REPUBLIC OF KENYA

Environmental and Social Impact Assessment (ESIA) Report for the Model Farm in Galana-Kulalu

August, 2015

CERTIFICATION FORM

I **Dr. Mary Wambui Kimani,** submit this Environmental and Social Impact Assessment (ESIA) Report for the proposed Model Farm in Galana-Kulalu.

The ESIA Report has been prepared in accordance with the Environmental Management and Coordination Act, 1999 and the Environmental (Impact Assessment and Audit) Regulations, 2003.

....**10/08/2015**.....

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PROJECT PROPONENT: NATIONAL IRRIGATION BOARD (NIB)

....

General Manager **Date**

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Abbreviations

ADC — Agricultural Development Corporation

ASAL — Arid and Semi-arid Areas

CBD — Convention on Biological Diversity

CFAs — Community Forest Associations

CMS — Convention on Migratory Species

EIA — Environmental Impact Assessment

EMCA — Environmental Management and Coordination Act

EMS — Environmental Management System

EP — Equator Principle

ESIA — Environmental & Social Impact Assessment

ESMP — Environmental and Social Management Plan

FAO — Food and Agriculture Organization of the United Nations

GKFSP — Galana-Kulalu Food Security Project

GOK — Government of Kenya

IFC — International Finance Cooperation

KARI — Kenya Agricultural Research Institute

KEFRI — Kenya Forestry Research Institute

KEMFRI — Kenya Marine and Fisheries Research Institute

KTB — Kenya Tourist Board

KTDA — Kenya Tourist Development Authority

KTF — Kenya Tourism Federation

KWS — Kenya Wildlife Service

MDGs — Millennium Development Goals

NCPB — National Cereals and Produce Board

NEAP — National Environmental Action Plan

NEMA — National Environment Management Authority

NEMA — National Environmental Management Authority

NIB — National Irrigation Board

PCC	—	Public Complaints Committee
PRSP	—	Poverty Reduction Strategy Paper
SPSS	—	Statistical Package for Social Scientists
UNFCC	—	United Nations Framework Convention on Climate Change
UNTWTO	—	World Tourism Organization
WCED	—	World Commission on Environment and Development

Executive Summary

The proposed Galana-Kulalu Food Security Project is to be implemented in three phases; a 10,000 acres Model Farm in the first phase which is to be developed into 100,000 acres Pilot Farm in the second phase, and later up-scaled to the larger 1.75 million acres Galana-Kulalu Food Security Project in the third phase.

This is the first phase of the Galana-Kulalu Food Security Project; 10,000 acres Model Farm which is proposed to mirror the greater Galana-Kulalu Food Security Project. The Model Farm is located in Kilifi County within the land delineated as the Pilot Farm in the larger proposed Galana-Kulalu Food Security Project which is located in the existing Galana-Kulalu Ranches which are on government (GOK) land. Currently the Galana Ranch in which the Model Farm is located is used for ranching purposes of a variety of livestock including cattle, sheep and goats.

The main source of water for the existing uses in the ranches is the Galana River which is at the south of the Model Farm and separates Galana Ranch from Kulalu Ranch. Hydrological analysis of the Galana River indicates that there is substantially enough water for the proposed Model Farmôs uses. Water quality analysis also shows that the water is suitable for irrigation. However, for domestic and industrial uses, the water requires purification and a treatment plant is designed to cater for that.

The soils within the selected Model Farmôs location are also suitable for irrigation. In areas where salinity and infiltration is a challenge, the proposed irrigation technologies will counter. These soils are also suitable for various crops such as maize, vegetables and most other high value crops. Crops planned for the Model Farm are maize and vegetables. The proposed Model Farm is planned to have various enterprises including maize, horticultural and vegetables production, agro-processing, human settlement, social and physical infrastructure and on-farm water reservoir.

The Model Farm is an ASAL area where evapotranspiration is quite high. Therefore, efficient irrigation methods are proposed to counter this. These include drip and centre pivot irrigation. It

is also expected that these irrigation methods will lead to lesser water use as compared to other irrigation methods such as furrow. Drip irrigation will be done on open fields and in greenhouses whereas centre pivot will be done on open fields.

The total calculated project cost is approximately Kenya Shillings 6.8 billion. This is inclusive of irrigation systems, pumping stations, logistics centre and agricultural machinery among others.

The Model Farm is likely to impact the project area and its surroundings either directly or indirectly. In order to safeguard the environmental and social concerns, the Proponent contracted Experts to undertake an Environmental and Social Impact Assessment for the proposed Model Farm. The ESIA was carried out in accordance with EMCA, 1999 and EIA/ EA regulations, 2003. Some of the project impacts highlighted in the study are improved food security, job creation, increased revenue, increased income, increased accidents, change of population dynamics, improved physical and social infrastructure, reduced food prices, lifestyle change, flood moderation, micro-climate change, curtailing of wildlife movement, pollution (air, noise, water and soil), conflicts, water-logging, salinity and cultural exchange among others. Appropriate mitigation measures are also recommended for the identified environmental and social concerns and presented in this report. The ESIA also evaluated the effectiveness of the environmental and social considerations undertaken by the project Proponent in safeguarding the environment to ensure sustainability. With due considerations to sustainable development, it is recommended that, the proposed Model Farm project be approved by the Authority.

1. Introduction of the Project

1.1 General Project Background

The proposed Galana-Kulalu Food Security Project is to be implemented in three phases; a 10,000 acres Model Farm in the first phase which is to be developed into 100,000 acres Pilot Farm in the second phase, and later up-scaled to the larger 1.75 million acres Galana-Kulalu Food Security Project in the third phase.

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1.2 Project Environmental and Social Impact Assessment Objectives

The objective of the Environmental and Social Impact Assessment (ESIA) for the Model Farm is to;

- Identify both positive and negative social and environmental impacts emerging from the implementation, commissioning and operation of the Farm
- Determine socio-economic impacts of the project
- Design and prepare appropriate mitigation measures and action plans to address all the possible environmental and social impacts of the project

1.3 Study Approach and Methodology

The *ESIA* study was carried out using the methodology described in EMCA, 1999 and Environmental (Impact Assessment and Audit) Regulations 2003 as well as World Bankôs IFC Environmental policies.

Household questionnaires were prepared to capture the demographics of the residents, socio-economic, and environmental status, availability and access to physical infrastructure, energy,

communication and the capacity for the project area community to provide human labour in the project phases.

A simple random sampling method was selected to administer the questionnaires as households are scattered and sparsely distributed. Project area administration (chiefs, community elders and religious leaders) were initially consulted to advice on how the household would be sensitized on the project objectives, selected and interviewed. Subsequently, key informant interviews were conducted by field researchers. The approach adopted included, focus group discussions with community elders, key informants with county government officials, Kenya Wildlife Services, touristsô camps and ADC management and relevant ministriesô officials and administration of questionnaires to households. The discussions with the key informants were one on one and guided by a pre-prepared set of questions in an interview schedule. A total of 80 household questionnaires were administered through question and answer sessions and responses recorded by the researchers. Some of the selected photos from the discussions are presented in Figures 1-1, 1-2, 1-3 and 1-4.

The information/data collected through questionnaires were analyzed using Statistical Package for Social Scientists (SPSS) and the output of the analysis subsequently presented in the section hereunder;

A public participation workshop was held on 10th od august 2015 and the deliberations were included in the esia reporting.

figure 1-1: key informant interview with adc manager

figure 1-2: group discussion with community elders

Figure 1-3: Focus group discussion with the local communities

Figure 1-4: Discussion with KWS Representative

2. Institutional, Policy and Legal Frameworks

This Chapter reviews the pertinent institutional, policy and legal framework governing environmental and socio-economic issues that must be taken into consideration during the Project implementation.

2.1 Institutional Frameworks

Ministry of Environment, Water and Natural Resources

The mandate of the ministry is to promote, monitor, conserve, protect and sustainably manage the environment, forestry and wildlife and water resources for national development.The National Environment Management Authority (NEMA) is a department under the Ministry of Environment, among others.

The core functions of the Ministry include:

- Environment and Natural Resources Policy formulation, analysis and review
- Sustainable management of Mineral resources and conservation of environment
- Continuous development of geo-database for integrated natural resources and environmental management systems
- Conduct applied research and dissemination of research findings in land resources and geology
- Carry out geological surveys, mineral exploration and regulation of mining and use of commercial explosives
- Promote, monitor and coordinate environmental activities and enforce compliance of environmental regulations and guidelines
- Meteorological services

The Ministryôs vision is to offer a clean, secure and sustainably managed environment and mineral resources conducive of national prosperity. The mission is to promote, monitor, conserve, protect and *sustainably manage the environment* and mineral resources for national development.

National Environment Management Authority (NEMA)

The National Environment Management Authority (NEMA) was established under the Environmental Management and Coordination Act (EMCA) as a Government Parastatal and became operational on January 1, 2002. The National Environment Management Authority (NEMA) is an advisory and regulatory body and therefore it is the principal Government institution responsible for the implementation of all policies relating to the environment. The Authority is responsible for dealing with Environmental and Impact Assessment (EIA) reports. NEMA has a Board of Management and a Director General who is appointed by the President.

Kenya Wildlife Service (KWS)

Kenya Wildlife Service (KWS) is a State Corporation established by the Wildlife (Conservation and Management) Act, CAP 376 and The Wildlife (Conservation and Management) (Amendment) Act no. 16 of 1989. They provide for the establishment of national parks and national reserves and define how they are to be managed. The Environmental Management and Coordination Act (EMCA) of 1999 provides for the legal and administrative co-ordination of the diverse sectoral initiatives, including management and conservation of wildlife so as to improve the national capacity for the management of biodiversity and the environment in general.

The operations of the KWS are also impacted and guided by other overarching policy and legal frameworks (e.g. those relating to Forests, Fisheries, Mining, Lands, Water, Industry, Rural Development, Agriculture, Local Government, National Security, National Museums and the research programs under KEFRI, KEMFRI and KARI) which necessitate structured and functioning relationships with other GOK departments/agencies and the international and local communities.

The overall mandate of KWS is to conserve and manage wildlife in Kenya with the following:

I. Sole jurisdiction over National parks
II. Supervisory role in the management of National Reserves, Local and Private Sanctuaries License, control and supervise all wildlife conservation and management activities outside the protected areas
III. Conservation Education and Training

IV. Wildlife Research

Kenya Tourism Board

Kenya Tourist Board (KTB) was established in 1997 through the legal notice no.14 under the state Corporations Act (Cap 446) of the laws of Kenya.

The mandate of the Board is to:

i. Promote and market Kenya as a tourist destination locally and internationally;
ii. Establish public Relations services to address issues of concern to the tourism industry, and facilitate the resolution of conflicts within the industry;
iii. Monitor the quality and standards of facilities available to tourists and advice both the private sector and relevant Government agencies on how to improve the facilities;
iv. Work in partnership with national, regional and international organizations as well as local authorities in the country to improve the tourism environment;
v. To initiate education and awareness programs on tourism locally as well as abroad;
vi. Develop and maintain professional personnel to deal with issues that adversely affect Kenya`s image in the tourism industry;

Kenya Tourist Development Authority (KTDA)

KTDA is established as a state corporation under the Kenya Tourist Development Authority Act (CAP 382) of the laws of Kenya. KTDA is charged with the duty of securing the investigation, formulation and carrying out of projects for developing the tourism industry in Kenya.

According to the KTDA ACT, the Corporation shall have power, either alone or in association with other authorities or persons, or as managing agent or otherwise on behalf of other authorities or persons to:

(a) investigate and formulate projects for the promotion or expansion of new or existing enterprises to which this section applies, and to carry out such projects;

(b) carry on undertakings which appear to the Corporation to be needed for or in connexion with the promotion or expansion of new or existing enterprises to which this section applies;

(c) carry on any activities incidental to such a project or to such an undertaking which appear to the Corporation to be requisite, advantageous or convenient for or in connexion with that project or undertaking;

(d) assist other authorities or persons, either financially or in any other way, to perform any functions which the Corporation is empowered to perform by virtue of any of the foregoing paragraphs;

(e) establish or expand, or promote the establishment or expansion of, other bodies to carry on (either under the control or partial control of the Corporation or independently) any such functions as are mentioned in paragraph (d).

Kenya Tourism Federation

Kenya Tourism Federation (KTF), was formed as an umbrella body bringing together the private sector bodies including; associations of Tour Operators, Hotelkeepers and Caterers, Travel Agents, Air Operators, Mombasa & Coast Tourism and Ecotourism Kenya. The key aims of KTF are to: -

i. Provide a single voice for the tourism industry;
ii. Enhance ethics and standards in the tourism industry;
iii. Strengthen private sector representation on the various organizations/boards that impact on tourism;
iv. Provide a forum through which the industry can give input to the marketing activities of the Kenya Tourism Board;
v. Lobby and constructively engage Government on issues critical to the industry.

National Irrigation Board (NIB)

The National Irrigation Board was established in 1966 through an Act of Parliament (Cap 347) to take over the activities of ALDEV. As per the Irrigation Act, NIBôs mandate is;

- Promoting and improving national irrigation schemes in the country
- Conducting research and investigation into the establishment of national schemes
- Designing, constructing, supervising and administering irrigation schemes
- Coordinating and planning settlement on national irrigation schemes
- Determining the number of settlers to be accommodated in national irrigation schemes
- Promoting marketing of crops and produce in national irrigation schemes in liaison with organizations responsible for marketing of agricultural produce and

- Formulating and executing policy regarding national irrigation schemes in conjunction with the Water Resource Authority
- For many years, NIB operated under the above mandate till 2002 when the board restructured itself following changes in government policy to focus its activities in;
- Coordination of construction and rehabilitation of major irrigation and drainage infrastructure
- Operation and maintenance of major irrigation and drainage infrastructure
- Administering land in the public schemes and providing technical advice to farmers

National Irrigation Board (NIB) is implementing a total of 119 developments projects which are spread out in the 47 counties and are at various stages of implementation: feasibility studies, detailed designs preparation, tendering for construction and construction. The proposed 10,000 acres Model Farm within the Galana-Kulalu Food Security Project is part of these development projects and therefore NIB will be the implementer in accordance with its mandate.

Agricultural Development Corporation (ADC)

Agricultural Development Corporation is a Government Parastatal, which was established in 1965 through an Act of Parliament Cap 346, to facilitate the land transfer programme from European settlers to locals following the countryôs independence. It was also to be a stabilizing factor to assist in maintaining the good quality livestock and continuity of the breeding programs in the affected farms.

With the successful completion of the land transfer programme, revision of objectives of the Corporation was done resulting in the Act of Parliament Cap 444 of 1986.As per this Act, the functions of the Corporation were redefined to include promotion and execution of agricultural schemes and reconstruction in Kenya by initiating, assisting or expansion of agricultural undertaking ands and enterprises. The land on which the proposed Model Farm is located has is currently ADC Galana-Kulalu Ranches and has been leased by NIB from ADC. On the basis of its mandate, ADC will implement the project in conjunction with NIB.

2.2 Policy and Legal Frameworks

The Constitution of Kenya, 2010

Article 32 of the Constitution of Kenya states that ñEvery person has the right to a clean and healthy environmentò, which includes the right:

a) To have the environment protected for the benefit of present and future generations through legislative and other measures particularly those contemplated in Article 69; and
b) To have obligations relating to the environment fulfilled under Article 70.

The obligations in respect of the environment as stated in Article 69 of The Constitution include:

(1) The State shall ï

c) Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
d) Work to achieve and maintain a tree cover of at least ten percent of the land area of Kenya;
e) Protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and genetic resources of the communities;
f) Encourage public participation in the management, protection and conservation of the environment;
g) Protect genetic resources and biological diversity;
h) Establish systems of Environmental and Social Impact Assessment, environmental audit and monitoring of the environment;
i) Eliminate processes and activities that are likely to endanger the environment; and
j) Utilize the environment and natural resources for the benefit of the Kenyan people

(2) Every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

This obligation therefore makes it mandatory to the way in which proposed project would affect the environment.

Kenya's Vision 2030

The Kenya's Vision 2030 stipulates the Kenya Governments' commitment to develop the arid and semi-arid lands (ASAL). The Proposed Model Farm is within the ASAL which has the potential for crop production if irrigated.

National Water Policy

The National Policy of Water tackles issues pertaining to water supply and sanitation facilities development, institutional framework and financing of the sector to ensure rational and efficient framework for meeting the water needs for national economic development, poverty alleviation, environmental protection and social wellbeing of the people through sustainable water resource management. The proposed Model Farm Project has been designed to adhere to the set guidelines as stipulated in the said irrigation policy.

Water Catchments Management Policies

The policy on water catchments management has been shaped over time by two Sessional Papers namely:

i. Sessional paper No. 1 of 1968; and
ii. Kenya Forest Development Policy Sessional paper No. 9 of May 2005.

Sessional Paper No. 9 encourages the involvement of the private sector, communities and other stakeholdersóparticipation in forest management in order to conserve water catchments areas and reduce poverty.

Policy on Environment and Development

The policy paper emphasizes that Environmental and Social Impact Assessment must be undertaken by the developer as an integral part of a project preparation. This has been done for the proposed Model Farm and a comprehensive Environmental and Social Management Plan developed to ensure that the impacts identified in the assessment are fully and appropriately mitigated.

The National Environmental Action Plan (NEAP)

The National Environmental Action Plan (NEAP) is provided for by EMCA, 1999 to ensure preparation of Environmental Action Plan at different levels. The framework recognizes the intertwined linkages between economic growth and environment in Kenya. It highlights priority themes and activities for the country towards achieving sustainable environment.

The policy framework among others, proposes integration of environmental concerns into regional and local development plans, promotion of appropriate land uses and enforcement of EMCA, 1999 and its subsidiary and other relevant legislations. The policy framework also advocates for efficient water harvesting, storage and usage. On human settlements and infrastructure, this policy framework recognizes the associated environmental issues. These include waste management, sanitation, diseases, land use changes in conservation areas, demand for water, energy, construction materials, pollution, land degradation, biodiversity loss etc. In managing operations of the proposed Farm, consideration of the highlighted issues is vital towards contribution to the national sustainable development goals.

Multiple stakeholdersô involvement inclusive of the private sector is advocated for within the implementation of this framework towards achievement of sustainable development goals. Finally, the framework also advocates for monitoring and evaluation to ensure effective and efficient environmental policy implementation. Design of the proposed Model Farm has adhered to all these requirements.

The Poverty Reduction Strategy Paper (PRSP)

The PRSP has the twin objectives of *poverty reduction and economic growth*. The proposed Model Farm project, during and after implementation, will offer jobs to many Kenyans as a way of contributing to this noble objective of reducing poverty.

National Land Policy

The National Land Policy has the vision to guide the country towards an efficient, sustainable and equitable use of land for prosperity and posterity. Subsequent to the enactment of the National Land Policy, Kenya has enacted several Acts of Parliament to help manage the land

question including the Land Registration Act legal Notice No. 3 of 2012, Land Commission Act Legal Notice No. 5 of 2012 and Land Act Legal Notice No. 6 of 2012.
Compliance with the new land legislations would be important for sustainability of the enterprises within the Model Farm Project.

The Environment (Impact Assessment and Audit) Regulations 2003

This offers guidance on the fundamental aspects on which emphasis must be laid during field study and outlines the nature and structure of Environmental Impact Assessments and Audit reports. The legislation further explains the legal consequences of partial or non-compliance to the provisions of the Act.

