Pill bug	Nkoben	Forest	LC
Drift Pitfall	Coleoptera	Coccinellidae	Cheilomenes lunata	Lady Beetle	Nkoben	Forest	LC
Drift Pitfall	Coleoptera	Coccinellidae	Cheilomenes lunata	Lady Beetle	Nkoben	Forest	LC
Drift Pitfall	Diplopoda		Cylindroiulus punctatus	Millipede	Nkoben	Forest	LC
Field Observation	Gastropoda	Achatinidae	Limicolaria sp	Snail	Nkoben	Forest	LC
Field Observation	Blattodea	Blattidae	<i>Cartoblatta</i> sp	Gregarious Cockroach	Toltol	Reclaimed Farmland	LC
Hand Picking	Hygrophila	Bulinidae	Bulinus sp	Land snail	Nkoben	Forest	LC
Pan Trap (Blue)	Hymenoptera	Apidae	Apis mellifera	Honeybee	Nkoben	Forest	LC
Pan Trap (Blue)	Coleoptera	Lycidae	Lycidae sp	Slender Net-winged Beetle	Nkoben	Forest	LC
Pan Trap (Blue)	Diptera	Muscidae	Musca domestica	Housefly	Nkoben	Forest	LC
Pan Trap (Blue)	Blattodea	Ectobiidae	Blatta lateralis	Common cockroach	Sierra Leon	Reclaimed Farmland	LC





Pan	Trap	Lepidoptera	Sphingidae	Cephanodes hylas	Oriental Bee	Sierra Leon	Reclaimed	LC
(Blue)		1 1	1 0	1 5	Hawkmoth		Farmland	
Pan	Trap	Coleoptera	Curculionidae	Curculionidae sp	Green Leaf Weevil	Sierra Leon	Reclaimed	LC
(Blue)		colcopieiu	Curcunomude	Curcultonitude Sp	Green Lear Weevin	Sierra Leon	Farmland	
Pan	Trap	Diretore	Mussides	Mussa domestica	Hawaafla	Ciarra Laar	Reclaimed	IC
(Blue)		Diptera	Muscidae	wiuscu uomesticu	nouseny	Sierra Leon	Farmland	LC
Pan	Trap	Dintono	Callimboridaa	Clamacoura	Plaufly	Taltal	Reclaimed	IC
(Blue)		Diptera	Camphoridae	Chrysomya sp	DIOWITY	101101	Farmland	LC
Pan	Trap	Calenatara	C	C		T - 1( - 1	Reclaimed	IC
(Blue)		Coleoptera	Curculionidae	Curcuitoniaae sp	Green Leaf Weevil	Toltol	Farmland	LC
Pan	Trap	Outh and and	Crallidee	Curillus er	Plash Field Crishet	Taltal	Reclaimed	IC
(Blue)		Orthoptera	Gryindae	Grynus sp	Diack Field Cricket	Tottol	Farmland	LC
Pan	Trap	Urmonontono	Arridaa	Hematuiaana an	Sugar has	Taltal	Reclaimed	IC
(Blue)		Trymenoptera	Apidae	riypoirigonu sp	Sweat bee	10101	Farmland	LC
Pan	Trap	A #2#222	Lucosidas	Lucacidas an	Walf Craidan	Taltal	Reclaimed	IC
(Blue)		Araneae	Lycosidae	Lycosiuue sp	won spider	101101	Farmland	LC
Pan	Trap	Colooptore	Malaidaa	Malaidaa an	Plictor bootlo	Taltal	Reclaimed	IC
(Blue)		Coleoptera	Meloidae	Meioluue sp	Difster beette	101101	Farmland	LC
Pan	Trap	Calcontere	Chambralinidaa	Desidences	Derre heatle	Taltal	Reclaimed	IC
(Blue)		Coleoptera	Staphymidae	Pueuerus sp	Kove beene	101101	Farmland	LC
Pan	Trap	Louidontono	Cabinaidea	Carlingua das lucitas	Oriental Bee	Charachur ar	Reclaimed	IC
(Blue)		Lepidopiera	springidae	Ceptunoues nyius	Hawkmoth	Chepatungu	Farmland	LC
Pan	Trap	Dintono	Callimboridaa	Chamacanana	Planufler	Chanalun	Reclaimed	IC
(Blue)		Diptera	Campnoridae	Chrysomya sp	DIOWITY	Chepalungu	Farmland	LC