Irrigation infrastructure development as an activity is listed in the second schedule of EMCA as among projects that require an Environmental Impact Assessments before commencement. For this reason, this report provides the legal requirements for the project approval, impacts of irrigation project, major elements of the environment, including land, water and human health and safety.

EMCA (Biological Diversity and Resources, Access) Regulations, 2006

The Act provides that no person shall engage in any activity that may have an adverse impact on any ecosystem that may lead to the introduction of any exotic species or to unsustainable use of natural resources, without an Environmental Impact Assessment License issued by the Authority under the Act. The proposed Model Farm traverses areas with diverse ecosystems and measures to conserve and improve them during construction works, operation and decommissioning have been proposed and must be adhered to.

Physical Planning Act (No. 6 of 1996)

The Physical Planning Act requires the preparation and implementation of physical development plans and for connected purposes. Under this Act, project proponents are required to provide a Certificate of Compliance indicating that the proposed development is in line with the physical development plan of the Government of Kenya. Certificate of Compliance is very important for the Model Farm.

EMCA (Wetlands, River, Lake and Sea) Regulations, 2009

The Act makes provision for the protection of all wetlands in Kenya whether occurring in private or public land through conservation and sustainable use for socio-economic development. It also aims at ensuring the conservation of water catchments and the control of floods and the sustainable use of wetlands for ecological and aesthetic purposes for the common good of all citizens. Sustainable use of wetlands within the project area has been integrated into the proposed Model Farm land use plan as ecological and aesthetic areas to ensure sustainable use and management of the resources.

EMCA (Water Quality) Regulations, 2006

The Regulations outline various water quality standards for drinking water, water used for industrial purposes, agricultural purposes, recreational purposes fisheries and wildlife and any other purposes. In compliance to these, water quality analysis was done and indicated that water from Galana River is suitable for irrigation. However, drinking and industrial water will require some treatment and a water treatment plant has therefore been designed within the Model Farm.

EMCA (Waste Management) Regulations, 2006

These regulations define the responsibilities of waste generators and define the duties and requirements for transportation and disposal of waste. It provides for mitigation of pollution and provides for hazardous and toxic wastes. The regulations require a waste generator to dispose waste only to a designated waste receptacle.

The proposed Model Farm is anticipated to use materials which may release hazardous and toxic wastes such as oil spillage from vehicles, equipment and water pumps, cement used during construction and rehabilitation of the Farmôs structures, agro-chemicals and greenhouse gases. Proper materials and waste management strategies have been proposed.

EMCA (Noise and Excessive Vibration Pollution) Control Regulations, 2009

Under the regulation the Contractor is prohibited from producing excessive noise and vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the

environment or excessive vibrations which exceed 0.5 centimeters per second beyond any source property boundary or 30 metres from any moving source. Under the regulation the Contractors will be required to undertake daily monitoring of the noise levels within the project area during construction period to maintain compliance.

The Water Act of 2002

This is an Act of Parliament to provide for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water; to provide for the regulation and management of water supply and sewerage services; to repeal the Water Act (Chapter. 372 of the Laws of Kenya) and certain provisions of the Local Government Act; and for related purposes.

In addition to this act and in furtherance of the said related purposes the Minister for Water and Irrigation, through the powers conferred to him by Sections 47(6) and 110(1) of the Water Act, 2002, made THE WATER (WATER SERVICES LEVY) REGULATIONS, 2008. This sought to impose a levy of one per cent (1%) of all sales of water services to consumers by each water service provider operating under the Act.

The Water Act, in general, gives provisions regarding the ownership of water, institutional framework, national water resources, management strategy, and requirement for permits, state schemes and community projects. Part IV of the Act addresses the issues of water supply and sewerage. Section 59 of the Act states that the National Water strategy shall contain details of:-

- Existing water services.
- The number and location of persons who are not being provided with basic water supply and basic sewerage.
- Plans for the extension of water services to underserved areas.
- The time-frame for the plan; and
- An investment programme.

Agriculture Act (Chapter 318 of the Laws of Kenya)

This statute seeks to promote and maintain a stable agriculture, to provide for the conservation of the soil and its fertility and to stimulate the development of agricultural land in accordance with the accepted practices of good land management and good husbandry. The proposed Model farm is designed to use modernized methods of irrigation and farming in adherence to this Act.

Irrigation Act, 347

The Act provides for the development, control and improvement of irrigation schemes and for purposes incidental and thereto and connected therewith. The proposed Model Farm is headed by the National Irrigation Board and is part of the Boards efforts to fulfil her mandate.

The Labour Act, 2007

An Act of Parliament to repeal the Employment Act, declare and define the fundamental rights of employees, to provide basic conditions of employment of employees, to regulate employment of children, and to provide for matters connected with the foregoing. The contractor on site will have to employ casuals probably from the communities where the road traverses and also other workers during construction and operation. The basic conditions of employees should be observed to avoid unnecessary conflicts during the construction works. The Contractor shall pay the entire amount of the wages earned by or payable to the workers. Payment of such wages should be done at the end of a working day at or near the place of work.

Occupational Health and Safety Act, 2007

The Act provides for the safety, health and welfare of workers and all persons lawfully present at work place, as well as the establishment of the National Council for Occupational Safety and Health and for connected purposes.

Section 3(1) and (2) of the Act explains that it applies in all workplaces where any person is at work, either temporarily or permanently. It expounds on the purpose, which is to secure the safety, health and welfare of persons at work as well as protecting persons other than persons at work against risks resulting from, or connected to, activities at workplace. Further, sections 43 and 44 of part V gives regulations on registration of work places.

For the success of the project, lots of manpower will be required and as a result employment of many people will be done. There will also be need for designated workplaces for operation. Thus, compliance with the relevant provisions in this Act will be important in ensuring that workers operate in safe healthy environment, and that their welfare shall be catered for.

The Public Health Act (Cap 242)

This Act makes provision for securing and maintaining health. Part III and IV of the Act focuses on notification, prevention and suppression of infectious diseases, including inspection, disinfection and provision of medical aid to affected parties in case of outbreaks of infectious diseases. Part IX regulates on sanitation and housing, granting health authorities powers to prevent or remedy any dangers to health arising from poor handling of sanitation issues as well as improper housing and nuisances arising there from. Besides, regulations governing prevention and destruction of mosquitoes, encompassing due maintenance of yards, premises, wells, cesspits and identification and destruction of breeding places are entailed in part XII.

The Public Health Act provides the necessary legal guidelines regulating measures aimed at effective control and management of the said issues. These will be adhered to during all the project phases.

Wildlife (Conservation and Management) Cap 376 Laws of Kenya

This Act of Parliament deals with the consolidation and amendment of the law relating to the protection, conservation and management of wildlife in Kenya; and for purposes connected there with and incidental thereto.

The act provides that where it is desirable that the present powers relating to the management and conservation of wildlife in Kenya should be amalgamated and placed in a consolidated Service of the Government and the prime objective of the Service should be to ensure that wildlife is managed and conserved so as to yield to the Nation in general and to individual areas in particular, optimum returns in terms of cultural, aesthetic and scientific gains as well as such

economic gains as are incidental to proper wildlife management and conservation and which may be secured without prejudice to such proper management and conservation.

For the achievement of the objective, that full account should be taken of the varied forms of land use and the inter-relationship between wildlife conservation and management and other forms of land use.

The Act controls activities within the park, which may lead to the disturbance of animals. Unauthorized entry, residence, burning, damage to objects of scientific interest, introduction of plants and animals and damage to structure are prohibited.

2.3 International Conventions

Convention on the Conservation of Migratory Species

The convention on migratory species (CMS) was adopted to conserve migratory species of wild animals given that migratory species are seen as an international resource. Such species may be terrestrial or marine. The convention is relevant due to presence of migratory wild animals, bird species and other aquatic organisms within the project area.

Convention on Biological Diversity (CBD)

The CBD is one of the outcomes of the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992. The CBD establishes a global legally binding framework for the conservation of biodiversity, the sustainable use of it components and the fair and equitable sharing of benefits arising out of utilization of genetic resources. The provisions of this convention should be taken into account in the conservation of various species of plants, animals and the variety of ecosystems in the project area.

EAC Protocol on Environment

The protocol was signed by the Partner States of the East African Community on 29th November 2003. It has relevant provisions for environmental and social management for the project; Article 5: Paragraph 4 provides that Partners States should promote sustainable utilization of water resources while taking into consideration factors such as ecology, geographic, climatic,

hydrologic factors among others; the social and economic needs of each Partner States; the population dependent on the water resources; existing and potential uses of the water resources.

Article 6: Paragraph 1 identifies the protection and conservation of the basin and its ecosystem with emphasis on improving water quality and quantity; preventing the introduction of invasive species; conservation of biological diversity and forest resources; protection and conservation of wetlands and fisheries resources conservation. Part 2 of the article provides for the harmonization of laws and policies for stakeholder participation in protection, conservation and rehabilitation. Sustainable agriculture and land use practices to achieve food security and rational agricultural production is provided for in Article 9. Article 12 of the Protocol urges Partner States to develop national laws and regulations requiring project proponents to undertake EIA and review of EIA reports to be done by all the Partner States if the potential impacts are likely to be trans-boundary and the same to apply for Environmental Audits in Article 13. Partner states should ensure control of pollution from non-point sources through legal, economic and social measures. This is provided for in Article 20 which further states that pollution control measures should promote sustainable forestry practices, appropriate agricultural land use methods, sanitation and hygiene within the basin. Public participation is provided for in Article 22 which should be enhanced to influence government decisions on project formulation and implementation.

Article 23 of the Protocol provides that Partner States should promote Community involvement and mainstreaming gender concerns at all levels of socio-economic development especially in decision making, policy formulation and implementation of projects and programmes.

The Rio Declaration

Agenda 21 ï a program of action for sustainable development worldwide, the Rio Declaration on Environment and Development was adopted by more than 178 governments at the United Nations Conference on Environment and Development, known as the Earth Summit, held in Rio de Janeiro, Brazil from 3rd to 14th June 1992. On sustainable and responsible development, Principle 3 states that ñthe right to development must be fulfilled so as to equitably meet development and environmental needs of present and future generations.ò

Principle No. 10 of the declaration underscore that environmental issues are best handled with participation of all concerned citizens at all the relevant levels.

In the Model Farm, stakeholder participation has been in-built so far in the pre-feasibility stage. The views of communities and their concerns have been captured through focus group discussions and interviews. Furthermore, mechanism exists through which they can raise issues and seek redress in situations where they feel their rights have been infringed upon.

World Commission on Environment and Development (WCED)

The Bruntland Commission as it is commonly known focused on the environmental aspects of development, in particular, the emphasis on sustainable development that produces no lasting damage to biosphere, and to particular ecosystems. In addition, environmental sustainability is the economic and social sustainability. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resources. While social sustainable development maintains the cohesion of a society and its ability to help its members work together to achieve common goals, while at the same time meeting individual needs for health and well-being, adequate nutrition, and shelter, cultural expression and political involvement. In the Model Farm, efforts have so far been made to abide by the principles of WCED by trying to solve the development problem of achieving food security while at the same time protecting the environment by undertaking a study that captures both principles.

Kyoto Protocol (1997 and 2004)

The protocol generally promotes the use of renewable energy through the requirement in Article 2 of the protocol that: ñEach party included in Annex 1 ... Shall:

(i) Research on, promote, develop and increase use of new and renewable forms of energy, of carbon sequestration technologies and of advanced and innovative environmentally sound technologiesò.

(ii) Demonstrate the ñprogressive reduction or phasing out of market imperfections, fiscal incentives, tax and duty exemptions and subsidies in all greenhouse gas emitting sectors that run

counter to the objective of the protocol and apply market instrumentsò. Article 10 (c) requires that all parties ñcooperate in the promotion of effective modalities for the development, application and diffusion of, and take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of or access to environmentally sound technologies, know-how, practices and processes pertinent to climate change, in particular to developing countries, including the formulation of policies and programmes for the effective transfer of environmentally sound technologies that are publicly owned or in the public domain and the creation of an enabling environment for the private sector to promote and enhance the transfer of and access to environmentally sound technologiesò

However the Kyoto protocol is not legally binding and there has been a major debate on the renewal of the protocol.

Convention on Biological Diversity (1992)

Principle No. 10 of the declaration states that environmental issues are best handled with participation of all concerned citizens at all relevant levels. At the national level, each individual shall have appropriate access to information that is concerning environment that is held by public authorities. States shall encourage and facilitate public participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy shall be provided.

The Model Farm has so far abided by the requirement of the environmental laws of the country.

International Finance Cooperation (IFC) Performance Standards

The section summarizes the IFC Performance Standards (PS) 1-8. Note that the IFC PS was revised in January 2012. Some PS aspects are enhanced and there are some new areas of focus. The main changes are in respect of issues around gender; resource efficiency; climate change and adaptation; project disclosure; supply chain management; waste management; labour conditions.

Assessment and Management of Environmental and Social Risks and Impacts

This Standard is similar to the NEMA Environment Regulations 2003. In addition to identifying risks and impacts of proposed projects, it also aims at ensuring that affected communities are appropriately engaged on issues that could potentially affect them.

The Standard requires that the area of influence encompasses, as appropriate:

(i) The primary project site(s) and related facilities that the project proponent (including its contractors) develops or controls , such as power transmission corridors, pipelines, canals, tunnels, relocation and access roads, borrow, disposal areas and construction camps;

(ii) Associated facilities that are not funded as part of the project (funding may be provided separately by the project proponent or by third parties including the government), and whose viability and existence depend exclusively on the project and whose goods or services are essential for the successful operation of the project;

(iii) Areas potentially impacted by cumulative impacts from further planned development of the project, any existing project or condition, and other project-related developments that are realistically defined at the time the Social and Environmental Assessment is undertaken; and

(iv) Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The area of influence does not include potential impacts that would occur without the project or independently of the project.

The standard has a number of components including management systems, training, community engagement, consultation and grievance mechanisms, actions plans and organizational capacity.

Labour and Working Conditions

Performance Standard 2 recognizes that the pursuit of economic growth through employment creation and income generation should be balanced with protection for basic rights of workers. Good practice for labour and working conditions requires compliance with International Labour Organization (ILO) and UN conventions and prevention of child labour, i.e. persons under the age of 18 years.

Resource Efficiency and Pollution Prevention

This revised PS requires assessment and effective use of resources as well as prevention and control of pollution in line with good international practice.

Biodiversity Conservation and Sustainable Management of Living Natural Resources

In order to avoid or minimize adverse impacts to biodiversity in the projectôs area of influence, the significance of project impacts on all levels of biodiversity is an integral part of the Social and Environmental Assessment process. The assessment should consider critical habitats with high biodiversity value and also legally protected areas. PS 6 presumes against development for certain critical habitats.

Indigenous People

The Indigenous Peoples are recognized as social groups with identities that are distinct from dominant groups in national societies, are often among the most marginalized and vulnerable segments of the population. Their economic, social and legal status often limits their capacity to defend their interests in, and rights to, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development. They are particularly vulnerable if their lands and resources are transformed, encroached upon by outsiders, or significantly degraded. Their languages, cultures, religions, spiritual beliefs, and institutions may also be under threat. These characteristics expose Indigenous Peoples to different types of risks and severity of impacts, including loss of identity, culture, and natural resource-based livelihoods, as well as exposure to impoverishment and disease. Government sector projects may create opportunities for Indigenous Peoples to participate in, and benefit from project-related activities that may help them fulfill their aspiration for economic and social development. In addition, this Performance Standard recognizes that Indigenous Peoples may play a role in sustainable development by promoting and managing activities and enterprises as partners in development.

Cultural Heritage

This Performance Standard recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural

and Natural Heritage, the Contractor will protect and support irreplaceable cultural heritage by undertaking internationally recognized practices for the protection, field-based study, and documentation of cultural heritage.

UN Framework Convention on Climate Change (UNFCC) (1992)

This is an international framework that requires that all parties ñstabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system within a timeframeò that is ñsufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable mannerò.

Convention on Biological Diversity (1992)

Principle No. 10 of the declaration states that environmental issues are best handled with participation of all concerned citizens at all relevant levels. At the national level, each individual shall have appropriate access to information that is concerning environment that is held by public authorities. States shall encourage and facilitate public participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy shall be provided.

United Nations Convention to combat Desertification (1994)

An agreement to combat desertification and mitigate the effects of drought through national action programs that incorporate long term strategies supported by international cooperation and partnership arrangements. The contractors will also combat land degradation through mechanisms which will involve planting trees to enhance vegetation cover.

Bamako Convention (1991)

A treaty of African nations prohibiting the import of any hazardous (including radioactive) waste. The materials used in the construction of irrigation scheme are not hazardous.

World Tourism Organization (UN WTO)

The World Tourism Organization (UNWTO) is the United Nations agency responsible for the promotion of responsible, sustainable and universally accessible tourism. As the leading international organization in the field of tourism, UNWTO promotes tourism as a driver of economic growth, inclusive development and environmental sustainability and offers leadership and support to the sector in advancing knowledge and tourism policies worldwide.

UNWTO encourages the implementation of the Global Code of Ethics for Tourism, to maximize tourismôs socio-economic contribution while minimizing its possible negative impacts, and is committed to promoting tourism as an instrument in achieving the United Nations Millennium Development Goals (MDGs)**,** geared towards reducing poverty and fostering sustainable development. UNWTO works in six main areas - competitiveness, sustainability, poverty reduction, capacity building, partnerships and mainstreaming - to achieve responsible, sustainable and universally accessible tourism.

UNWTO generates market knowledge, promotes competitive and sustainable tourism policies and instruments, fosters tourism education and training, and works to make tourism an effective tool for development through technical assistance projects in over 100 countries around the world. UNWTOôs membership includes 156 countries, 6 Associate Members and over 400 Affiliate Members representing the private sector, educational institutions, tourism associations and local tourism authorities.

2.4 International guidance and standards

Equator Principles

The Equator Principles refer to a financial industry benchmark for determining, assessing and managing social and environmental risk in project financing. As per the Equator Principles, negative impacts on project affecting the ecosystems and communities should be avoided whenever possible, and if the impacts are unavoidable, they need to be reduced, mitigated and/or compensated for appropriately. In accordance to Equator Principles, potential social and environmental issues to be addressed in documentation include the following:

- Assessment of the baseline social and environmental conditions;
- Consideration of the feasible environmentally and socially preferable alternatives;

- Requirement under the host country laws and regulations, applicable international treaties and agreements;
- Protection of human rights and community health, safety and security;
- Protection of cultural property and heritage;
- Protection and conservation of biodiversity, including endangered species and sensitive ecosystems in modified, natural and critical habitats, and identification of legally protected areas;
- Sustainable management and use of renewable natural resources (including sustainable resource management through appropriate independent certification systems);
- Use and management of dangerous substances;
- Major hazards assessment and management;
- Labour issues and occupational health and safety;
- Socio-economic impacts;
- Fire prevention and life safety;
- Land acquisition and involuntary resettlement;
- Impacts on affected communities, and disadvantaged or vulnerable groups;
- Impacts on indigenous peoples, and their unique cultural systems and values;
- Cumulative impacts of existing projects, the proposed project, and anticipated future projects;
- Consultation and participation of affected parties in the design, review and implementation of the project;
- Efficient production, delivery and use of energy; and
- Pollution and prevention and waste minimisation, pollution controls (liquid effluents and air emissions) and solid and chemical waste management.

For this project, adherence to IFC standards is required to be Equator Principles (EP) compliant and is a sufficient condition.