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Pan (Blue)	Trap	Diptera	Diopsidae	Diopsis apicalis	Stalk eyed-fly	Chepalungu	Reclaimed Farmland	LC
Pan (White)	Trap	Diptera	Diopsidae	Diopsis apicalis	Stalk eyed-fly	Chepalungu	Reclaimed Farmland	LC
Pan (White)	Trap	Diptera	Muscidae	Musca domestica	Housefly	Chepalungu	Reclaimed Farmland	LC
Pan (White)	Trap	Coleoptera	Curculionidae	<i>Curculionidae</i> sp	Green Leaf Weevil	Nkoben	Forest	LC
Pan (White)	Trap	Coleoptera	Scarabaeidae	Heteronychus arator	African Black Beetle	Nkoben	Forest	LC
Pan (White)	Trap	Araneae	Lycosidae	<i>Lycosidae</i> sp	Wolf Spider	Nkoben	Forest	LC
Pan (White)	Trap	Coleoptera	Staphylinidae	Paederus sp	Rove beetle	Nkoben	Forest	LC
Pan (White)	Trap	Lepidoptera	Tortricidae	Thaumatotibia leucotreta	False Codling Moth	Nkoben	Forest	LC
Pan (White)	Trap	Lepidoptera	Sphingidae	Cephanodes hylas	Oriental Bee Hawkmoth	Sierra Leon	Reclaimed Farmland	LC
Pan (White)	Trap	Diptera	Calliphoridae	Chrysomya sp	Blowfly	Sierra Leon	Reclaimed Farmland	LC
Pan (White)	Trap	Orthoptera	Acrididae	Omocestus sp	Common Green Grasshopper	Sierra Leon	Reclaimed Farmland	LC
Pan (Yellow)	Trap	Hymenoptera	Apidae	Apis mellifera	Honeybee	Chepalungu	Forest	LC

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Pan (Yellow)	Trap	Blattodea	Ectobiidae	Blatta lateralis	Common cockroach	Chepalungu	Forest	LC
Pan (Yellow)	Trap	Lepidoptera	Sphingidae	Cephanodes hylas	Oriental Bee Hawkmoth	Chepalungu	Forest	LC
Pan (Yellow)	Trap	Lepidoptera	Sphingidae	Cephanodes hylas	Oriental Bee Hawkmoth	Chepalungu	Forest	LC
Pan (Yellow)	Trap	Hymenoptera	Apidae	<i>Ceratina</i> sp	Small carpenter Bee	Chepalungu	Forest	LC
Pan (Yellow)	Trap	Orthoptera	Gryllidae	<i>Gryllus</i> sp	Black Field Cricket	Chepalungu	Forest	LC
Pan (Yellow)	Trap	Hymenoptera	Apidae	Hypotrigona sp	Sweat bee	Chepalungu	Forest	LC
Pan (Yellow)	Trap	Diptera	Muscidae	Musca domestica	Housefly	Chepalungu	Forest	LC
Pan (Yellow)	Trap	Coleoptera	Aphidae	Myzus persicae	Peach potatoe aphid	Chepalungu	Forest	LC
Pan (Yellow)	Trap	Orthoptera	Acrididae	Omocestus sp	Common Green Grasshopper	Chepalungu	Forest	LC
Pan (Yellow)	Trap	Hymenoptera	Apidae	Apis mellifera	Honeybee	Sierra Leon	Reclaimed Farmland	LC
Pan (Yellow)	Trap	Coleoptera	Coccinellidae	Cheilomenes lunata	Lady Beetle	Sierra Leon	Reclaimed Farmland	LC
Pan (Yellow)	Trap	Coleoptera	Chrysomelidae	Chrysomelidae sp	Metalic Leaf Beetle	Sierra Leon	Reclaimed Farmland	LC