ISO 14000 Standards

ISO 14000 is a series of voluntary international standards on environmental management. It provides a framework for the development of an environmental management system,

environmental auditing, environmental labelling, environmental performance evaluation and life cycle assessment. The standards provide a framework for a strategic approach to an organizationôs environmental policies, plans and actions. An Environmental Management System (EMS) based on the ISO 14000 standards is a management tool enabling an organization of any size or type to control the impact of its activities, products or services on the environment.

It defines a structured approach for;

a) Setting environmental objectives and targets;
b) Achieving these goals; and
c) Demonstrating that they have been achieved.

Because ISO 14000 does not set levels of environmental performance, the standards can be implemented by a wide variety of organizations, whatever their current level of environmental maturity. However, a commitment to compliance with applicable environmental legislation and regulations is required, along with a commitment to continuous improvement.

3. Project Area Baseline Information

3.1 Location, Size and Climatic Conditions

The proposed Model Farm is within Kilifi County. It is located in agro ecological zone VII and receives an average annual rainfall of 480mm. The average annual temperature of the project area is 25^0C. Due to low rainfall the zone has been classified as semi arid hence it cannot support rain fed agriculture. To improve agricultural potential of the project area, alternative source of water are to be introduced through irrigation.

3.2 Topography

The Model Farm is located in the coastal lowlands. The topography of the area is largely flat. The slope of the site ranges from 0 to 4.4 percent. The largest area has slope values in the range of 0.0% to 0.2 %, 0.5% to 1.0% and 01% to 2% which covers 40.39%, 43.32% and 12.57 % respectively of the total land. The nature of topography makes the project area suitable for mechanized farming since the equipments used move about without terrain challenges. The low slopes make construction of water conveyance system less challenging.

3.3 Soils

The soil type over most of the area of the Model Farm is defined by the Kenya Agricultural Research Institute (KARI) Soils Report[1] as: PsmOb1 which is moderately well drained, deep to very deep, brown to very dark grey, friable to extreme firm, slightly to strongly calcareous, moderately saline, moderately sodic, cracking clay with very thin topsoil of sandy clay. The soils are suitable for the proposed crops of the Model Farm. However, some soils are classified as light to medium soils (sandy clay) which will require frequent water application that can be done by the proposed irrigation methods/technologies.

[1] The full title of the KARI Soils Report is "The Soils of Galana ADC Ranch and their Suitability for Irrigated Agriculture" (2014).

3.4 Demographic Characteristics of the Project Area Communities

Population and Human Settlement

ADC Galana-Kulalu Ranches are on a government land. However, there are human settlements apart from the ADC workers ñsquattersò along the riverine (both sides of River Galana) within the ranches. They are settled in clusters or village, namely; Bakaye, Mchekenzi, Ruruma, Kwa Pembe, Katsangani, Katana Hakeye, Divayo, Garsemke and Habura villages. Other neighbouring communities include Bombi and Chakama among others.

Ethnicity and Livelihood

The major ethnic groups in the project area are the Mijikendas and Ormas. Others include Sanyes, and Pokomos. Many of the Mijikendas are subsistence farmers along River Galana, and the Ormas are predominantly nomadic. The other ethnic groups are involved in various activities that include crop farming, bee keeping (apiary), fishing and trade and business. The Orma people, who are nomadic pastoralists, migrated to the area around the year 2000 because of population pressures in their initial areas of Tana-River (Garsen and Injara) and in search of pasture and water for their livestock. At the time of entry into the area, Ormas had large herds of cattle, but they have lost a number of them over time, mainly due to invasion by wild animals and drought. The Ormas have continuously lived in the area ever since. They live off the river-line where there is pasture. However, they have to access the river to water their livestock and this is a source of conflict between them and the farming community.

Household Membership

Most of the households in the project area have between six (6) and 10 members, representing 54 per cent. About a third, 34 per cent, of the households in the study had less than five (5) members. In an area where over 76 per cent of the residents are in poverty, such big household sizes makes poverty situation even chronic as the dependency ratio remains high.

Socio-Cultural Characteristics

- **Religious Profile**

The Upper Pokomo people are mainly Muslim, and have been so since the first half of the 20th century. The Lower Pokomos, who live along the lower part of the Tana River, were receptive to the teachings of the Christian missionaries who arrived in the area in the late 1870s, and, by 1914, were almost exclusively Christian. The Joshua Project site states that their primary religion is Christianity with 90 per cent, (Evangelical: 44 per cent), but they must have taken into account only lower Pokomo. Ethnologies also indicates that the group is mainly Muslim (Spear 1978).

The Orma are almost all Muslim and have been so for three or four generations. They are devoted in their faith, observing all the rites and religious festivals of Islam. The original religion of the Orma included belief in a creator God associated with the sky. They recognized the existence of many spirits and associated them with various locations in nature such as mountain tops, trees, groves, rivers and wells. These beliefs have now apparently been combined with their Islamic beliefs.

The Giriamas just like all Mijikenda people worship a Supreme Being and creator god known as Mulungu. Mulungu is believed to the God above all the gods and cannot be seen. He is worshiped through mediators who ask favors for Giriama people. Mulungu punishes and blesses according the deed of an individual (Spear 1978).

Apart from Mulungu, the Giriamas traditionalists also believe in ancestral deity worship. Their famous deity is called the Koma. They used to offer sacrifice at the Koma, nearly on weekly basis. Sacrifices included alcohol (the traditional Mnazi) which is palm wine. Giriama people believe that the Koma were actually the representatives of the living dead, they would therefore name the Komas with names of all the elders that have gone before them. The Koma was a curved piece of wood, and the eldest of them that have already gone before them was represented with a bigger piece of wood called the Kigango. When trouble befalls a family, they would sometime go to offer sacrifice by the Koma side, sometimes porridge and blood would be used. The Giriama people however are now largely migrating from these believes and majorly have

become Christians, with some few becoming muslims. There are a few however that still practices the tradition religion. They also believed in witchcraft (Morton 1972).

- **Cultural Practices**

In the Project area, among the Orma community, children are charged with household chores like cooking, fetching water, and grazing, as elders go out grazing. As such, the children fail to attend school and this negatively affects their social-economic well-being. The communities in the project area, the Giriama and the Orma live in separate settlements, though they get along well as they trade amongst themselves. The Orma have borrowed some eating patterns from Giriama. A few Orma people grow crops. However, there has been no reported case of inter-marriage between the two communities to date.

In the project area, the communities have simple houses constructed of locally available materials- mainly mud-walled, mix of grass thatch and iron sheets, post-erected walls and earth floors. The settlements are in small clustered pattern which are located along existing road networks. Each settlement comprises seven (7) to ten (10) homes or families. The communities have settled mainly on the edges of the ranch. The staff houses are brick-walled and roofed with iron-sheets. The houses are built next to each other and centrally located on the Galana side of the ranch.

Economic Characteristics

In the project area, majority (96 per cent) of the residents are subsistence farmers. Their farming activities are crop farming and livestock herding. Four (4) percent of the residents are tour guides, a situation expected to change once the project is initiated. The farming sector, being the prevalent activity among most residents in the area, requires much intervention by the government and other development partners. Besides the intended activities that constitute the Model Farm, capacity-development for farmers in the area would help incorporate them in the project as out-growers. Deployment of agricultural extension officers to help equip farmers with necessary skills and availing relevant farm inputs to them would help up their production.

Some residents around Bombi and Chakama areas practice trade as they own shops whereas others are in *matatu* and motorbike transport services. This shows a potential for big business investments in the area with the proposed project in place. There is need to improve road networks and means of communication in the area so as to facilitate trade development in the area.

Income and Expenditure of the Residents

Twenty (20) per cent of the residents in the project area earn less than 5,000 Kenya Shillings, 10 per cent between 6,000 and 10,000 and another 10 per cent 11,000-15,000 shillings per month. The study further indicates that the main sources of income the communities in the project area are crop and animal farming, charcoal burning, tourism (carvings, Giriama dances), retail shops, *posho*-mill, beekeeping and transport businesses (*bodaboda*). The Giriama and Sanye communities are mainly crop farmers, though they also keep few cattle. The Orma community are mainly pastoralists and practice nomadism during stringent weather conditions. Currently the area lacks enough employment opportunities to cater for the communities around the area. The proposed project is anticipated to create jobs and help in improving food security in the area. Sufficient incomes will enable people afford basic necessities and also venture into investments.

3.5 Education Status

Education is an investment in human capital. Education is not only a welfare indicator, but also a key determinant of earnings and thus an important exit route to poverty. Human resources development has continued to be an area of major concern in the Coastal region. Literacy level within Kilifi County is relatively high, at 65 per cent. The study shows that 86% of the residents in the project area had completed primary education. This is largely because the communities in the area are closely-settled around Bombi and Chakama areas where there are primary schools.

The long distances to secondary schools in the project area makes many children miss post-primary education and consequently lack the necessarily skills for employment. The Model Farm is planned to set up boarding primary and secondary schools to address this scenario. Permanent bridges will be put up to facilitate crossing of school children to either side of the river all through the school days.

3.6 Health Status

Medical Services

The communities in the area are experiencing health problems as they have to travel long distances to access health services. There are only two health centers in the area. The PCEA sponsored dispensary at Bombi center that offers first aid services only. There is also the ADC sponsored dispensary located in Galana ranch that serves residents from within and outside the ranch. To provide improved and specialized medical services, the proposed Model Farm is planned to set up a modern health facility with modern equipment and specialized medical staff. Ambulances which can pick clients from enterprises in case of emergency will be provided.

Public Health

The main source of water for domestic use in the area is the Athi/Galana River. The waters of this river are highly polluted with heavy metals and other particles from industrial and agricultural activities upstream which are may be harmful to human health when used directly from the river. Most (90%) of the households interviewed indicated that they source water for drinking and other household chores from the river with only 24% treating the water by use of water treatment chemicals. Others filter, decant and boil the water for drinking or take the water directly from the river.

Most households within the area do not have latrines hence they dispose off their wastes into the bushes or the river. This remains a big health hazard to the community. To improve public health status within the project area, awareness campaigns will be conducted amongst the residents.

Disease Prevalence

Water borne diseases such as malaria, diarrhea and typhoid are common in the project area. Other diseases prevalent in the area include HIV/AIDs, chest ailments (mostly pneumonia), tuberculosis, brucellosis and ringworms.

Injuries as a result of wildlife attacks are also on the rise. Animals which are most dangerous to human include snakes, hippopotamus and crocodile.

3.7 Land tenure/ownership

In Kilifi County, landlessness is a challenge to some households. It is estimated that 11.3 per cent of the households in the county are landless according to the data available in the lands office. Many of these people are squatters on private land.

According to this study, land ownership remains a big problem in the project area. The proposed Model Farm is located within Galana-Kulalu Ranches which are on Government (GOK) land which has been leased by NIB from ADC. As per this study, 60 per cent of the residents in the project area own some acreage of land. Only 14 per cent of the residents in the area own allotment letters and none of the residents possess a title deed. The area is sparsely populated with few inhabitants who have settled in a nucleated manner. The Giriama and Watha communities are scattered in small groups as per their family relations and settled along the river. The Orma are also in small groupings though off the riverine. Majority (67%) of the households within these areas reported to have lived in their farms for over 12 years. Average land holding capacity per household within the area ranges between one (1) and three (3) acres.

Therefore, dynamics of land ownership and utilization are major considerations for the succeeding activities relating to the proposed project.

3.8 Agricultural activities

Livestock herding is the main activity in the project area. Beef cattle and goats are the main animals reared in the area. The area is exclusively arid with climatic conditions that favor Boran animals suitable for meat production. The place has also plenty of fodder for livestock. The Ranch currently has 6,000 herds of cattle and 2,000 goats/sheep. However, the ranch is facing the challenge of tsetse fly infestation. In times of drought, pasture dries up and water is a problem as the reservoirs dries up and water levels in the river runs low. The pastoralists also lack technical support from the government which would help improve their production. Animal rearing is concentrated away from the boundary of Tsavo National Park to minimize on livestock-wildlife conflicts. ADC rears livestock for meat and also for breeding. The ADC manager reported that the ranch had up to 30,000 herds of cattle when the farm was owned by a white settler. There was also crop farming practiced within the ADC farm initially but was

abandoned as the crops were often destroyed by livestock and wild animals. The ADC has also employed 190 workers, all of whom together with their families live in the ranch and depend on ADC.

The Giriama and Warsanya communities living next to the ranch are mainly crop farmers growing cereals- maize, beans, greengrams, peas, pumpkins, fruits and vegetable. The farmers practice small-scale basin irrigation using Athi water. They also keep few cattle, chicken and practice a few of them have adopted bee-keeping. The Orma community are mainly pastoralists and practice nomadism during stringent weather conditions. During the study it was noted that tobacco could also grow in the area because some farmers were growing it in their farms.

3.9 Availability & Accessibility of Physical Infrastructure

The state of physical infrastructure plays a major role in the attraction of investments which are in turn vital for employment creation.

Transportation Network

The Project area can be accessed through Voi or via Malindi. The road connecting the site from either Voi or Malindi is only gravelled and becomes impassable during rainy season. The drift linking the site to other areas is only passing. The main modes of access to the project area are broad and air. The level of road standards requires the use of four-wheel drive vehicles. The access roads in the Project area are generally graded and the running surfaces are in fairly good condition. Moreover, more grading works are on-going in the project area and more access roads being put up. Motorbikes have also been embraced as modes of transport in the area and are widely being used of late. According to the study, locals travelling far distances to Malindi and other towns take long to travel as the available buses plying Bombi-Malindi route make few trips in a week.

The connection between Kulalu and Galana is through a concrete raft across the river but this is only possible during the dry spell. During rains the river swells rapidly and the raft is submerged. This leaves the locals to devise own methods of crossing the river such as using electric cables. The available modes of crossing the river in the river are inadequate unreliable. Planning of the

proposed Model Farm project must provide for construction of a number of permanent bridges at strategic points along Sabaki River. This would ease movement of people and especially school children across the river.

ICT Infrastructure

Access to information is a big challenge for residents in the project area. Modes of accessing information such as newspapers, internet and television are hardly available. There are two mobile phone network providers in the project area (Safaricom and Airtel). However, the networks in the area are poor. As per the study, majority, 87 per cent, of residents in the area own cell phones. There were a number of challenges identified in using alternative sources of information. These included high prices, inadequate sources of energy, poor communication networks for available providers, failure of radio waves and financial challenges.

Health and Education Infrastructure

More than half (55%) of households are more than ten (10) kilometers away from hospitals with in-patient facilities. While a little over a quarter are within a kilometer away from such a facility, about three quarter are still within about four kilometers or farther from higher level medical infrastructure and care. Also, one in every four household has no information about their access to hospitals with in-patient facilities Figure 3-1 shows a summary of the physical access to selected social infrastructure.

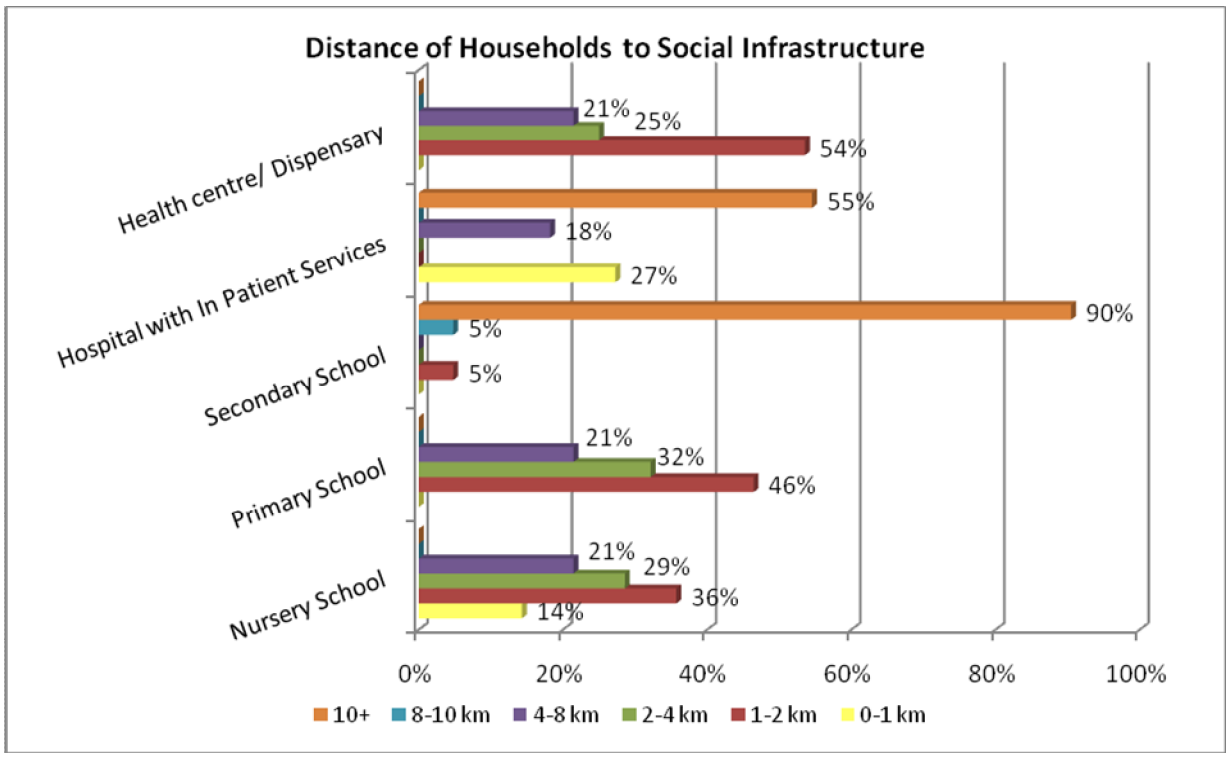


Figure 3-1: Access to Social Infrastructure

Water and Sanitation

Almost 90% of all households source their domestic water requirements from rivers or streams whereas the rest use rain water. The average household travel a kilometer or less to get water from these rivers and streams (*Figure 3-2*).

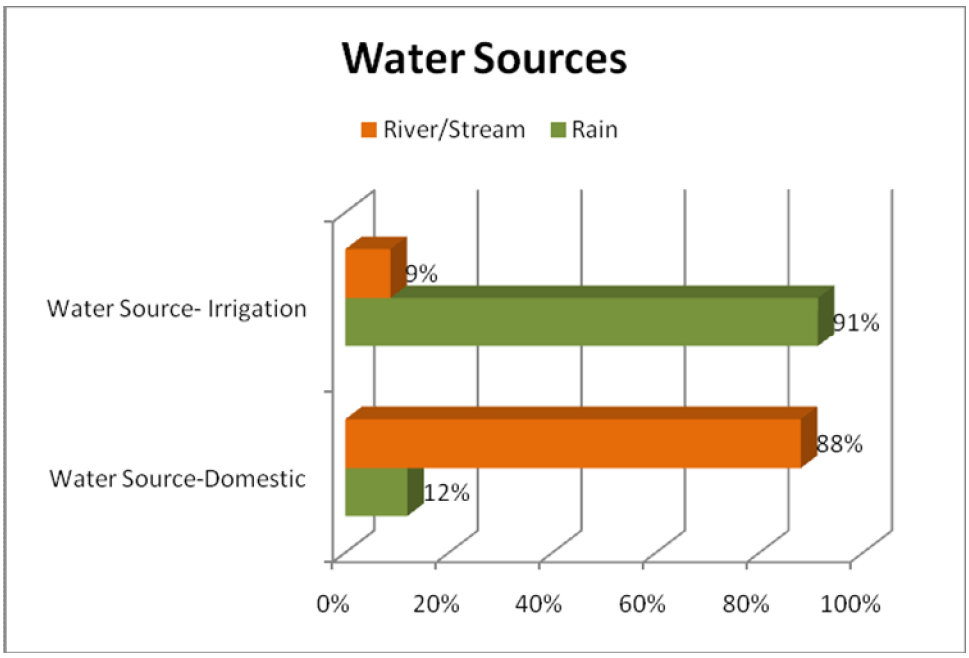


Figure 3-2: Water Sources

Rain water and rivers and streams are also the main sources of water for crops and livestock. As with water for domestic use, nine out of every ten households use the rivers and streams as sources of water for crops. Households have to travel about 0.7 kilometers to get water for their crops.

Water and Sewerage Network

There is no water and sewerage networks within the project area. Water pipes will be key trunk infrastructures in order to deliver the required amounts for irrigation and are therefore designed within the Model Farm.

Solid and Liquid Waste Management

Burying, burning, composting and community garbage collection are the main methods of solid waste disposal in the area. Still, two (2) in every five (5) households burn their solid waste while one in every five either bury or burn (*Figure 3-3*).

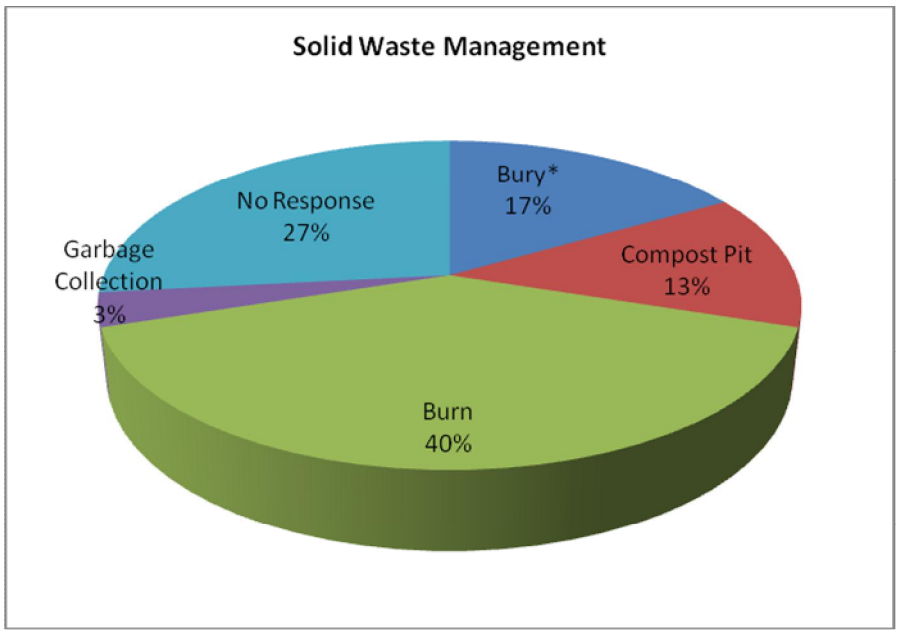


Figure 3-3: Solid Waste Management

However, in this case, it is possible that the community interprets solid waste in the context of human fecal matter. In this case, all households use the burying method.

Housing Characteristics

The nature of housing and the materials used for them are proxy indicators of affluence and living condition. In the project area, almost all of dwellings (96%) of houses have mud walls and 4% are brick walls. Meanwhile, more than three quarters of houses have grass roofs and a quarter (23%) are roofed with corrugated iron sheets (see *Figure* 3-4 and *Figure* 3-5).

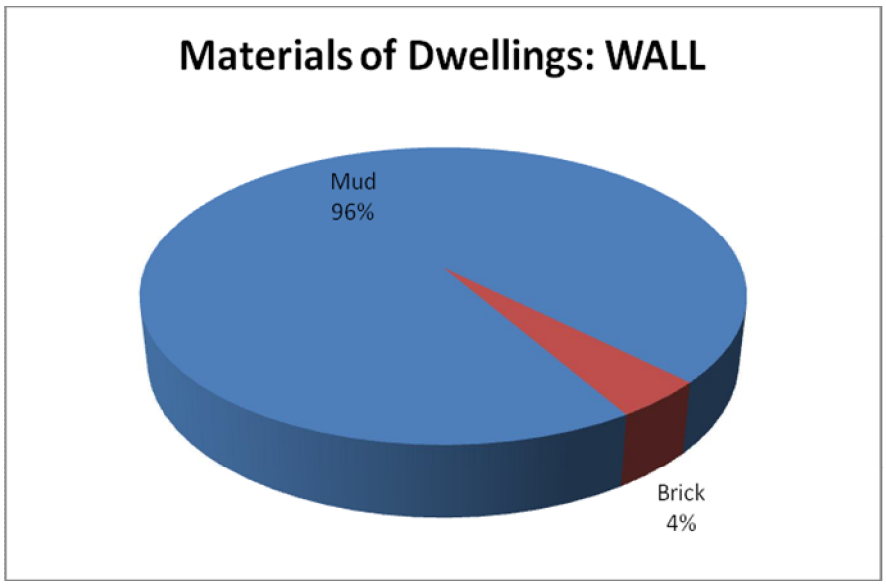


Figure 3-4: Building Material Walls

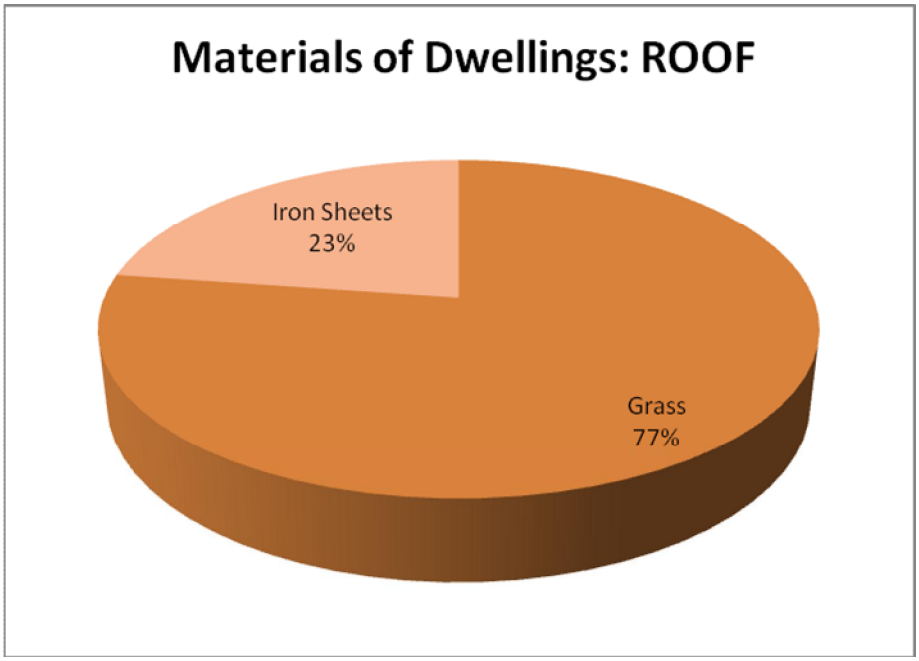


Figure 3-5: Building Material Roof

3.10 Economic Analysis

Subsistence farming, which is characteristic of the surrounding areas, is the prevalent mode of economic activity in the area. Currently, 96% of residents are farmers with main activities being pastoralism and peasant agriculture. Four percent (4%) of residents are tour guides, a situation

expected to be changed once the project is initiated. *Figure 3-6* shows that only 30 of the respondents live within the ranch.

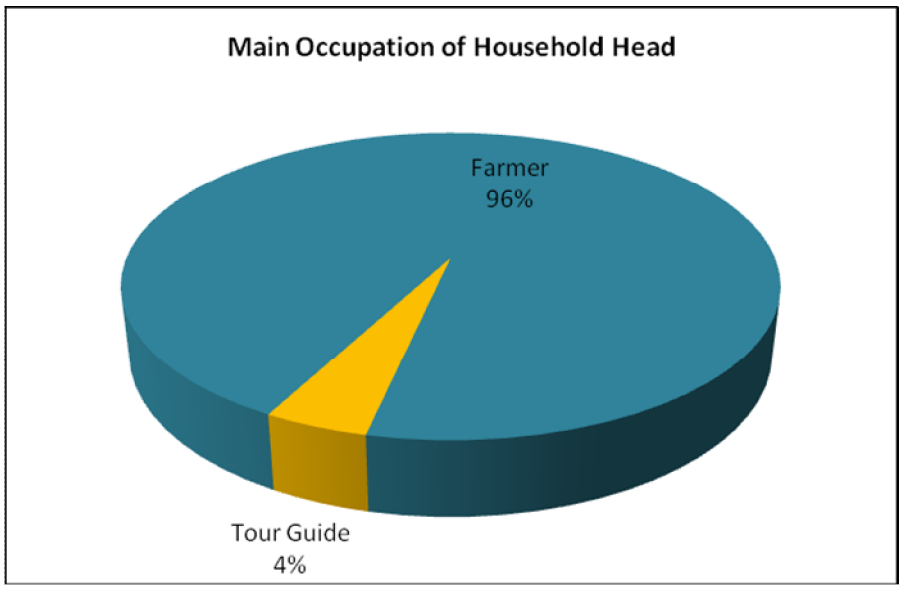


Figure 3-6: Occupation

3.11 Neighbouring settlement activities

The settlements inside and neighbouring the project area is predominantly rural partly nucleated with up to ten households. The communities living around express a dichotomy of livelihood strategies along agrarian and pastoralist practices. For the Giriama and Watha indigenous peoples, they are hunters and gatherers who are slowly settling down to carry out minimum agriculture. The political class has demanded an out-grower arrangement with the project so that they can access enterprises within the project area for value addition.

The pastoralist Orma community have been grazing within the ranch against the policy of the ADC. Individuals own up to 3,000 heads of cattle. This has brought about a hostile relationship between the community and the ADC. They argue that whenever they are caught grazing within the farm they are fined and in the process their fattest and most pricey animals have to be forfeited. They claim indigenous and use rights which they say will be further alienated if the ranch is developed into a large scale irrigation project. Besides their conflicts with the ADC over grazing rights and penalties, they argue that they main need is to access the river and they have used the ranch as the only corridor. Use of other routes brings them into conflict with the

communities who practice agriculture o the riverine over livestock destruction of crops. They argue that with alienation of the ranch, and its potential in accessibility they will be deprived of the only avenue to avoid conflicts with the agrarian communities as they seek access to Galana River for watering their livestock. The political class claims that a 2.5 mile (5km) buffer zone between the Tsavo National Park and the ranches was designated or them as a corridor to access the river and must be maintained.

In general, as a condition for acceptance of the project, adjacent communities have demanded mitigation measures to disruption of their livelihoods and a reservation of 70% of jobs generated within the project area.

3.12 Existing Environmental Conditions

3.12.1 Habitats and Species Diversity

Model Farm

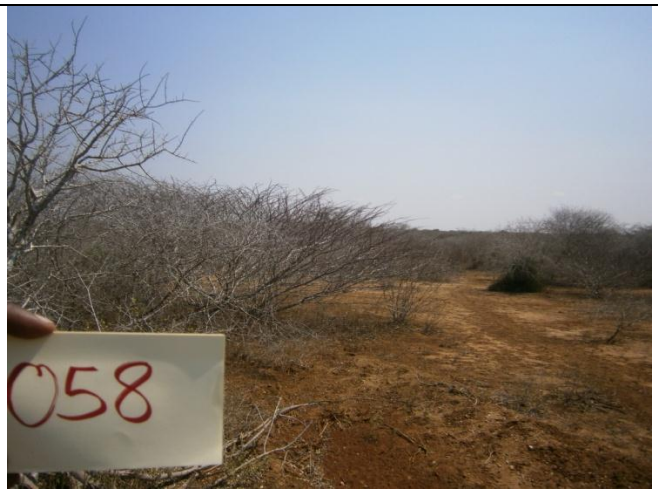
The Model Farm lies at a distance of about 3km from the Galana River. This zone is referred to as a *riparian buffer zone* and acts as an interface between a flowing body of water and irrigated land with aim of filtering pollutants. When irrigated farms are located very close to rivers, there is runoff of fertilizers and other agricultural to the river leading to rapid eutrophication.

The key vegetation types within the proposed Model Farmôs area are riverine woodlands, bushland, shrubland and bush grassland. The vegetation in the Model Farm consists largely of dense bushland that gradually transitions to woodland moving south-east towards Bombi. Clearing of bush using heavy machinery had already commenced therefore proposed farm now consists of cleared and un-cleared sections.

The dense bushland is dominated *Acacia horrida, Acacia reficens, Boscia coriacea* and *Grewia tenax.* The vegetation was sampled using 5m x 20m belt transects. *Acacia* species (*A. horrida* and *A. reficens)* accounted for highest density with an absolute density and relative density of 900 individuals/ha and 69% respectively. The woodland has higher stature trees dominated largely by Acacia *tortilis, Commiphora Africana,* and *Dobera glabra* with *Axcacia xanthophloea* adjacent to *laggas.*

Composition and structure of the vegetation types and habitats identified at various study sites in the Model Farm are;

Table 3-1: Habitants and Species Diversity Description of the Model Farm Site

Plate No.	**Description: Model Farm**	**Photo**
6.5j	Sections of the Model Farm that has been cleared and debris piled in heaps	
6.5 k	Bushland in the Model Farm	

6.5 l	ADC Galana ranch goats grazing in the cleared sections	

The cleared sections of the Model Farm are utilized extensively for grazing by ADC Galana livestock and to some extent illegally by livestock from the adjacent communities. Herbaceous cover is low and dominated by the grass *Aristida kiensis* and some herbs such as *Commelina benghlensis*. It was also noted that woody species such as those of *Commiphora* have started to re-sprout while others such as *Boscia* are re-establishing vigorously. This has cost implications if another phase of clearing has to be done.

Model Farm Intakes

The proposed Model Farmôs intake site is at Owayo downstream of Shoroa Camp. The river is very wide at this point while the riverine vegetation belt is very narrow. Livestock from neighboring villages are brought for watering here. ADC livestock do not water here frequently due to the development of 19 inland water pans within the ranch in 2013. Vegetation of the riverine belt is dominated by *Acacia tortilis.* However, there is large population non-local species brought by water transport. The high population of non-local species is attributed to the fact the river here wide, slower with wide zone sand bank. Upland weeds are also common such as *Dutura stramonium* and *Caltropis procera* among others. Other species are *Solanum incanum, Rhus natalensis, Grewia tenax* among others.

Table 3-2: Habitants and Species Diversity Description of the Model Farm Intakes Site

Plate No.	**Description: Intake**	**Photo**
6.5.f	Proposed intake: Riverine vegetation, narrow belt, heavy grazing and trampling	
6.5.g	Proposed intake: Wide river bed, many non-local species brought by water transport.	
6.5 h	Proposed intake: A disused water pump house just outside the riverine zone	

3.12.2 Fauna

Fauna includes large and small mammals, birds, fish, invertebrates, insects and others. In this study, observations were on large mammals and birds which were reinforced with wildlife survey data, utilization and migration patterns from secondary sources. Through a simplified road count conducted in the Tsavo National Park, animals observed were elephants, grants gazelle, yellow baboon, zebras, reticulated giraffes and impalas. Within Galana-Kulalu Ranches reticulated giraffes, yellow baboons, elephants, impalas, gerenuks, zebras, grants, crocodiles, and guinea fowls were observed.

3.13 Tourism in the Project Area

The proposed Model Farm is located within Galana-Kulalu ranches which borders Tsavo National park and the Arabuko-Sokoke Forest Reserve. Therefore, the area has also a wide range of wild animals.

The area and the surrounding areas have huge tourism potential. Along the Galana River, on the Kulalu Ranch side, are a number of tented camps for tourists. The camps included the Kiboko Camp, Kulalu Camp, Kifichoni Camp, Msiba Village, Shoroa Camp, Swara Camp, Kudu Camp, Galana Crocodile Camp, Sala Inn, Tsavo Buffalo Camp, Tsavo River Hill Kenya, Tsavo East National Park and Kuwinda Camp. This is not exhaustive and there could be more camps.

Besides the resorts, there are small-scale eco-tourism activities taking place in the surrounding areas. The local communities sell carvings and also perform traditional dances to tourists who visit the resorts. The existence of these tourism infrastructures is a clear indication that with further development, tourism can become a vibrant activity in the area.

The riverine ecosystems that exist along the rivers also offer a unique attraction for tourists for instance crocodile watching. In fact all the touristsô resorts are located next to the river.

The Model Farm is expected to incorporate eco-tourism as enterprise. This is expected to promote and improve tourism in the area.

3.14 Conflicts

There already exists a conflict between pastoralists (Orma) and the management of Galana-Kulalu ADC ranches over grazing land. The pastoralists are barred from grazing in the ADC farms whereas they feel it is their right to access pasture in the ranch. Most times when they get their animals to graze in the ADC farms, the animals are often confiscated by management of ADC. The culprits are fined and when they fail to raise the fines the livestock is kept by the ADC until they redeem them.

The Orma community in the area keeps large herds of cattle. Some are reported to own over 1000 herds of cattle. At times, there are conflicts between these herders and the farmers in the area as the livestock invades farms and graze on the crops.

There exist human- wildlife conflicts amongst communities living in the area as people drive their livestock into wildlife territories in search of pasture and water together with the migrating pastoralists. The area community also illegally hunts wild animals for meat. About 15 cases of illegal hunting were recorded on a monthly basis. The wild animals also attack people especially during dry spells and destroy crops. Some of the wild animals notorious of destroying crops are baboons, hippopotamus, warthogs, elephants and buffaloes. Galana River is infested with crocodiles and hippos. There are cases reported on an annual basis of people attacked either when crossing the river or as they fetch water. Snake bites are also common in the area. A report from ADC Danisa Dispensary indicated an average of seven (7) cases of poisonous snake bites reported to the center in a year, seven (7) and one (1) cases of crocodile and hippopotamus attacks respectively for the last three (3) years.

3.15 Challenges of Service Delivery

With the majority of residents practising peasant farming and pastoralism, it is also done with minimum intervention from sector institutions. For instance *Figure 3-7* shows only 17% of residents receive credit facilities. This is in line with the tenure system where majority have no documentation that proves land ownership which could be used as collateral as in the practice elsewhere in Kenya.

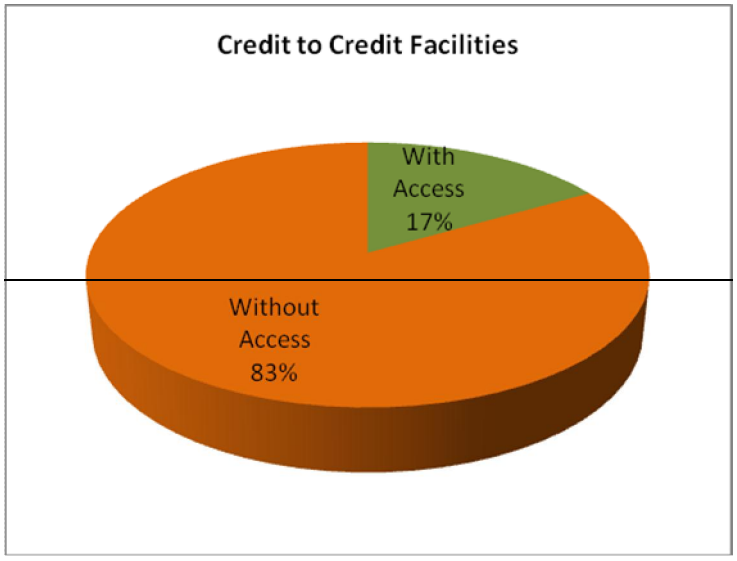


Figure 3-7: Access to Credit Facilities

Further, the farming practiced is still rudimentary without any training or reception of advice from extension farmers of livestock officers. According to *Figure 3-8*, only 30 percent of respondents receive farm training.