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Pan (Yellow)	Trap	Diptera	Calliphoridae	Chrysomya sp	Blowfly	Sierra Leon	Reclaimed Farmland	LC
Pan (Yellow)	Trap	Coleoptera	Curculionidae	<i>Curculionidae</i> sp	Green Leaf Weevil	Sierra Leon	Reclaimed Farmland	LC
Pan (Yellow)	Trap	Orthoptera	Gryllidae	<i>Gryllus</i> sp	Black Field Cricket	Sierra Leon	Reclaimed Farmland	LC
Pan (Yellow)	Trap	Coleoptera	Scarabaeidae	Heteronychus arator	African Black Beetle	Sierra Leon	Reclaimed Farmland	LC
Pan (Yellow)	Trap	Hymenoptera	Apidae	Hypotrigona sp	Sweat bee	Sierra Leon	Reclaimed Farmland	LC
Pan (Yellow)	Trap	Araneae	Lycosidae	Lycosidae sp	Wolf Spider	Sierra Leon	Reclaimed Farmland	LC
Pan (Yellow)	Trap	Araneae	Lycosidae	Lycosidae sp	Wolf Spider	Sierra Leon	Reclaimed Farmland	LC
Pan (Yellow)	Trap	Diptera	Muscidae	Musca domestica	Housefly	Sierra Leon	Reclaimed Farmland	LC
Pan (Yellow)	Trap	Orthoptera	Acrididae	Omocestus sp	Common Green Grasshopper	Sierra Leon	Reclaimed Farmland	LC
Pan (Yellow)	Trap	Hymenoptera	Argidae	Arge ochropus	Large Rose Sawfly	Sierra Leon	Reclaimed Farmland	LC
Pan (Yellow)	Trap	Hemiptera	Coreidae	Coreidae sp	Leaf Footed Bugs	Sierra Leon	Reclaimed Farmland	LC
Pan (Yellow)	Trap	Hemiptera	Pyrrhocoridae	Dysdercus sp	Cotton stainer	Sierra Leon	Reclaimed Farmland	LC

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Pan Trap	Orthoptera	Acrididae	<i>Omocestus</i> sp	Common Green	Sierra Leon	Reclaimed	LC
(Yellow)	-		-	Grasshopper		Farmland	
Pan Trap	Hvmenoptera	Apidae	Avis mellifera	Honevbee	Toltol	Reclaimed	LC
(Yellow)	J - 1	I	F	)		Farmland	
Pitfall Trap	Coleoptera	Carabidae	Carabidae sp	Ground beetle	Chepalungu	Forest	LC
Pitfall Trap	Coleoptera	Dytiscidae	<i>Dysticidae</i> sp	Diving beetle	Chepalungu	Forest	LC
Pitfall Trap	Orthoptera	Gryllidae	<i>Gryllus</i> sp	Black Field Cricket	Chepalungu	Forest	LC
Pitfall Trap	Diptera	Muscidae	Musca domestica	Housefly	Chepalungu	Forest	LC
Pitfall Trap	Hymenoptera	Vespidae	<i>Vespidae</i> sp	Potter Wasp	Chepalungu	Forest	LC
Ditfall Tran	Urmonontono	Arridaa	Anos salanomus	Lange Rece Courfly	Chanalungu	Reclaimed	IC
Filian Trap	Hymenoptera	Argidae	Arge ochropus	Large Rose Sawiiy	Chepalungu	Farmland	LC
Dittall Tran	Isonada	Armadillidiidaa	Amadillidiidaa oo	Pill bug	Chanalungu	Reclaimed	IC
Than Trap	isopoua	Annaumunuae	Armaannaa sp	1 III bug	Chepalungu	Farmland	
Dittall Trees	Coloomtono	Carabidaa	Canabidaa an	Plack ground hootle	Chanalungu	Reclaimed	IC
Filian Trap	Coleoptera	Carabidae	Curuoluue sp	black ground beetle	Chepalungu	Farmland	LC
Dittall Tran	Dintono	Callimboridaa	Chamasana	Ploufly	Chanalungu	Reclaimed	IC
Filian Trap	Diptera	Camphoridae	Chrysomya sp	blowity	Chepalungu	Farmland	LC
Ditte 11 Trees	Calcaratera	Currentianides	Cumulianida a an		Charachura	Reclaimed	IC
Pittali Trap	Coleoptera	Curculionidae	Curcuitoniuue sp	Green Lear Weevil	Chepalungu	Farmland	LC
Ditfall Tran	Homintora	Dumbacanidaa	Ducdaraus	Cotton stainer	Chanalungu	Reclaimed	IC
	Tiennpiera	i yimocomuae	Dysuercus sp		Chepatungu	Farmland	
Ditfall Tran	Orthorntor	Crallidae	Cimillus an	Plack Field Crister	Chanalun	Reclaimed	IC
Filian Trap	Ormoptera	Grymude	Grynus sp	Diack Field Cricket	Chepalungu	Farmland	LC