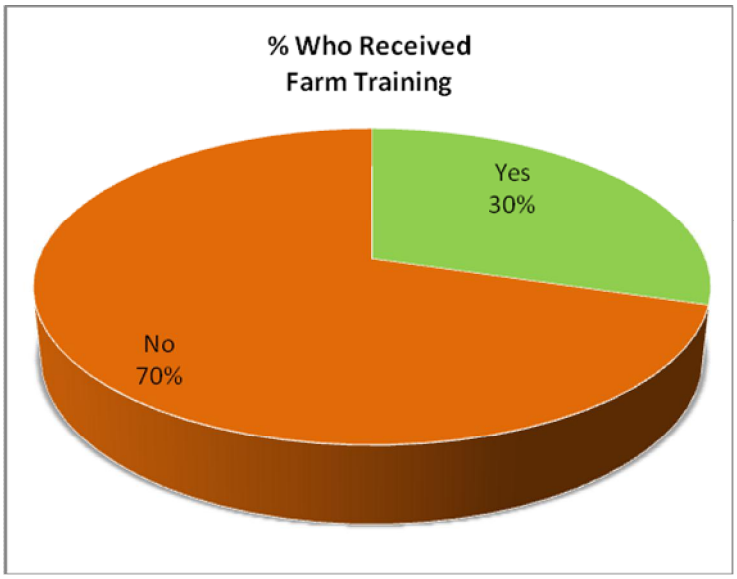


Figure 3-8: Farm Training

4. Model Farm Project Description

4.1 Introduction

The Model Farm is the first phase of the Galana-Kulalu Food Security Project which covers 10,000 acres of land. It is expected to;

- Mirror the concepts, technologies and practices and exhibit the image of the overall Galana Kulalu Food Security Project.
- Test in small scale under the actual conditions of the Galana and Kulalu ranches the suitability of variety of crops (such as maize, sugarcane) proposed for the larger Galana-Kulalu Food Security Project.
- To implement all the elements required for agriculture development: design, soil preparation, growing, harvesting and processing.
- Serve as the introduction to the following development stages. Extension to 40,000 ha (100,000 acre) Pilot Farm will follow the successful implementation of the Model Farm.

Location

The Model Farm is located in Kilifi County (see *Figure 4-1*) within the land delineated as the Pilot Farm in the larger proposed Galana-Kulalu Food Security Project which is located in the existing Galana-Kulalu Ranches. The Model Farmôs coordinates are 3^0 01ô30.51ò S and $39^0$27ô16.56òE. Currently the Galana Ranch in which the Model Farm is located is used for ranching purposes of a variety of livestock including cattle, sheep and goats. The main source of water for the existing uses in the ranches is the Galana River which is at the south of the Model Farm and separates Galana Ranch from Kulalu Ranch.

There will be two intakes on the Galana River to supply water to the Model Farm through an elaborate pipe system. The coordinates for the water intakes are:

Intake A - 3° 4'8.54"S, 39°19'51.38"E

Intake B - 3° 4'12.23"S, 39°21'9.66"E

The same river provides water to the neighbouring communities. Sedentary farmers have settled along this river where they practice small scale rain fed farming. The pastoralists who move from North to South in search of water and pasture also use the river, where their livestock get water.

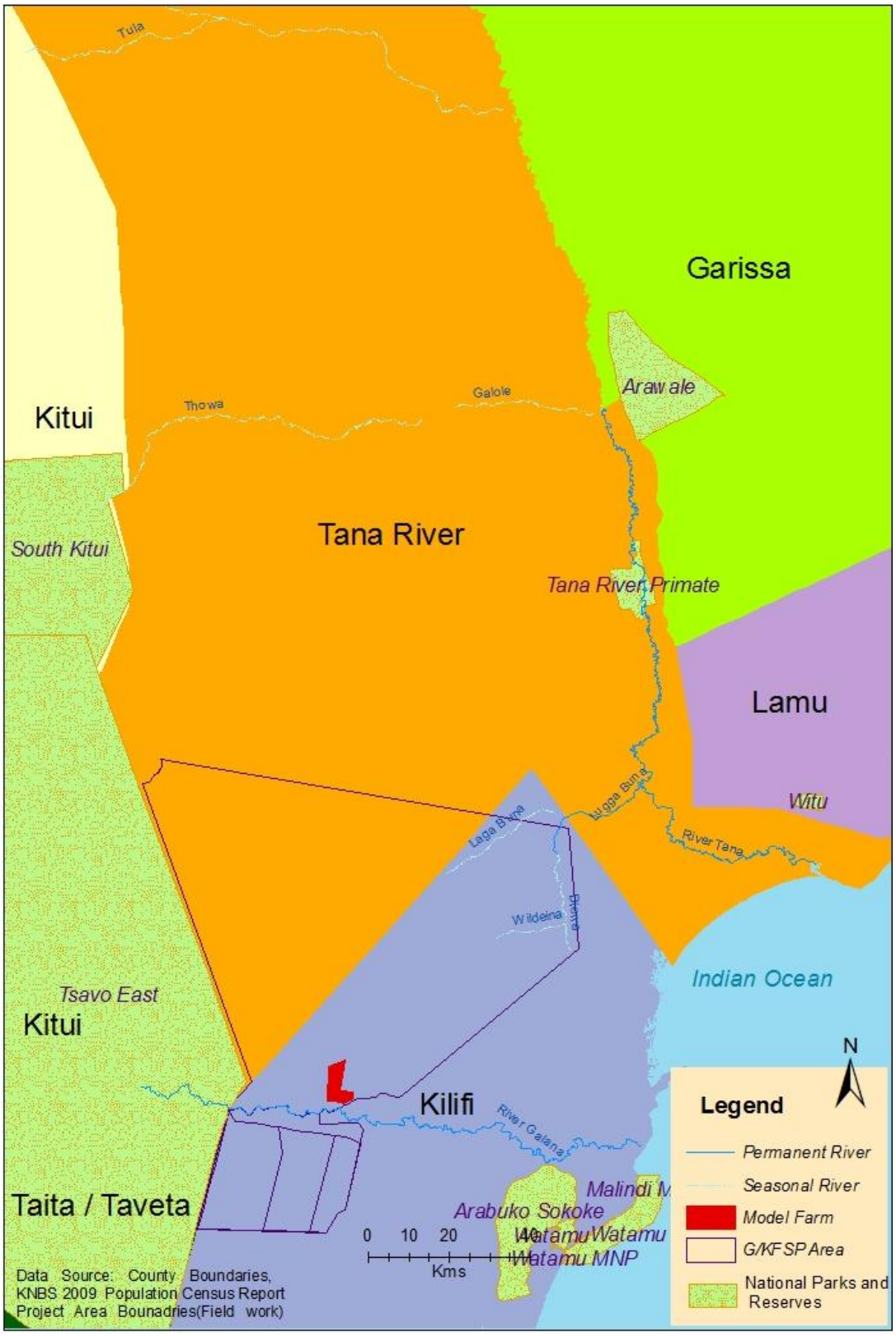


Figure 4-1: Location of the Model Farm

4.2 Proposed Model Farm's Enterprises

The proposed Model Farm is planned to have various enterprises including maize, horticultural and vegetables production, agro-processing, human settlement, social and physical infrastructure and on-farm water reservoir. *Table 4-1* shows a summary of the proposed enterprises;

Table 4-1: Summary of the proposed Model Farm enterprises

Model Farm Enterprise	Size of Land (acres)
1. Maize Production	8,583
2. Open field vegetables	942
3. Horticulture	65
4. Urban center	274
5. Agro-processing	88
6. On-farm water reservoir	30
7. Trunk infrastructure e.g. roads, water supply & sewerage networks	18
Total	**10,000**

4.2.1 Maize Production

Maize is the main staple food in Kenya with current production standing at 40 million bags against the national demand of 42 million bags. From this statistics it is clear that there is a deficit of two (2) million bags. Maize production in Kenya accounts for 60% of land under cultivation indicating how high it is demanded on the local market. The production is mainly under rain fed agriculture with crop failure due to low precipitation being recorded. High crop failures have been recorded in areas where Kenyans have planted maize in agro ecological zones classified as arid and semi arid areas (Office of the President 2011).

Maize Production Agro-Ecological Requirement

Natural maize is grown in temperate to Tropical climatic zones where annually average temperature is above 15 0^0. Under natural conditions where, maize will do better in areas with average rainfall of 600 to 1200mm, temperature 18 0^0 to 33 0^0 soil pH of 5.0-8.5. Where all these conditions are mate maturity period ranges from 80 to 140 depending on breed selection. Generally maize crop is sensitive to frost during seedling period. The crop will tolerate hot and dry atmospheric conditions provided that that sufficient water is supplied. Maize will survive in

most soils with exception of very clay and very sandy soils. The soils should be well aerated and well drained. It therefore evident that the project implementation agencies for the model farm will have to use farming techniques which will improve the drainage as the area is imperfectly drained. A detail soil study prior to implementation will give a clear indication on fertilizer or manure requirement. Generally FAO estimates of fertilizer requirement of maize stands at 200kg/Ha of N, 50 to 80 Kg/Ha of P, and 60 to 100kg/Ha of K. Furthermore maize can be grown continuously as long as the fertility of the soil is maintained.

Galana-Kulalu Model Farm receives an annual rainfall which is below the minimal conditions required to sustain maize production. In order to boast production the project will practice irrigated farming. Proper soil management and irrigation patterns will be adopted in all phases of plant growth in order to maximize production.

Proposed Acreage for Maize Production

Maize production is therefore the major land use within the Model Farm. It is proposed to take over 80% (8,613 acres) of the Model Farmôs land. Under proper management it is estimated that the production of maize is six (6) ï nine (9) tonnes per Ha. This translates into 27 ï 40.5 bags of 90kg each per acre under one harvest. Therefore approximately 463,000ï 695,000 to bags can be added to the market if two seasons of planting are practiced. The actual production per acre will depend on farming technology and seed choice.

Proposed Maize Production Technologies

Maize production within the Model Farm is proposed to be carried out using two irrigation technologies; 3,855 acres using center pivot (24 center pivot machines) irrigation technology and 4,314 acres under drip irrigation technology.

4.2.2 Horticulture

Fruits in Kenya are produced in the semi arid areas. The country produces different fruits in different seasons. Mangoes, oranges, avocadoes, watermelons and passion fruits are the most common. Fruits are sweetest when grown with controlled water. Mangoes, oranges and water melons do best in the West Pokot, Kitui/Makueni and the Coast Region. Sometimes however, the

country imports fruits from Tanzania, Israel and South Africa. Avocadoes are a special export fruit especially to Europe. The project area neighbours a zone which is currently under the production of various fruits. Currently local farmers produce mangoes and pineapples at GIS station and areas like Ramada and Jilore. The Model Farm is located in a very strategic area where some of the products can be sold into the lucrative hotel industry within the region. With the introduction of value addition plants within the Model Farm, some products can be processed, branded, preserved and sold when production from farms is low. The Project will boost the production level as the targeted fruits would be of high quality.

The Model Farmôs soils and climate are favourable for various horticultural crops including tomatoes, eggplant, cucumbers, lettuce and pepper among others. A 65 acres land is delineated for horticultural crops production within the Model Farm. All this land will be developed under greenhouses (20 greenhouses) and drip irrigation technology will be used.

4.2.3 Open Field Vegetables

Kenyans are not known for rich diet diversity despite the country being a melting pot of cultures. In the rural areas vegetables derived from the kitchen garden form a significant portion of the diet. The main leafy greens on Kenyan tables are cabbage and kales (*sukuma wiki*). A dozen others such as carrots and tomatoes are interchanged to form a very modest mix. Most vegetables in the market are grown by small scale farmers through irrigation mainly on the riverines. However, vegetables are one of the premier export products from Kenya. Large and medium scale farmers grow vegetables almost exclusively for export market among these are baby corn, okra, snow peas, French beans, cauliflower, lettuce, broccoli among others; vegetables which are rarely on the Kenyan menu but which Kenya is a major exporter.

Consumption of these exotic vegetables as well as infiltration of traditional vegetables would require a paradigm shift and robust marketing in order to ensure the society derives the myriad nutritional advantages present in them. However, the tourism sector also forms a significant market for them since the visitors recognise them as they consume them at home. The neighbourhood of the project area has a high potential for tourism activities. Vegetable

production is meant to provide food products to this rich market although the surplus will be packed for export market.

Open field vegetables are part of the proposed enterprises within the Model Farm and will take up to 942 acres of land. Drip irrigation technology is proposed for these open fields. It is expected that the horticulture sector will improve food security especially in delivery of nutritional balance and also improve balance of trade once the surplus is exported.

4.2.4 Urban Settlement

One urban settlement is proposed within the Model Farm. The settlement will act as a service center and accommodate workers who will be employed in the Farm. Education and health facilities will be built within the settlement to serve the workers and their families. The urban center is delineated to cover a total of 274 acres within the Model Farm.

i. Health

There exists one dispensary within the Galana Ranch which was established by ADC. The dispensary serves the ADC personnel who work in Galana ranch and the neighbouring community. To provide improved and specialized medical services, there is a need to establish a modern health facility with modern equipment and specialized medical staff. The facility will be constructed in zone marked 4_2 in the urban center land use plan (see *Figure 4-2*). The health facility should also be equipped with modern equipments and ambulances which can pick clients from enterprises in case of emergency.

ii. Education

There is only one existing primary school serving the Galana ï Kulalu Ranch residents. Within the proposed urban settlement three learning institutions are proposed. To cater for primary school going age one facility is proposed. To improve the transition from primary to secondary level one facility is also proposed. The middle level education institution will provide technical education to the project area residents and the catchment will extend to other parts of the country. Areas zoned for education infrastructure are 2_1, 2_2, 2_3, and 2_4 (see *Figure 4-2*).

iii. Recreation facilities

Recreation facilities were provided for in order to provide the youth and other residentsô opportunities to exercise and carry out other health related activities. These facilities are Public Park and public play grounds. Areas delineated for recreational facilities are zoned as 3_1 and 3_2 of *Figure 4-2*.

iv. Security services

The state of security determines how safe a place is. Safer places attract more investors and everybody will like to settle in a place where security is guaranteed. Workers within the project site will want to be assured of security for their personal property and families. In order to improve security in the project area a police station is proposed. The station will provide services. Security however is a substantive component of the Model Farmôs terms of reference.

v. Worship places

Majority of the population within the project area are muslims with few christians. Therefore, the proposed land use plan for the urban center has delineated some areas as worship places including churches and mosques. Churches are in areas zoned as 4_4 and mosques in areas zoned 4_5 in *Figure 4-2*.

vi. Financial services and Banking

All business enterprises within the project area will require banking services. Currently the nearest banking services can be found in Malindi or Voi which are more than 90 kilometres away. To ensure that business community withdraw and deposit money securely banks will be established within the proposed urban settlement. The space planned for banking sector will be within the urban area zone 5_2 in *Figure 4-2*.

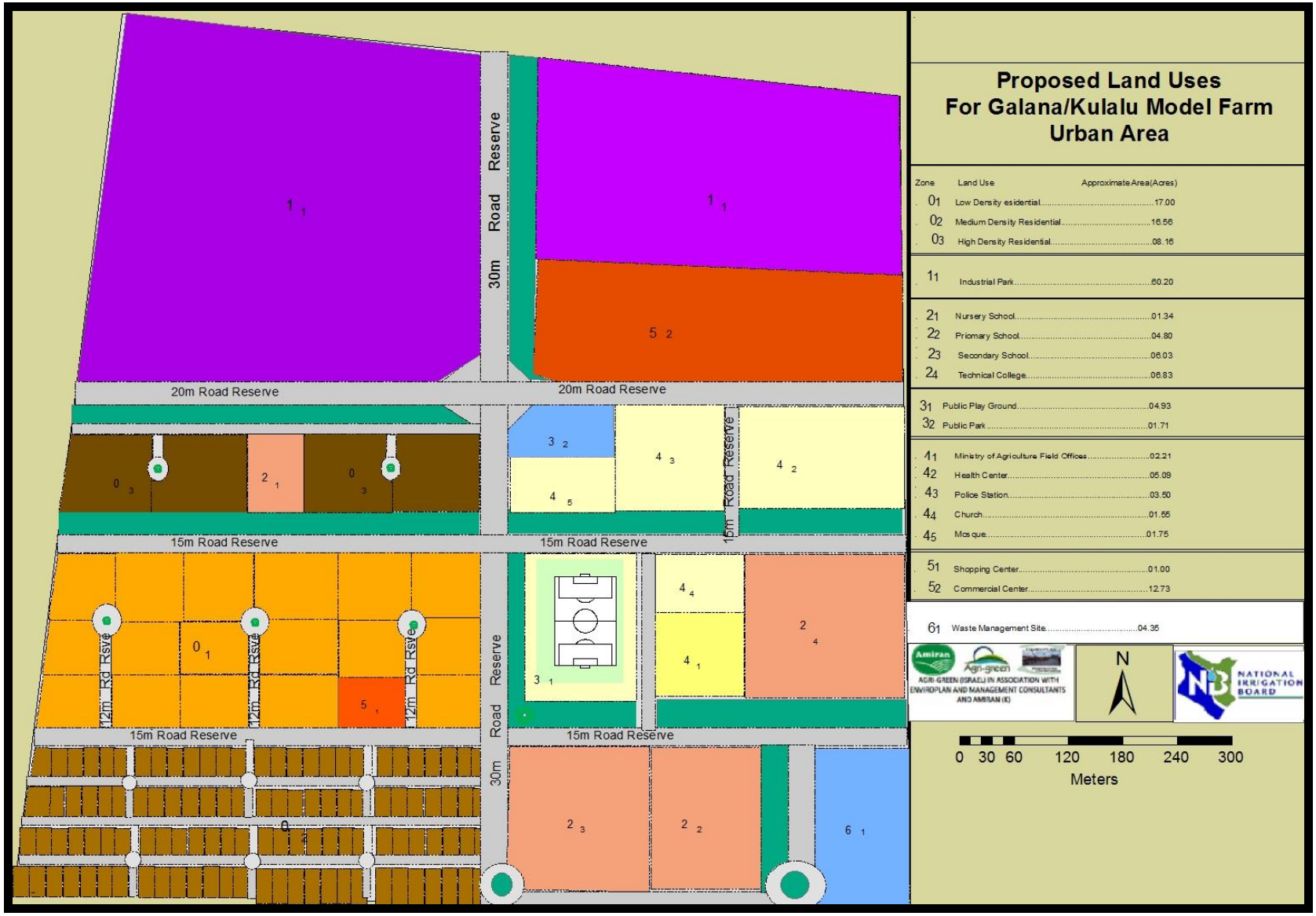


Figure 4-2: Urban land Use and Development Plan

4.2.5 Agro-Processing Enterprises

In the Model Farm plan, a zone for processing is proposed and will cover around 88 acres of land. Most post harvest activities including maize drying and milling, vegetables and horticultural drying, extraction and refrigeration will be carried out in the proposed agro-processing zone. The zone is proposed to the proximity of the production area due to the bulkiness of the product.

4.2.6 Infrastructure

About 18 acres of the Model Farm are reserved for trunk infrastructure. These comprise of massive and trunk structures that facilitate delivery of services from one end to the other. These include the following components:

- Roads
- Water supply and sewerage
- Energy infrastructure
- Telecommunication

i. Road Network

The proposed project site can be accessed through Malindi or Via Voi Town. Both of the two access roads have to be upgraded in order to improve the accessibility. Nevertheless a new road is proposed which will link the project to the existing Mombasa ï Nairobi Highway at Macknon Road the existing Voi-Galana road should not be upgraded as the road passes through a conservation area (Tsavo National Parks) as it may lead to conflicts between wildlife and road users.

A bridge will be constructed along the existing drift on Galana River and ensure the site is accessed throughout the year. For internal connectivity several roads have been proposed as indicated in the land use plan.

ii. Water Supply and Sewerage

Water supply and waste water treatment are covered as a substantive component of the Model Farm terms of reference. The main target for water source is River Galana. A water intake will be constructed to supply water to the Farm by pumping.

iii. Energy

The project site is not connected to the national power grid. In this project, energy will be required to run heavy machines including water pumps, agro-processing and industrial machines. There is a high potential to tap both solar and wind energy. Alternatively the high voltage power line which connects Rabai and Lamu (Hindi) substation is only 20kms to the south of the project area. It is recommended that a substation to power farm machineries and other activities be constructed. Individual developers are highly encouraged to utilize the available options for green energy (Solar and Wind). The new station is proposed in order to reduce losses which could be recorded if power is transmitted from the existing station in Malindi.

iv. Telecommunications

The project site records a weak network of major service providers. To enhance the telecommunications network service providers can set up Base Transmission Stations (BTS) on the higher points within the project site. The more accurate sites will have to be established by telecommunication engineers. The neighbouring villages will also benefit from the good network connections once the BTS are constructed. Currently mobile phones are a major economy enabler in terms of message delivery and money transfer/mobile banking. It is therefore highly recommended that the mobile phone services be given a high priority.

4.2.7 Proposed Layout of the Model Farm

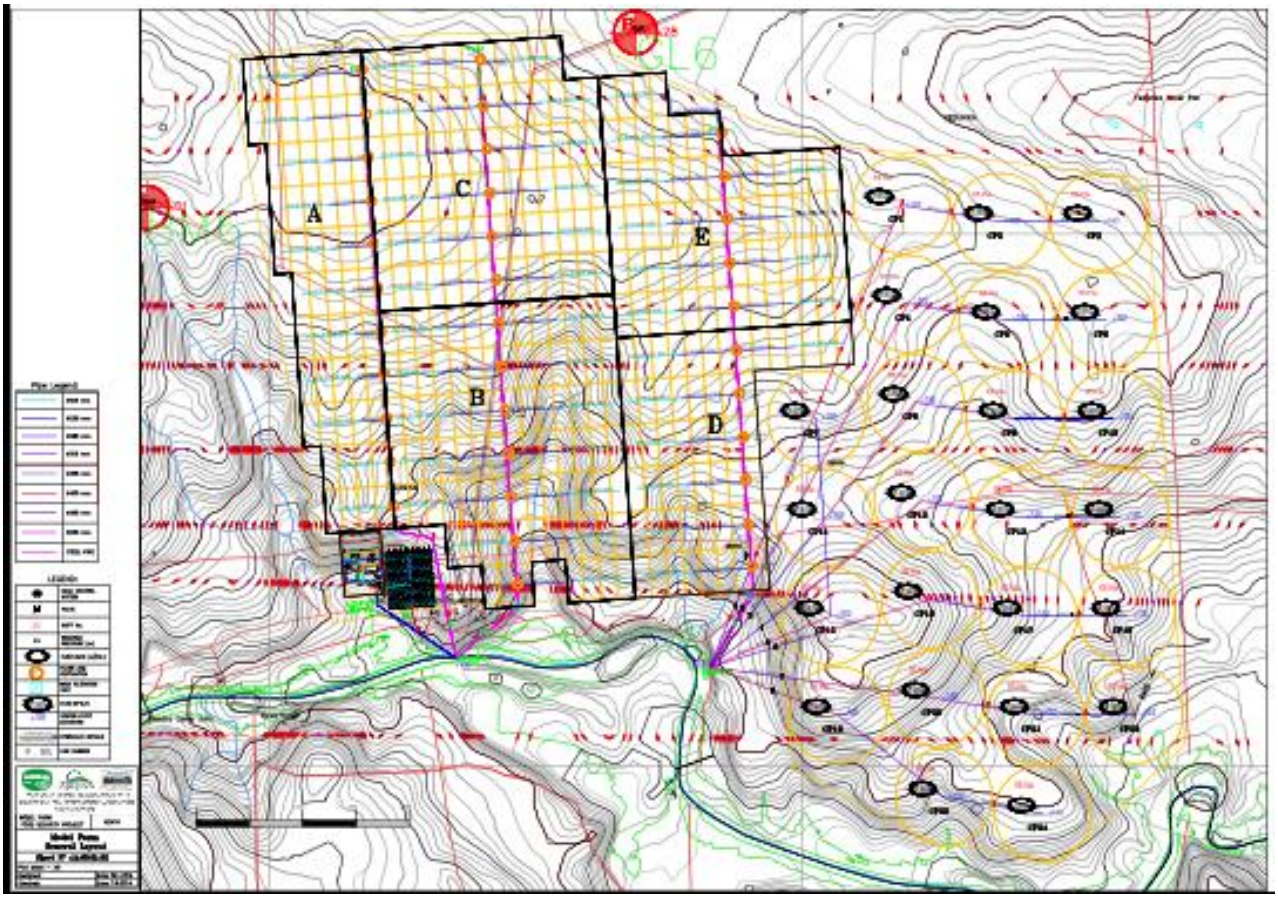


Figure 4-3: Proposed Layout of the Model Farm

NB: See Appendix 1 for a Layout with higher resolution

4.3 Model Farm Water Source

The main source of water for the Galana-Kulalu Food Security Projectôs Model Farm is the Galana River. Hydrological analysis of the river flow indicates an average monthly flow of 91.7m^3/s. After analysis (taking into account other existing projects, proposed/future projects and environmental flow), the annual available water quantity for the project is 2,105.3 million cubic metres indicating that the maximum potential area for irrigation by the Galana River water is 161,946 ha (2105.3 x 10^6/13,000) or 400,177 acres. The Model Farm is proposed to only cover 10,000 acres (with only 91% under irrigation) and therefore the available Galana River water is sufficient for the Model farmôs activities. Hence no water storage reservoir is required for the Model Farm.

The net irrigated cropping area for the Model Farm is as follows:

Table 4-2: Proposed land sizes (acres) for irrigated crops

Irrigation Enterprise	Net Irrigated Area (acres)
Maize under center pivot	3,855
Maize under drip irrigation	4,314
Vegetables under drip irrigation	890
Green houses with drip irrigation	50
Total irrigated area	9,109

Based on the proposed irrigation enterprises and their net water requirements, the design discharge for the Model Farm is 3.2m^3/s. Comparing the design discharge of 3.2m^3/s with the available water of 67.4m^3/s, the discharge is very small and can be abstracted without a reservoir throughout the year. The project can also be said to have minimal impacts on the Galana River flows.

4.4 Model Farm Water Abstraction Method

The Model Farm will be supplied water from two intakes on the Galana River. Intake A with a capacity of 4644 m^3/h and intake B with a capacity of 6880 m^3/h. The Farm is located on a fairly higher elevation as compared to the proposed suitable intakes site. Intake A is at 140m above sea level delivering water to the areas designed for drip irrigation with elevation ranging between 135m and 182m above sea level. Hence the head difference is between 5m to 42m excluding friction losses. Whereas intake B is at 130m above sea level delivering water the areas designed for center pivots which have elevations ranging between 124m and 167m above sea level. The head difference is between 6m and 37m excluding friction losses. To deliver water to the Model Farm countering these head differences, pumping water from both intakes to the Model Farm is required. A total of 22 electric water pumps will be used.

4.5 Irrigation Technologies and Systems

Water use efficiency is important in any irrigation project. The proposed Model Farm being in an ASAL area where water is a scarce resource, irrigation technologies with high irrigation efficiencies have been designed. These include drip irrigation (on open fields and greenhouses)

and centre pivot irrigation.

Centre Pivot Irrigation

The Model Farm is planned to have 1,560 hectares under centre pivot (CP) irrigation on maize only requiring 24 CP units. The centre pivot will be powered by electrical motors with fertilizers solution that will be injected into the irrigation water at the inlet. The design daily application depth is 6mm/day and the CP system is designed for application of 6 mm during 22 hours of one complete revolution. Hence, the CP unit operation includes one (1) revolution per day. Fertilizers will be injected into the water according to the fertilizers application program.

Drip Irrigation

Drip irrigation will be on maize, open field vegetables and greenhouses vegetables covering a total of 5,254 acres of land. A total of ten (10) greenhouses each measuring approximately two (2) ha with dimensions of 206.6 m x 100m will be required for the proposed 20 ha land for greenhouses. The area will be divided into two (2) identical blocks of five (5) greenhouses each. Each block will have all the components needed (main pipes, fertigation, boosting system and control).

Main Pipes

Main pipes will be composed of the pipes that deliver water from the pumping station directly to irrigation systems (centre pivot and drip) and pipes that deliver water from the pumping station water centre tanks in the logistic centre. In total there will be twelve (12) main lines of PVC pipes of varying diameters and classes to deliver water from Galana River to the Farm. The main lines will be operating under high pressures of up to 10 bars.

4.6 Pumping Station

The pumping station will include the set of 22 pumps with the power supply (generators or grid connection) and the control cabinet. Each pump serving water from the main pipe line will have a generation unit. The generators will be installed in a separate building outside of the pumping house, 15 m away.

4.7 Project Cost

The total calculated project cost is approximately Kenya Shillings 6.8 billion. This is inclusive of irrigation systems, pumping stations, logistics centre and agricultural machinery among others.

5. Potential Project Impacts

The project is expected to have environmental impacts on certain aspects of biophysical and socio-economic environment of the project area both during the construction and operation stages. The impacts of the project were assessed and are generally grouped into those *affecting soil, water resources, air quality, flora and fauna, community and their economic activities, vegetation and forests, land acquisition and resettlement, aesthetics and landscape, noise and human health.* Appropriate mitigation measures are also discussed. These impacts were considered for the various phases of the project as:

- During construction and rehabilitation of the Model Farm infrastructure
- During operation of the Model Farm
- Decommissioning of the facilities such as construction camps, equipment and materials used for the construction and maintenance of the Farm when in operation.

5.1 Positive Project Impacts

Improved Food Security

Maize which is Kenyaôs staple food is expected to take up to 80% of the Model Farmôs total acreage. The Model Farm will employ improved agricultural technologies. This coupled with irrigation will lead to high yields (32 bags of maize per season translating to over 500,000 bags per year (with two planting seasons)) thus leading to improved food security situation.

Job Creation

The project will create job opportunities for people living in the area, around the area and even from far places. Both skilled and unskilled labor will be required during project implementation and operation phases. Some of the personnel required include contractors, casual laborers for construction, rehabilitation and operation of the Model Farm, security personnel, cooks and cleaners, irrigation engineers, agronomists, food technologists, farm managers, accountants among others. This has the main benefit of increasing income to the locals and consequently improving their livelihoods. In addition, the amount of money earned through wages will directly enhance the operation of various economic activities and enterprise development in the areas neighbouring the project area.

Improved Management of Natural Resources

The project area is currently covered with bushes, shrubs and acacia trees that are all adjusted to arid conditions. Converting this to an agricultural land will result to improved land management and optimal land use.

Opportunity for Enhanced Research and Development

The Model Farm is a mirror of the proposed Galana-Kulalu Food Security Project (GKFSP). It will act as a research farm to test in small scale the proposed agricultural technologies of the greater GKFSP. Improvement of the technologies used in the Model Farm will be done depending on their performance for use in the greater GKFSP and other future projects. Successful implementation of the Model Farmôs activities will require dynamic and multi-disciplinary professionals. Regular short and tailor made training courses and seminars will be organized to reinforce the capacity of the Farmôs staff and other stakeholders during the entire project period. Thus enhanced know-how of the technologies amongst the staff and stakeholders involved within the Model Farm operations.

Improved Micro Climate

Sugarcane, horticultural tree crops, greenhouses, maize and, green and recreation areas are part of the proposed enterprises within the Model Farm. This will lead to improved vegetation cover within the project area leading to improved micro-climate hence encouraging growth and multiplication of biodiversity in the area.

Domestic and International Trading Opportunities

Through purchase of farm inputs and machinery, and selling of the farm produce and by-products for the Model Farm, there will be improved trading opportunities both locally and international.

Improved Infrastructure

Implementation and operation of the Model Farm will necessitate establishment and improvement of other social amenities like schools, trading centres, roads, hospitals, and recreation facilities, financial and religious institutions within the project area. This will benefit

the people working within and living around the project area.

Floods Moderation

The project area is prone to flooding cases. Implementation of the proposed Model Farm will help in reducing inundation downstream. Use of water in irrigation and other activities within the Farm will be a way of controlling water flow downstream of the project area.

Public-Private Partnerships

The proposed Model Farm Project is envisaged to be managed on public- private partnership venture basis. There are few if any such ventures within the agriculture sector in Kenya. This project will therefore provide learning opportunities on how best to undertake such venture in the future.

5.2 Negative Impacts and Mitigation Measures

5.2.1 During Construction Phase

Environmental and social impacts expected during construction phase of the proposed project include;

Occupational Hazards

There are likely to be accidents during the construction of the Model Farmôs infrastructure and both the skilled and unskilled workers at project site will be prone to the various accidents. The safety of workers can therefore be guaranteed through awareness creation on dangers, risks and safety and also training on first aid.

It is recommended that this be minimized and or controlled through adoption of effective measures to guarantee the health and safety of all workers. Application of health and safety measures required by law and internationally accepted standards must be ensured and be complied with so as to minimize impacts on health and safety incidences. Health and safety regulations should be imposed on all the workers. Safety regulations including life and health insurance, first aid kits, protective clothing such as uniforms gloves and helmets will be adhered to.

The Contractor will put barriers where heavy machinery will be under use to avoid trespassing and as well as employing competent people to operate the machines used in order to minimize accident occurrence.

Air pollution

There will be air pollution from the equipment that will be used during the construction works from dust and exhaust fumes from vehicles and equipment used. This may endanger the health and safety of the workers and the surrounding communities if not mitigated appropriately.

The following mitigation measures are recommended for the proposed Model Farm;

- All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction.
- Construction heavy earth moving vehicle drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon and minimize idling of engines.
- Careful screening of construction site will be done to contain and arrest construction-related dust.
- Exposed stockpiles of such as dust and sand will be enclosed, covered, and watered daily, or treated with non-toxic soil binders.
- The Contractor will ensure that all workers wear protective gear whenever on duty
- The Contractor will ensure that construction machinery and equipment are well maintained to reduce exhaust gas emission
- Stop all excavation work if wind threshold velocity has been exceeded.

Noise Pollution

Noise pollution is likely to arise from on-site construction activities especially from machinery and heavy vehicles. This is likely to be noise (short term) to the households living around the Model Farm and the wildlife in the bordering Tsavo National Park. The Contractor will consider minimizing noise during the construction works by;

- Using equipment designed with noise control elements where necessary
- Routing away trucks from noise sensitive areas where feasible at construction site
- Reducing idling time for pick-up trucks and other small equipment

- Providing all workers operating in noisy areas or operating noisy equipment with earpieces to protect against extreme noise.

Water and Soil Pollution

Oil wastes may become a source of pollution to the soils and water resources if carelessly handled, stored or drained from construction vehicles and equipment. There will also be increased sediment loads to the rivers and streams resulting from excavation works and construction debris.

Project related excavation could lead to surface and ground water quality degradation. Contaminated soil or ground water in the project area could be disturbed by excavation resulting potential transfer of the contamination to surface waters. Spills of hazardous materials in excavated areas during construction could introduce contaminants to groundwater. The Contractor will ensure proper disposal off of all construction debris in a sensible manner and not throw it into any of the rivers/stream.

Loss of Natural Vegetation Cover

The proposed Model Farm is expected to convert the current state of vegetation into agricultural land hence will require natural vegetation clearing. Clearing of vegetation during the rehabilitation works and excavation work for the Farmôs infrastructure construction could also result in an increased runoff and thus encourage erosion. Incorporating soil conservation measures during construction would help to mitigate damage caused by erosion.

Disturbance of Soil Structure

Excavations and farming may result in to the disturbance of soil profile and structure. Soil management measures should be observed.

Public Health

Construction and rehabilitation works and traffic during operation will create dust, air and noise pollution, which can have an impact on public health. Oil wastes from vehicles can also impact on public health if they find their way into water sources. The leaded compounds will

accumulate on any vegetation planted for consumption purposes. Sanitation and hygiene in the workmenôs camp are also issues of concern, and if not properly addressed can lead to outbreaks of illness such as hepatitis, typhoid, intestinal worms, etc. Construction works are associated with an increase in sexually transmitted diseases such as STDs and, HIV/AIDS due to the influx of workmen interacting with the local people. Construction teams can also cause social upheaval among communities near the project area.

Labour Issues

The Project is anticipated to stimulate many labour issues in the project area. The project activities are mainly labor-intensive. This call for locals in the project area to have them take up to 70% of the available jobs coupled with the changing labour patterns that make labour-intensive irrigation unattractive will be a big challenge. There is need for continuous awareness campaigns to sensitize the local people on the various dimensions of the project to enable them embrace immigrants.

5.2.2 During Operation Phase

Environmental and social impacts expected during operation phase of the proposed project include;

Soil Erosion

Destruction of natural vegetation will expose the soil to more erosion. This will be mitigated by planting cover crops and other soil management strategies such as;

- Use of soil erosion control techniques which disperse erosive energy and avoid concentrating it by providing good vegetative cover to disperse the energy of rain drops and contour drainage to slow down surface runoff
- Proper maintenance of canal and the irrigation infrastructures.
- Adoption of conservation tillage systems and ripping to control hardpan and enhance infiltration and seepage

Biodiversity Loss

Removal of natural vegetation will also lead to loss of biodiversity. The project will incorporate horticultural tree crops, sugarcane, green areas and forestation within the recreational areas to ensure maintenance of biodiversity.

Restriction of Wildlife Movement and Migration Routes

The project area is currently acting as a corridor for wildlife between the neighbouring Arabuko-Sokoke Forest and Tsavo National Park. Establishment of the Model Farm will restrict wildlife from free movement within the area since some of the migration routes will be converted to agricultural land. This effect will be minimized by providing wildlife migration routes especially on the green areas and provision of wildlife crossing areas in the project roads.

Alteration of Soil Structure

Use of irrigated water might also alter the structure of the soil. This will be mitigated by sensitizating the Farm operators/workers on proper soil conservation and management measures.

Water-Logging and Salinization

Irrigation projects are largely associated with salinization and the rise in the local water-table (water-logging). Low irrigation efficiencies are one of the main causes of rise of water table. Poor water distribution systems, poor main system management and archaic in-field irrigation practices are the main reason. However, the proposed Model Farm is expected to use improved/modern irrigation technologies including drip and center pivot leading to high field water application efficiency to mitigate water-logging and salinization occurrences.