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Pitfall Trap	Hymenoptera	Megachilidae	<i>Heriades</i> sp	Native bee	Chepalungu	Reclaimed Farmland	LC
Pitfall Trap	Araneae	Lycosidae	Lycosidae sp	Wolf Spider	Chepalungu	Reclaimed Farmland	LC
Pitfall Trap	Coleoptera	Meloidae	Meloidae sp	Blister beetle	Chepalungu	Reclaimed Farmland	LC
Pitfall Trap	Coleoptera	Oedemeridae	Nacerdes melanura	Pollen Feeding Beetle	Chepalungu	Reclaimed Farmland	LC
Pitfall Trap	Orthoptera	Acrididae	<i>Omocestus</i> sp	Common Green Grasshopper	Chepalungu	Reclaimed Farmland	LC
Pitfall Trap	Coleoptera	Staphylinidae	Paederus insularis	Devil's Coach Horse Beetle	Chepalungu	Reclaimed Farmland	LC
Pitfall Trap	Coleoptera	Carabidae	Carabidae sp	Black Ground beetle	Kass	Reclaimed Farmland	LC
Pitfall Trap	Orthoptera	Gryllidae	<i>Gryllus</i> sp	Black Field Cricket	Kass	Reclaimed Farmland	LC
Pitfall Trap	Hymenoptera	Apidae	Hypotrigona sp	Sweat bee	Kass	Reclaimed Farmland	LC
Pitfall Trap	Isopoda	Armadillidiidae	Armadillidiidae sp	Pill bug	Nkoben	Reclaimed Farmland	LC
Pitfall Trap	Isoptera	Termitidae	Trinervitermes sp	Snouted harvester termites	Nkoben	Reclaimed Farmland	LC
Sweep Net	Lepidoptera	Nymphalidae	Acraea encedon	Encedon acres	Chepalungu	Forest	LC