Effects of the River Downstream Eco-System

The Model Farm has been designed to optimize the available water resources. Operation of the Farm will result to reduced water flows for downstream users. To argument the available water source, a storage reservoir is proposed as an alternative source for the project to store water during high flows for use during low flows.

Effects on the Tourism Sector

Malindi town which is at the downstream of the project is one of the most visited tourist town in Kenya, implementation and operation of the project may negatively affect the tourism sector within the area in the following ways:

- Increased operation at the proposed projectôs site may cause disturbance to the existing camp sites and other tourist attraction sites nearby the project hence reducing the number of tourists.
- Increased sediment load in River Sabaki resulting from agricultural activities in the proposed project may lead to increased siltation and destruction of Malindi beach and on the beaches of Malindi due to sedimentation of humus. Sediment deposits reduce the aesthetic quality of the beaches reducing visits by tourist.
- The Malindi ï Watamu Marine National Park receives water from Sabaki River. Increased sediment and nutrients from the Sabaki River associated with increased agricultural activities upstream may result in loss of biodiversity in the Malindi - Watamu national park and other marine parks drawing water from Sabaki River, this in turn may lead to reduced tourist visit to the parks.
- The Sabaki River Mouth is one of the most important bird areas on the Kenyan coast and has been identified as a globally important site under the ócongregationsôcategory of the Important Bird Area (IBA) criteria. The sandbanks at the mouth of the river are roosting sites for tens of thousands of gulls and terns, while the intertidal mudflats provide a feeding ground for thousands of shorebirds and lesser numbers of other waterbirds. Destruction of the birdôs habitat and pollution in Sabaki River may result in loss of biodiversity, this will inter result in fewer tourist visits in the area depriving the district and country gains through tourism.

To mitigate the above impacts it is planned to preserve the existing campsites and other tourists sites near the project site as well as upgrading them to attract more tourists. Proper soil management practices within the Farm will be observed as well as incorporation of soil conservation structures within the project. Chemicals (herbicides, fungicides and fertilizers) used within the Farm will be properly handled.

Pollution

Use of agro-chemicals including pesticides, fertilizers, herbicides, and insecticides may cause pollution to water, air and the soils. Improper use of these chemicals may become toxic. Some of these chemicals may also be dangerous in nature hence leading to health hazards. Safe disposal of these chemicals should be observed.

Gas emissions from the pumps, vehicles and greenhouses during operation of the Model Farm may result to air pollution. This will be mitigated by the use of minimal equipment, pumps, vehicles that are less pollutant to the environment. A safety officer will be anointed to ensure observation of proper disposal guidelines, maintenance and/or piece of works carried out on any piece of equipment or construction work are undertaken by qualified personnel, in case of spillage emergency spillage control measures are instituted and containerization of any wastes and disposal through a NEMA licensed waste handler.

Invasive Plant Seeds and Diseases

Elimination of dry season die-back and the creation of a more humid micro-climate may result in an increase of agricultural pests and plant diseases; diverting river water has the potential to cause major environmental disturbances, resulting from changes in the hydrology and limnology of the Galana River basin. This can be mitigated by proper planning and management of the project activities such as reduction of input to and release of nutrients (nitrogen and phosphorous) from cropped fields and use of organic instead of chemical fertilizers where possible.

Population Influx

Currently the project area is not a human settlement area. Establishment and operation of the project will lead to population influx within the area. People will migrate from the neighbouring areas and other areas to be part of the actors within the Farmôs operations. This may lead to culture change and increased conflicts over resources and public and social services. This will be mitigated be enforcing by-laws, rules and regulations concerning movement in and out of the Farm which will be coordinated through the area administration office. Development of infrastructure for housing, electricity, domestic water supply, water treatment, roads, sanitation,

bridges, schools, health facilities among others will be important within the farm so as to support the population increase.

Solid Waste Management

With the proposed Model Farmôs enterprises and operations coupled with the rising population influx, enormous solid waste generation rate is expected. It is therefore proposed that proper waste management strategies be employed and adherence to solid waste management regulations. Minimization of waste generation will be first priority. However, unavoidable wastes will be separated at source, recycled or re-used, combusted, and disposed in sanitary landfills.

Conflicts

i. Human-Human Conflicts

Sharing of resources between the local people and the people coming in to be involved in the Farmôs operations will lead to increased conflicts. This will be mitigated by establishing separate settlement areas for the entire Farmôs staff within the project area far from the existing settlement furnished with adequate necessary services. Sensization of the project workers and local community on the expected culture change will aslo be done.

i. Human-Wildlife Conflicts

During the operation stage, crops on the farms could be affected adversely by encroachment of wildlife. This would lead to perpetual conflict on the beast control approach that would solve the same challenge. Restriction of wildlife movement within the project area will also result in more human-wildlife conflict in the surrounding areas or even in the irrigated land. In addition, increased human settlement within the project area may lead to increased human attacks by wildlife and vice-versa. This will be mitigated by fencing off the project area leaving some corridors for the wildlife to move to river and Tsavo National Park.

Increased Insecurity

The Model Farm operation will necessitate an increase in population in the project area. The proposed project enterprises will bring about many business activities in the area. As such, issues

of insecurity in the project area are expected to rise. This will be mitigated by integrating security measures within the project and enforcing laws, rules and regulation pertaining security within the country.

Increased Poaching

Increased population coupled with improved road and rail networks will ease access to the neighbouring Tsavo National Park and Arabuko-Sokoke Forest, which may lead to increased poaching activities. This may be mitigated by enforcing laws governing wildlife conservation and management.

Increased Accidents

The project area is inhabited with wild animals. Implementation and operation of the Farm will result in more and improved transport networks. The anticipated rail and road networks will pose accident risks to both humans and wildlife. To mitigate this, road and air safety measures will be taken such as extra training for road users and installation of road safety infrastructure like road bumps, zebra crossings and speed limit posters at strategic locations along the roads. All workers will be sensitized and trained on occupational safety and health issues and on how to control accidents related to field operations. In cases of unavoidable accidents, there will be emergency response provided within the proposed health centre.

Increased Communicable Diseases

If not well managed, an irrigation project may result to water-borne diseases such as malaria, bilharzia, diarrhoea among others. On the other hand, increased population growth with the associated social change may lead to communicable diseases such as HIV/AIDs. The proposed mitigation measure for these effects is to ensure stagnant waters and possible mosquitoes breeding areas are controlled and that HIV/AIDS campaigns and safeguard against prostitution are done to create awareness to the population within the area. Awareness creation on the expected social changes amongst the population will also be done.

5.2.3 During Decommissioning Phase

Occupational hazards

There are likely to be accidents during the dismantling of the construction camps and burying and making good of borrow pits. Barriers should be put where heavy machinery will be under use to avoid trespassing. The Contractor should ensure the following mitigation measures are observed;

- All workers be sensitized before the exercise begins, on how to control accidents related to the demolition exercise
- A comprehensive contingency plan be prepared before demolition begins, on accident response.
- Adherence to safety procedures be enforced at all stages of the exercise
- All workers, pursuant to labour laws, be accordingly insured against accidents.
- All workers be provided and instructed to wear protective attire during demolition, including helmets.
- Demolition work be limited to daytime only to avoid workers accidents due to poor visibility

Noise Pollution

During the dismantling works, there is likely to be noise to the households living around the camps. To mitigate these effects, the Contractor should consider putting up the camps in less densely occupied areas, install portable barriers to shield compressors, use equipment designed with noise control elements where necessary, routing trucks used during demolition exercise on site away from noise sensitive areas in the neighbourhood, where feasible minimizing idling time for pickup trucks and other small equipment, limiting use of very noisy equipment to daytime only and ensure that all workers operating in noisy areas or operating noisy equipment wear earpieces to protect against extreme noise.

Air Pollution

There will be air pollution from the equipment that will be used during the demolition works from dust. The exhaust fumes from vehicles and equipment used is also likely to pollute the

soils, vegetation and water sources around the camp. To mitigate this, the Contractor will ensure;

- The demolition exercise is be limited to day time only
- All personnel working in the project are trained prior to commencing the demolition exercise on methods for minimizing negative impacts on air quality.
- Construction vehicle drivers are under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon and minimize idling of engines.
- All active demolition areas are watered at least twice a day to reduce dust.
- All trucks hauling demolition debris/wastes are covered.
- Careful screening to contain and arrest demolition related dust are adopted
- Exposed demolition debris of e.g. dust and sand, are enclosed, covered, and watered daily before transported to disposal site.
- All workers on the site are required to wear protective gear while on duty

Solid Waste Generation

Demolition of the project buildings and related infrastructure will result in large quantities of solid waste. The waste will contain materials used in construction including concrete, metal, drywall, wood and fasteners. It proposed that a licensed operator be engaged to collect demolition debris/wastes to avoid illegal final dumping at unauthorized sites. All debris/wastes should also be collected regularly to control air pollution and injuries.

6. PRODUCTS, BY-PRODUCTS AND WASTES

Numerous products, by-products and wastes are expected from the project during the construction and rehabilitation phase and operational phases. These are presented as;

6.1 Construction and Rehabilitation Phase

6.1.1 Products

The product from the construction and rehabilitation works are the infrastructure developments and this are seen as products of the project, this are:

- Intake works
- Riverbank protection works
- Irrigation system structures
- Greenhouses works
- Human settlement and associated physical and social infrastructure
- Water supply systems
- Access roads

6.1.2 By-products

By definition a by-product is a substance that is incidentally manufactured, processed or otherwise used at the facility at any concentration and released in-situ to the environment, released to surface waters or transferred off site for disposal.

During the project construction phase it is foreseen that the by-products may include any excess construction materials brought to the site by the contractor and can be reused later.

6.1.3 Waste

During the construction and rehabilitation phase, numerous waste products are expected to be generated. These include:

Domestic Wastes

- The construction workers are expected to be supplied with various forms of foodstuffs packed in plastic or other types of containers. These are expected to occur within the site

area and in the immediate vicinity. The management of such waste will need to be incorporated by the Contractor in the Construction HSE Management Plan.

- Other forms of waste include sanitary waste and therefore the provision of sanitary facilities will need to be considered both for the site construction workers and the visiting population.
- Kiosks selling various items will also emerge.

Site clearing Waste

The project will generate waste from the site construction activities including:

- Demolition wastes;
- Excavated soils and vegetation;
- Construction equipment maintenance wastes;
- Dusts and fumes;
- Packaging materials, etc.

Dust

The construction activities that will occur particularly during the site excavation process will generate a considerable amount of dust and other particulates that will be released into the atmosphere.

Smoke Emissions

The site machinery, equipment and trucks brought in by the Contractor are expected to generate smoke emissions when in operation during the construction activities. The concentration of these emissions will depend on their maintenance levels and servicing by the Contractor.

6.2 Operational Phase

6.2.1 Products

The main products from the project are crops produce and animal products.

6.2.2 By-products

During the operational phase of the project there will be minimal amounts of by-products

generated except the manure and crop residues like plant stalks and stovers after crop harvesting. This could be utilized for organic fertilization, biogas production, mulching and as livestock feed.

6.2.3 Waste

Along the canal the main waste likely to be produced will be silt, the potential build-up of stagnant water and the proliferation of exotic plants. Crops organic waste will be produced but should be recycled to improve soil humus. Of importance will be packaging material used for crop carriage especially plastic bags.

Other wastes to be generated are those from human settlements and recreational areas within the project. This is expected to be channelled to an onsite sewage disposal system.

7. Project Alternatives

7.1 Do Nothing Alternative

Kenyaôs population is currently (2013) estimated to be around 40 million and is expected to rise to 45.7million by 2015 and 64 million by 2030[2]. This population will present a greater food security challenge than experienced today. Currently, the country faces challenges in feeding that population if the country is to continue relying on rain-fed agriculture. When rains fail, people in different parts of the country have difficulties feeding themselves and have to rely on famine relief.

Maize is the main source of carbohydrate food component and a key indicator of food security. Due to crop failure in the predominantly short rains dependent southeastern lowlands in addition to pre- and post harvest losses of up to 20-30% in Kenyaôs grain basket (Rift Valley), food insecurity for farmers and urban households is high. Furthermore, increase in prices of food stuffs and other commodities exacerbate the food security challenge. According to Kenya Maize Development Programme (KMDP, 2012) the per capita maize consumption stands at 98 kilograms (aprox.100 kilograms) which is equivalent to 35% energy requirement. This is however differentiated with incomes whereby the lowest income quartile uses 28% of its income on maize.

Productivity of small holder farms has rarely been optimal. Whereas optimum maize production per acre should be around 32bags/acre many small scale farmers rarely produce more than 5-8 bags per acre. This is part of the challenge that places the National maize production is 40 million bags against a national consumption requirement of 42 million bags [3]. This deficit has hitherto been met through importation of maize which stood at 314,000tonnes in 2001 and 243,000 tonnes in 2009 or 16.8million bags. The deficit is never a definite known. According to FAO, the number of food insecure people requiring direct food aid has dropped from 2.1 million in 2012 to 1.1 million in 2013. The National maize stocks as at 30th April 2013 stood at 21,574,305 bags, with farmers holding about 14,886,683 bags, traders 3,666,176 bags, millers

[2] Facts and Figures on population and Development by National Council for Population and Development, 2011

[3] Soil suitability for Maize production in Kenya Report by MoA, 2014

721,446 bags and National Cereals and Produce Board (NCPB) holding 2,300,000 bags. Beans stocks totaled 2,443,685 bags, Wheat 602,521 bags and Rice 687,665 bags. The position of the Government is that National stocks will continue being replenished by imports, cross-border inflows especially from Uganda and Tanzania where harvests is expected to peak in May to July. This state of affairs predisposes the country to risk as food security ought to be a national security issue. The proposed project is planned to reduce national imports and cross-border inflows.

This alternative requires that no intervention should be carried out in the project area, the land should remain at status quo. If the project is not implemented food security will remain a crisis in Kenya. Other benefits associated with the project will not be realized. At the same time, the negative impacts emanating from the project would not also materialize.

7.2 The Proposed Model Farm Project

The proposed Model Farm Project is expected to develop a total of 10,000 acres within the proposed Galana-Kulalu Food Security Project and 80% of the land will be under maize crop. It will act as a mirror of the larger Galana-Kulalu Food Security Project (GKFSP). It will be a research farm to test in small scale the proposed agricultural technologies of the greater GKFSP. Improvement of the technologies used in the Model Farm will be done depending on their performance for use in the greater GKFSP and other future projects. Its success will therefore show success of the greater GKFSP which is expected to curb food insecurity situation in Kenya greatly.

The Model Farm is to be located in the Galana-Kulalu ranches which for several years have remained unproductive. The area is currently used for used for ranching purposes of a variety of livestock including cattle, sheep and goats. This has not been lucrative especially during the dry spells. The area is also infested with tsetse flies which is a threat to the livestock within the ranches. The proposed Model farm is expected to convert part of the Galana-Kulalu into an agricultural land under irrigated agriculture.

The main source of water for the existing uses in the ranches is the Galana River which is at the

south of the Model Farm and separates Galana Ranch from Kulalu Ranch. Hydrological analysis of the Galana River indicates that there is substantially enough water for the proposed Model Farmôs uses. Water quality analysis also shows that the water is suitable for irrigation. However, for domestic and industrial uses, the water requires purification and a treatment plant is designed to cater for that.

The soils within the selected Model Farmôs location are also suitable for irrigation. In areas where salinity and infiltration is a challenge, the proposed irrigation technologies will counter. These soils are also suitable for various crops such as maize, vegetables and most other high value crops. Crops planned for the Model Farm are maize and vegetables.

The Model Farm is an ASAL area where evapotranspiration is quite high. Therefore, efficient irrigation methods are proposed to counter this. These include drip and centre pivot irrigation. It is also expected that these irrigation methods will lead to lesser water use as compared to other irrigation methods such as furrow. Drip irrigation will be done on open fields and in greenhouses whereas centre pivot will be done on open fields.

The Model Farm is likely to impact the project area and its surroundings either directly or indirectly. Some of the project impacts highlighted are improved food security, job creation, increased revenue, increased income, increased accidents, change of population dynamics, improved physical and social infrastructure, reduced food prices, lifestyle change, flood moderation, micro-climate change, curtailing of wildlife movement, pollution (air, noise, water and soil), conflicts, water-logging, salinity and cultural exchange among others.

7.3 Comparison of alternatives

Under the Do Nothing alternative, no change or development would be expected therefore, there would neither be benefits from the project nor the insignificant effects. On the contrary, the proposed Model Farm Project is expected to impact the area through improved food security, job creation, increased revenue, increased income, improved physical and social infrastructure, reduced food prices, flood moderation and micro-climate change among others. The proposed Model Farm is therefore the most feasible alternative for Kenya.

8. Environmental and Social Management Plan (ESMP)

8.1 Introduction

This Environmental and Social Management Plan (ESMP) provides a logical framework within which the negative environmental and social impacts identified during the Environmental and Social Impact Assessment study can be mitigated and any beneficial environment effects can be enhanced. Monitoring and management practices are considered and cost estimates included. Responsibilities and time frames for the implementation of the various aspects of the Environmental and Social Management Plan have been identified. The Environmental and Social Management Plan should be implemented accordingly.

8.2 Mitigation of Negative Impacts

The mitigation measures for the anticipated negative impacts of the proposed project are presented in the Environmental and Social Management Plan (Tables 8-1, 8-2 and 8-3).