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Sweep Net	Lepidoptera	Pieridae	Afrodryas leda	Orange-and-Lemon Butterfly	Chepalungu	Forest	LC
Sweep Net	Lepidoptera	Erebidae	Amphicallia sp	Beautiful Tiger Moth	Chepalungu	Forest	LC
Sweep Net	Lepidoptera	Pieridae	Belenois aurota	Brown veined white butterfly	Chepalungu	Forest	LC
Sweep Net	Lepidoptera	Nymphalidae	Byblia ilithyia	Joker	Chepalungu	Forest	LC
Sweep Net	Hymenoptera	Formicidae	<i>Camponotus</i> sp	Carpenter ant	Chepalungu	Forest	LC
Sweep Net	Lepidoptera	Pieridae	Catopsilia florella	African Emigrant Butterfly	Chepalungu	Forest	LC
Sweep Net	Lepidoptera	Nymphalidae	Charaxes varanes	Pearl charaxes	Chepalungu	Forest	LC
Sweep Net	Coleoptera	Gyrinidae	Gyrinidae sp	Small Whirligig Beetle	Chepalungu	Forest	LC
Sweep Net	Coleoptera	Carabidae	Hycleus lunatus	Lunate Blister Beetle	Chepalungu	Forest	LC
Sweep Net	Lepidoptera	Nymphalidae	Junonia hedonia	Brown pansy	Chepalungu	Forest	LC
Sweep Net	Lepidoptera	Nymphalidae	Mycalesis perseus	Common Bushbrown Butterfly	Chepalungu	Forest	LC
Sweep Net	Coleoptera	Scarabaeidae	Pachnoda sp	Rose Chafers	Chepalungu	Forest	LC
Sweep Net	Hymenoptera	Formicidae	Pachycondyla sp	Singing ants	Chepalungu	Forest	LC
Sweep Net	Coleoptera	Staphylinidae	Paederus sp	Nairobi eye	Chepalungu	Forest	LC
Sweep Net	Lepidoptera	Papilionidae	Papilio demodocus	Citrus swallowtail	Chepalungu	Forest	LC
Sweep Net	Lepidoptera	Nymphalidae	Pardopsis punctatissima	Polka Dot	Chepalungu	Forest	LC
Sweep Net	Hymenoptera	Formicidae	Polyrhachis sp	Polyrhachis Ant	Chepalungu	Forest	LC
Sweep Net	Lepidoptera	Hesperiidae	Pyrgus malvae	Grizzled skipper	Chepalungu	Forest	LC





Sweep Net	Diptera	Syrphidae	Syrphus sp	Banded Hoverfly	Chepalungu	Forest	LC
Sweep Net	Lepidoptera	Lycaenidae	Zizeeria sp	Grass Blues Butterfly	Chepalungu	Forest	LC
Sweep Net	Lepidoptera	Lycaenidae	Zizula hylax	Tiny grass blue	Chepalungu	Forest	LC
Swoon Not	Homintora	Aphididaa	Anhididaasn	Croop Aphids	Chopalupqu	Reclaimed	IC
Sweep Net	Tieniiptera	Аршинае	Aphiuiuue sp	Green Aprilas	Chepalungu	Farmland	
Sween Net	Coleoptera			Burrowing Ground	Chenalungu	Reclaimed	IC
Sweep Net	concopicia	Carabidae	Carabidae sp	Beetle	Chepananga	Farmland	LC
Sween Net	Lepidoptera	Nymphalidae	Iunonia sonhia	Little Commodore	Chenalungu	Reclaimed	IC
Sweep Net	Lephdopteru	Tymphaneae	junoniu sopiiu	Entite Continiouore	Chepalanga	Farmland	
Sween Net	Lepidoptera	Papilionidae	Palino rev	Regal Swallowtail	Chenalungu	Reclaimed	IC
Sweep Net	Lephdopteru	rupilloillaac	1 широ тех	Regul Swallowiali	Chepulungu	Farmland	
Sween Net	Lepidoptera	Nymphalidae	Precis tuoela	African Leaf butterfly	Chenalungu	Reclaimed	IC
Sweep Net	Lepidopiera	Tymphandae	1 recis tuzetu		Chepananga	Farmland	LC
Swoon Not	Lonidontora	Sphingidae	A arius convolvuli	Convolvulus	Kass	Reclaimed	IC
Sweep Net	Lephoptera	Springidae	rightus concolouti	Hawkmoth	IXd35	Farmland	EC
Sween Net	Lenidontera	Nymphalidae	Iunonia conhia	Little Commodore	Kass	Reclaimed	IC
Sweep Net	Lepidopiera	Tymphandae	<i>junoniu sopniu</i>	Entre Commodore	IX435	Farmland	LC
Sweep Net	Hymenoptera	Apidae	Apis mellifera	Honeybee	Nkoben	Forest	LC
Sweep Net	Lepidoptera	Pieridae	Appias epaphia	African Albatross	Nkoben	Forest	LC
Sweep Net	Araneae	Araneidae	Araneidae sp	Orb-weaver spider	Nkoben	Forest	LC
Sweep Net	Lepidoptera	Nymphalidae	Charaxes fulvescens	Forest pearl charaxes	Nkoben	Forest	LC
Sweep Net	Diptera	Calliphoridae	<i>Chrysomya</i> sp	Blowfly	Nkoben	Forest	LC
Sweep Net	Lepidoptera	Pieridae	Eurema sp	Forest Grass Yellow	Nkoben	Forest	LC





Sweep Net	Lepidoptera	Nymphalidae	Gnophodes betsimena	Banded evening brown	Nkoben	Forest	LC
Sweep Net	Lepidoptera	Nymphalidae	Hypolimnas misippus	Diadem	Nkoben	Forest	LC
Sweep Net	Araneae	Lycosidae	<i>Lycosidae</i> sp	Wolf Spider	Nkoben	Forest	LC
Sweep Net	Lepidoptera	Papilionidae	Palipo rex	Regal Swallowtail	Nkoben	Forest	LC
Sweep Net	Lepidoptera	Papilionidae	Papilio mackinnoni	Mackinnon's swallowtail	Nkoben	Forest	LC
Sweep Net	Lepidoptera	Papilionidae	Papilio phorcas	Green-banded Swallotail	Nkoben	Forest	LC
Sweep Net	Hemiptera	Reduviidae	<i>Reduviidae</i> sp	Assassin Bug	Nkoben	Forest	LC
Sweep Net	Lepidoptera	Siricidae	Sirex sp	Wood wasp	Nkoben	Forest	LC
Sweep Net	Gastropoda		Turritella communis	Turritella communis	Nkoben	Forest	LC
Sweep Net	Hymenoptera	Apidae	Xylocopa flavorufa	Carpenter Bee	Nkoben	Forest	LC
Sweep Net	Coleoptera	Dytiscidae	<i>Dysticidae</i> sp	Diving Beetle	Nkoben	Reclaimed Farmland	LC
Sweep Net	Hemiptera	Aphididae	Myzus persicae	Peach-Potato Aphid	Nkoben	Reclaimed Farmland	LC
Sweep Net	Coleoptera	Oedemeridae	Nacerdes melanura	Pollen Feeding Beetle	Nkoben	Reclaimed Farmland	LC
Sweep Net	Coleoptera	Staphylinidae	Paederus insularis	Devil's Coach Horse Beetle	Nkoben	Reclaimed Farmland	LC
Sweep Net	Coleoptera	Staphylinidae	Paederus sp	Rove Beetle	Nkoben	Reclaimed Farmland	LC

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Field	Lepidoptera	Sphingidae	Agrius convolvuli	Convolvulus	Sierra Leon	Reclaimed	LC
Observation		1 0		Hawkmoth		Farmland	
Field	Lepidoptera	Nymphalidae	Danaus sp		Sierra Leon	Reclaimed	LC
Observation	Deplacpiera	nymphanaae	Dunnue op		Siella Leon	Farmland	EC
Field	Lonidontoro	Nymphalidae	Danauson		Ciorra Loon	Reclaimed	IC
Observation	Lepidopiera	Tymphandae	Dunuus sp		Siena Leon	Farmland	
Field	Tanilantana	D	D	African Mocker	Ciarra I a a a	Reclaimed	IC
Observation	Lepidoptera	Papilionidae	<u>Papilio dardanus</u>	Swallowtail	Sierra Leon	Farmland	LC
Field	Louidoutous	Normanhalidaa	Cleanance fulleresses	Equat Decul	Ciarra Laar	Reclaimed	IC
Observation	Lepidoptera	Nymphalidae	Churuxes juioescens	Forest Pearl	Sierra Leon	Farmland	LC
Field	Tanilantana	D	D	Le che e che Conselle e de la	Ciarra I a a a	Reclaimed	IC
Observation	Lepidoptera	Papilionidae	Ραρίlio jacksoni	Jackson's Swallowtail	Sierra Leon	Farmland	LC
Field	Lonidontono	Danilianidaa	Danilio nhorcas	Green-banded	Ciarra Laon	Reclaimed	IC
Observation	Lepidoptera	rapinonidae	Pupilio phorcus	Swallotail	Sierra Leon	Farmland	LC
Field	Oderete	Chlanamahidaa	Distuce mana calibrata	Den ein e Jeruel	Ciarra Laar	Reclaimed	IC
Observation	Odonata	Chlorocyphidae	Ριαιής τρητά σαιτιχατά	Dancing Jewei	Sierra Leon	Farmland	LC
Field		A · 1	X 1 0 C		с: т	Reclaimed	IC
Observation	Hymenoptera	Apidae	Xylocopa flavorufa	Carpenter Bee	Sierra Leon	Farmland	LC
Field	TT	A	A	TT	Ciarra I a a a	Reclaimed	IC
Observation	путепортега	Apidae	Apis mellifera	попеурее	Sierra Leon	Farmland	LC
Field	Orthorntorio		Acanthacris	Common Garden	Taltal	Reclaimed	IC
Observation	Ormoptera	Acrididae	ruficornis	Locust	101101	Farmland	LC
Field	Louidoutour	Calinaidee	A anima anna 17771	Convolvulus	Taltal	Reclaimed	IC
Observation	Lepidoptera	Spningidae	Agrius convolvuli	Hawkmoth	10101	Farmland	LC

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Field Observation	Hemiptera	Pentatomidae	Antestiopsis sp	Antestia bug	Toltol	Reclaimed Farmland	LC
Field	Castanasta		D.1.	Grafi	T - 11 - 1	Reclaimed	IC
Observation	Gastropoda	Planorbidae	Bulinus sp	Shall	1 oltol	Farmland	LC
Field	Homintora				Toltol	Reclaimed	IC
Observation	Tiennptera	Pentatomidae	<i>Chinavia</i> sp	Green stink bug	10101	Farmland	LC
Field	Odonata			Skimmers	Toltol	Reclaimed	IC
Observation	Odonata	Libellulidae	Hadrothemis sp	JKIIIIIIEIS	10101	Farmland	LC
Field	Lonidontora			Green-banded	Taltal	Reclaimed	IC
Observation	Lepidopiera	Papilionidae	Papilio nireus	swallowtail	10101	Farmland	LC
Field	Orthoptora			Loof Katudid	Taltal	Reclaimed	IC
Observation	Ormopiera	Tettigoniidae	ettigoniidae Tettigoniidae sp		10101	Farmland	
Field	Orthoptora		Truvalis sp	Stick Grasshoppors	Toltol	Reclaimed	IC
Observation	Ormoptera	Acrididae	тилинэ эр	Suck Grasshoppers	10101	Farmland	
Field	Lonidontora			African babul blue	Nikohon	Forest	IC
Observation	Lepidopiera	Lycaenidae	Azanus jesous	butterfly	INKODEII	Totest	
Field	Lonidontora		Amauris	Layman	Nikobon	Forest	IC
Observation	Lepidopiera	Nymphalidae	albimaculata		INKUDEII	101051	





Annex 7: Location where water quality parameters were measured in the western side of Maasai Mau Forest during the rapid biodiversity survey on from October 31st to November 8th 2019





Streams in Sierra Leone

Stream in Chepalungu



Spring in reclaimed area in Toltol



Ewaso Ngiro River in Kass FM forming boundary of forest and settlement





Site	Sector	Coordinate	Date	EC	TDS	pН	Temp.	Transparency
				(µS)	(ppm)	-	(°C)	
Nkoben	Stream	S 00.84721°	30/10/2019	240	120	7.82	14.2	Very Turbid
		E 035.74202°						
Chepalungu	Stream	S 00.80555°	1/11/2019	134	66	7.87	13.6	Clear
		E 035.75092°						
Sierra	Stream 1	S 00.72932°	03/11/2019	146	73	7.70	17.2	Moderately
Leone		E 035.63492°						Clear
	Stream 2	S 00.72922°	03/11/2019	179	90	7.67	15.6	Very Turbid
		E 035.63477°						
Kass FM	River	S 00.76890°	06/11/2019	104	52	7.35	17.2	Very Turbid
		E 035.65094°						
	Spring	S 00.46790°	06/11/2019	227	112	6.86	18.5	Clear
		E 035.39672°						
Toltol	Spring	S 00.74247°	07/11/2019	90	45	6.32	20.2	Clear
		E 035.72756°						

## Annex 8: Water quality parameter measurements from streams in the western side of Maasai Mau Forest during the rapid biodiversity survey on from October 31st to November 8th 2019





Annex 9: Laboratory measurements of soil physical and chemical parameter collected from the western side of Maasai Mau Forest during the rapid biodiversity survey on from October 31st to November 8th 2019

			Farmlan				
	Forest		d	Reclaimed			
	Nkobe	Chepalung		Chepalung			Sierra
Site	n	u	Nkoben	u	Kass FM	Toltol	Leone
SOC (%)	2.68	3.27	2.93	2.71	3.34	3.09	2.93
BLD							
(g/cm3)	0.89	1.12	0.93	1.03	0.96	1.02	1.14
CEC							
(meg/100g)	27.04	14.03	20.16	10.48	9.96	10.07	7.8
pН	7.15	6.76	6.50	6.61	5.02	5.75	5.59
Nitrate							
(NO3-N)	40.72	9.14	26.81	<0.03	15.43	12.56	1.44
Calcium						1228.6	
(mg/kg)	4269.51	2068.8	1673.19	1624.23	1260.08	5	977.97
Magnesiu							
m							
(mg/kg)	463.69	185.6	342.205	154.85	234.91	253.99	189.10
Potassium							
(mg/kg)	568.63	608.01	539.85	351.8	561.31	616.55	429.26
Sodium							
(mg/kg)	84.87	134.32	46.34	37.26	59.99	52.12	54.56



## Annex 10: Photo Gallery

Courtesy Visit with DCC Narok South Mr. Kioko Kisalu on 7 <sup>th</sup> November, 2019
One of the Ogiek Representatives sharing his views at Nkareta on 6 <sup>th</sup> November, 2017
Focus Group discussion with women at Nkareta





Focus group discussion with Indigenous people at Nkareta
Meeting proceedings at Olshapani on 7 <sup>th</sup> November, 2019
Focus group discussion with farmers at Olshapani





	Focus group discussion with business people at Olshapani
	Chief Kobei addressing meeting at Nkaroni, Sogoo location on 8 <sup>th</sup> November, 2019
<image/>	Community member addressing the meeting at Sogoo





	Sociologist addressing meeting at Sagamian on 8 <sup>th</sup> November, 2019
HOLY STRIT ON DUTY	Community member addressing meeting at Sagamian
	Dr. Winfred Musila (KWTA representative) addressing the meeting on the project description











Consultant addressing the meeting at Nkoben on 29 <sup>th</sup> November, 2019
Chief Michael addressing meeting at Nkoben on 29 <sup>th</sup> November, 2019







Community member addressing meeting at Nkoben on 29th November, 2019

ESIA Study for the Proposed Electric Fencing of Maasai Mau Forest





Annex 11: Participants' Lists





Annex 12: Minutes of Stakeholder Meetings