8.2.1 Project Construction

Table 8-1: Environmental and Social Management Plan during Project Construction

Possible Impacts	***Proposed Mitigation Measures***	***Monitoring Indicators***	***Frequency of Monitoring***	***Responsible Party***	**Cost Estimates (KSh.)**
1. Workers accidents during construction process.	• All workers will be sensitized before construction begins, on how to control accidents related to construction. • A comprehensive contingency plan will be prepared before construction begins, on accident response. • Accordingly, adherence to safety procedures will be enforced. • All workers to wear protective gear during construction, including helmets. • Construction work should be limited to daytime only	• No of workers sensitization meetings • List of attendants • Minutes of sensitization meetings • No. workers accidents cases • Number of first aid kits purchased • A Safety Plan • No. of safety posters produced and displayed	Periodic checks	• Contractor • Project proponent	• 40, 000 per month
2. Air pollution by dust and VOCs generated during construction process	• All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction. • Construction heavy earth moving vehicle drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon and minimize idling of engines. • Careful screening of construction site to contain and arrest construction-related dust.	• No of workers sensitization meetings • List of attendants • Minutes of sensitization meetings • Less dust and vehicles gas vehicles emissions produced • No. of workers wearing protective	Periodic and surprise checks	• Contractor • Project proponent/contractor • NEMA inspectors	100 000 per month over the construction period

Possible Impacts	***Proposed Mitigation Measures***	***Monitoring Indicators***	***Frequency of Monitoring***	***Responsible Party***	**Cost Estimates (KSh.)**
	• Exposed stockpiles of e.g. dust and sand, will be enclosed, covered, and watered daily, or treated with non-toxic soil binders. • All workers will be required to wear protective gear • Ensure construction machinery and equipment are well maintained to reduce exhaust gas emission • Stop all excavation work if wind threshold velocity has been exceeded.	gear			
3. Noise and vibration by construction activities.	• Use of equipment designed with noise control elements will be adopted where necessary. • Trucks used at construction site shall be routed away from noise sensitive areas where feasible. • Idling time for pick-up trucks and other small equipment will be minimized to limited time. • All workers operating in noisy areas or operating noisy equipment will be provided with earpieces to protect against extreme noise. • Comply with L.N. 25: Noise prevention and control rules, 2005	• Less noise and vibrations heard/felt • No. of workers in noise earpieces	Periodic and surprise checks	• Contractor • Project proponent/contractor • NEMA inspectors	50 000 per month over the construction period
4. Generation of solid waste	• Wastes to be collected regularly to control air pollution and vermin/insects etc. • Receptacles will be provided for waste storage prior to collection.	• Presence of waste receptacles and refuse collection vehicles • Presence of	Periodic and surprise checks	• Project proponent • Hired private contractor • Provincial Public Health Officer	20 000 per month

Possible Impacts	***Proposed Mitigation Measures***	***Monitoring Indicators***	***Frequency of Monitoring***	***Responsible Party***	**Cost Estimates (KSh.)**
	• Resource recovery will be encouraged once the project takes off so as to shrink waste stream and recover non-recyclables. • Refuse collection vehicles will be covered to prevent scatter of wastes by wind. • Wastes will be collected by a licensed operator to avoid illegal final dumping at unauthorized sites. • All persons involved in refuse collection shall be in full protective attire.	unmanaged soild waste • No. of waste collectors in protective attires		• NEMA inspectors	
5. Inadequate human waste disposal by workers during construction process	• As provided for by the Building Code, a temporary latrine will be provided on site to be used by construction workers	• Number of established sanitation facilities within the project area	Periodic checks	• Project proponent • Contractor • Ministry of Health • NEMA inspectors	50,000 per visit
6. Pollution from Hazardous waste	• Handling of the materials using the material safety data provided by the manufacturers • Appoint a safety officer to ensure that proper disposal guideline are observed • Ensuring that maintenance and/or piece of work carried out on any piece of equipment or construction work is undertaken by qualified personnel • In case of spillage emergency spillage control measures to be instituted • Containerization of any wastes and	• No. of safety officers within the project • Presence of spillage and unmanaged hazardous waste	Periodic and surprise checks	• Project proponent • Contractor • Ministry of Health: provincial public health officer • NEMA inspectors	100 000 per month

Possible Impacts	***Proposed Mitigation Measures***	***Monitoring Indicators***	***Frequency of Monitoring***	***Responsible Party***	**Cost Estimates (KSh.)**
	disposal through a licensed waste handler.				
7. Loss of natural vegetation cover	• Ensure proper demarcation and delineation of the project area to be affected by construction works. • Introduction of vegetation (trees and grass) on within the green and recreational areas within the project and their maintenance. • Design and implement an appropriate landscaping programme to help in re-vegetation of parts of the project area after construction.	• Re-vegetation and landscaping programme	Periodic and surprise checks during construction	• Project proponent • Contractor • Project Engineer	50,000 per month
8. Disturbance of soil structure	• Sensitization to the project workers on proper soil conservation and management measures • Escavations on unintended areas should be avoided	• No. of workers sensitization meetings	Periodic checks	• Project proponent • Contractor	100, 000 per month
9. Increase in STI infections and other related diseases	• Sensitization of local communities and staff working on the project on dangers of free lifestyle • HIV/AIDS awareness training for all employees and subcontractors. • Sensitization of the locals and the project staff on proper sanitation and hygiene	• No. of sensitization meetings held • A health plan • No. of STI posters poster produced and displayed	Quarterly	• Project proponent • Ministry of Health • Contractor	Part of project budget
10. Labour issues	• Project proponent should put in place a proper strategy to ensure fair recruitment of workers incorporating both locals and people from other areas • Sensitization to the local	• List of workers employed from the local community and other areas	Periodic checks	• Project proponent • Contractor • Ministry of Labour	50,000 per month

Possible Impacts	***Proposed Mitigation Measures***	***Monitoring Indicators***	***Frequency of Monitoring***	***Responsible Party***	**Cost Estimates (KSh.)**
	communities on the expected population influx should be done				

8.2.2 Project Operation

Table 8-2: Environmental and Social Management Plan during Project Operation

Possible Impacts	***Proposed Mitigation Measures***	***Monitoring Indicators***	***Frequency of Monitoring***	***Responsible Party***	**Cost Estimates (KSh.)**
1. Soil erosion	• Use erosion control techniques which disperse erosive energy and avoid concentrating it e.g providing good vegetative cover will disperse the energy of rain drops and contour drainage will slow down surface runoff • Proper maintenance of canal and the irrigation infrastructures. • Adopt conservation tillage systems and ripping to control hardpan and enhance infiltration and seepage.	• Soil erosion control levels	Periodic checks	• Project Proponent • Project Engineer	100,000 per month
2. Biodiversity loss	• Incorporation of horticultural tree crops, sugarcane, green areas and forestation within the recreational areas to ensure maintenance of biodiversity.	• Biodiversity levels	Periodic checks	• Project Proponent	Part of the project budget
3. Restriction of wildlife movement & migration routes	• Provision of wildlife migration routes especially at the proposed green areas • Provision of wildlife crossing areas in the project roads especially at the provided migration routes	• Delineated wildlife migration routes • No. of wildlife crossing areas at the project roads	Periodic checks	• Project Proponent • KWS	100,000 per month
4. Alteration of soil structure	• Sensitization to the project workers on proper soil conservation and	• No. of workers sensitization	Periodic checks	• Project proponent	10, 000 per month

Possible Impacts	***Proposed Mitigation Measures***	***Monitoring Indicators***	***Frequency of Monitoring***	***Responsible Party***	**Cost Estimates (KSh.)**
	management measures	meetings			
5. Water-logging	• Use of proper irrigation management, closely matching irrigation demands and supply • Installation and maintenance of adequate drainage system.	• Levels of drainage within the Farm	Periodic checks	• Project Proponent • Project Engineer	Part of project budget
6. Increased soil salinization	• Careful management should be practiced to reduce the rate of salinity build up and minimize the effects on crops.	• Levels of soil salinization	Periodic and surprise checks	• Project Proponent	200,000 per month
7. Effects of the river downstream eco-system	• Ensure sustainable abstraction of water from Athi/Sabaki River • Establish a water storage reservoir	• River abstraction levels	Periodic and surprise checks	• Project Proponent • Project Engineer • WRMA • NEMA	100,000 per month
8. Increased sedimentation	• Construction of sedimentation retention ponds (if necessary) • Filters should be added to all storm water inlets, and silt fences established where erosion is predicted. • Install sediment traps or screens to control runoff and sedimentation • Design and management of canals to minimize sedimentation. • Provision of access to canals for removal of weeds and sediments	• Presence of sedimentation pondsa and traps • Levels of sedimentation	Periodic and surprise checks	• Project Proponent • Project Engineer	Part of project budget
9. Air pollution	• NEMA/ WHO environmental air emission standards should always prevail controlling suspended particles of matter, Sulphur Dioxide, Nitrogen Dioxide and other pollutants	• Dust levels • Pollution audit reports	Periodic and surprise checks	• Project Proponent • Ministry of Health: provincial public health	10,000 per month

Possible Impacts	***Proposed Mitigation Measures***	***Monitoring Indicators***	***Frequency of Monitoring***	***Responsible Party***	**Cost Estimates (KSh.)**
	• Tilled surface should not be left bare to minimise wind erosion and where possible embrace conservation agriculture. • Use of pesticides and other chemicals should be done when the weather is relatively calm.			officer • NEMA inspectors • Ministry of Labour	
10. Proliferation of aquatic weeds	• Clearance of woody vegetation from inundation zone prior to irrigation (nutrient removal) • Use Best Practices in weed control • Harvest of weeds for compost, fodder or biogas • Regulation of water discharge and manipulation of water levels to discourage weed growth	• Absence of aquatic weeds	Periodic and surprise checks	• Project Proponent	10,000 per month
11. Algal blooms and weed proliferation	• Reduction of input to and release of nutrients (nitrogen and phosphorous) from cropped fields. • Use of organic instead of chemical fertilizers where possible.	• Absence of algae	Periodic and surprise checks	• Project Proponent • NEMA inspectors	10,000 per month
12. Pollution from Hazardous Chemicals (Waste)	• Appoint a safety officer to ensure that proper disposal guideline are observed. • Ensuring that maintenance and/or piece of work carried out on any piece of equipment or construction work is undertaken by qualified personnel. • In case of spillage emergency spillage control measures to be instituted. • Containerization of any wastes and	• Pollution audit reports	Periodic and surprise checks	• Project Proponent • Ministry of Health: provincial public health officer • NEMA inspectors	20,000 per month

Possible Impacts	***Proposed Mitigation Measures***	***Monitoring Indicators***	***Frequency of Monitoring***	***Responsible Party***	**Cost Estimates (KSh.)**
	disposal through a licensed waste handler. • Adhere to L.N. 121: Waste Management Regulations.				
13. Population influx	• Population monitoring coordinated through the administration office • Development of infrastructure: housing, electricity, domestic water supply, water treatment, roads, sanitation, bridges, schools, health facilities, etc to support the population increase	• No. of people moving in and out of the project	Periodic checks	• Project Proponent	10,000 per month
14. Improper solid waste management	• Waste generation must be minimised as first priority • Unavoidable wastes should be separated at source, recycled or re-used, combusted, and disposed in sanitary landfills • Use of an integrated solid waste management system i.e. through several options including of source reduction recycling ,composting and reuse and incineration • Ensure that wastes generated at the Farm are efficiently managed through recycling, reuse and proper disposal procedures.	• Presence of waste receptacles and refuse collection vehicles • Presence of unmanaged soild waste • No. of waste collectors in protective attires	Periodic and surprise checks	• Project Proponent • Project Engineer	Part of the operation and maintenance budget
15. Conflicts	• Develop means to ensure equitable distribution among users and monitor to assure adherence between farmers and pastoralists. • Develop proper measures to reduce conflicts	• No. of physical and social infrastructure • No. of conflict cases	Periodic cases and accidents audit	• Project Proponent • KWS	10,000 per month

Possible Impacts	***Proposed Mitigation Measures***	***Monitoring Indicators***	***Frequency of Monitoring***	***Responsible Party***	**Cost Estimates (KSh.)**
	• Sensization of the project workers and local community on the expected culture change				
16. Increased insecurity	• Provision of security measures within the project • Enforcing laws, rules and regulation pertaining security within the country	• Monthly security report	Periodic checks	• Project Proponent	Part of the project budget
17. Increased poaching	• Enforce existing laws and by-lawsw concerning wildlife conservation and management	• Monthly poaching activity cases report	Periodic checks	• Project Proponent • KWS	100 per month
18. Increased accidents	• All workers will be sensitized and trained on occupational safety and health issues and on how to control accidents related to field operations. • A comprehensive contingency plan will be prepared on accident response. • Accordingly, adherence to safety procedures will be enforced. • Establishment of road bumps, zebra crossing areas and barriers • Provision of speed bumps before and after human settlement, recreational, and national parks and game parks	• Safety and training reports • Monthly accident reports • No. of safety posters produced and displayed • No. of vehicle speed bumps, zebra crossing places and road barriers	Periodic checks and Accident audits	• Project Proponent • Divisional Public Health Officer • Ministry of Labour • Workers • NEMA inspectors	40 000 quarter annually
19. Increased communicable diseases	• Sensitization of local communities and staff working on the project on dangers of free lifestyle • HIV/AIDS awareness training for all employees and subcontractors. • Sensitization of the locals and the	• No. of sensitization meetings held • A health plan • No. of STI posters poster produced and displayed	Quarterly	• Project proponent • Ministry of Health	Part of project budget

Possible Impacts	***Proposed Mitigation Measures***	***Monitoring Indicators***	***Frequency of Monitoring***	***Responsible Party***	**Cost Estimates (KSh.)**
	project staff on proper sanitation and hygiene				

8.2.3 Project Decommissioning

Table 8-3: Environmental and Social Management Plan during Project Decommissioning

Possible Impacts	***Proposed Mitigation Measures***	***Responsible Party***	**Cost Estimates (KSh.)**
1. Air pollution during demolition process.	• The demolition exercise will be limited to day time only • All personnel working in the project will be trained prior to commencing the demolition exercise on methods for minimizing negative impacts on air quality. • Construction vehicle drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon and minimize idling of engines. • All active demolition areas will be watered at least twice a day to reduce dust. • All trucks hauling demolition debris/wastes shall be covered. • Careful screening to contain and arrest demolition related dust will be adopted • Exposed demolition debris of e.g. dust and sand, will be enclosed, covered, and watered daily before transported to disposal site. All workers on the site will be required to wear protective gear while on duty	• Project proponent • NEMA inspectors • Contractor	300,000
2. Noise pollution by disassembly activities	• Portable barriers will be installed to shield compressors • Use of equipment designed with noise control elements will be adopted where necessary. • Trucks used during demolition exercise on site shall be routed away from noise sensitive areas in the neighbourhood, where feasible. • Idling time for pickup trucks and other small equipment will be minimized to limited time. • Use of very noisy equipment will be limited to daytime only.	• Project proponent • NEMA inspector • Contractor	100,000

Possible Impacts	***Proposed Mitigation Measures***	***Responsible Party***	**Cost Estimates (KSh.)**
	• All workers operating in noisy areas or operating noisy equipment will be provided with earpieces to protect against extreme noise. • The demolition exercise will be limited to day time only		
3. Traffic and Transport	• Carry out fuel deliveries during the day to avoid noise and disruption of sleep to the residents of the neighbouring center	• Project proponent	
4. Demolition debris and related wastes	• Private contractor will be engaged to collect demolition debris/wastes • All debris/wastes will be collected regularly to control air pollution and injury etc • A licensed operator to avoid illegal final dumping at unauthorized sites will collect demolition debris. • All persons involved in refuse collection shall be in full protective attire.	• Project proponent • NEMA inspectors • Contractor	1,000,000
5. Workers accidents during demolition process.	• All workers will be sensitized before the exercise begins, on how to control accidents related to the demolition exercise • A comprehensive contingency plan will be prepared before demolition begins, on accident response. • Adherence to safety procedures will be enforced at all stages of the exercise • All workers, pursuant to labour laws, shall be accordingly insured against accidents. • All workers will be provided and instructed to wear protective attire during demolition, including helmets. • Demolition work will be limited to daytime only to avoid workers accidents due to poor visibility • Provision of mobile clinics	• Project proponent • Provincial Public Health Officer • Ministry of Labour • NEMA inspectors • Contractor	100,000

9. Environmental and Social Monitoring Programme

9.1 Introduction

It is important that the Project Proponent sets up regular monitoring programmes to assess the ambient levels in principle parameters of the environment and social aspects as stipulated under sub-section 40-41 of EMCA, 1999.

Environmental and Social Monitoring will serve the following functions:-

- To ensure that the environmental and social mitigation measures proposed in the ESIA report are effectively implemented by the various agencies in compliance to environmental provisions and standard specifications
- To evaluate the effectiveness of environmental and social remedial measures as well as various evaluation techniques and procedures
- To facilitate development of responses to new and developing issues of concern.

The environmental and social monitoring program will operate through the project construction and operation phases as presented in Tables 9-1 and 9-2.

9.2 Environmental Monitoring Programme

9.2.1 Project Construction

Table 9-1: Environmental Monitoring Programme during Project Construction Phase

Item	***Parameter***	***Frequency***	***Location***
1. Public Health and Safety	• Frequency of incidents/accidents and fatalities • Number of vector breeding sites created by poor drainage. • Availability of condoms, contraceptive supply, impregnated bed nets, mosquito repellents. • Health and safety awareness among staff	Weekly	Project area and environs
2. Soil Erosion and siltation	• Soil erosion rates, stability of bank and canal embankments, etc.	Monthly	River banks, farm and canals
3. Solid and liquid wastes	• Scattered litter and interruption of surface water flows • Unpleasant smell • Complain/ lack of complain of pollution of water sources.	Weekly	Project area and environs
4. Surface and ground water quality	• As per the Second Schedule of Legal Notice No. 120 2006	Monthly	River :same locations that were sampled during baseline studies
5. Noise	• Noise limits.	Monthly	At major construction sites
6. Air pollution	• Particulates, especially dust as a result of earthworks and construction machinery	Monthly	In the project area and environs where major works will take place
7. Vegetation and habitats	• Vegetation structure, biodiversity, fuel wood,	Quarterly	Project area and environs
8. Crime	• Registered crimes/disputes; • Crimes/disputes involving women; • Crimes/disputes involving vulnerable groups	Monthly	In the project area and environs
9. Demographic and population changes	• Total population, in- and out-migration, structure of the population and vital statistics; informal settlements	Annual	In the project area and environs
10. Infrastructure	• Housing, health facilities, water, transport and communications	Annual	Project area and nearby settlement

Item	***Parameter***	***Frequency***	***Location***
11. Water	• Water usage by different operation areas	Monthly	Project area

9.2.2 Project Operation

Table 9-2: Environmental Monitoring Programme during Project Operation Phase

Item	***Parameter***	***Frequency***	***Location***
1. Surface and ground water quality	• As per the Second Schedule of Legal Notice No. 120 2006	Monthly	River :same locations that were sampled during baseline studies
2. Water quality (sources of domestic water)	• As per the Second Schedule of Legal Notice # 120 2006	Monthly	Water source: same locations that were sampled during baseline studies
3. Hydrology	• Discharge of Sabaki River	Monthly	River Sabaki (Downstream the irrigation scheme)
4. Water from irrigation farms and Discharge from the Irrigation scheme	• As per the Eighth Schedule of Legal Notice # 120 2006	Monthly	River Sabaki (Downstream the irrigation scheme)
5. Water related diseases	• Identification of water related diseases, adequacy of local vector control and curative measure.	Three times a year	Labour camps and farmers homes.
6. Soil erosion and siltation	• Types and rate of erosion on farmland and banks of rivers and canals	Seasonally	Project area
7. Solid waste generation	• Types and sources of solid wastes	Monthly	Project area
8. Air quality	• NO_2, SO_2, O_3, CO_2, CO,VOC, Benzene, and Hydrocarbons	Monthly	Project area
9. Noise	• Noise limits for different working environments	Monthly	Project area
10. Wildlife	• Types and condition of habitats (nesting places, breeding grounds, feeding places etc); endemic biota	Annual	Project area and environs

Item	***Parameter***	***Frequency***	***Location***
11. Aquatic ecology	• Phytoplanktons, zooplanktons, benthic life, fish composition and diversity; food chain and food webs;	Annual	River Sabaki (Downstream the proposed project area)
12. Infrastructure	• Housing, health facilities, water, transport and communications	Annual	Urban centers in the project area
13. Accidents and hazards	• Number, causes and actions taken	Quarterly	Project area
14. Public Health and Safety	• HIV/AIDs, STDs and other diseases • Accidents; • Hazardous materials	Quarterly	Project area and environs
15. Demographic and population changes	• Total population, in- and out-migration, structure of the population and vital statistics; informal settlements	Annual	In the project area and environs
16. Crime	• Registered crimes/disputes; crimes/disputes involving women; crimes/disputes involving vulnerable groups.	Monthly	In the project area and environs

10. Conclusions and Recommendations

10.1 Conclusions

Irrigation development projects of large magnitude impose significant impacts to the physical and biological environment as well as social, cultural and economic setting of the area. The proposed Model Farm which is of this nature is also anticipated to impose such impacts. The negative impacts, however, are identifiable and can be mitigated through design and administrative measures. However, the overall positive impacts of the project far outweigh the negative projects through the mitigation measures outlined for the project.

10.2 Recommendations

i. Implementation

The Environmental and Social Impact Assessment was conducted in compliance with the relevant legislations and planning requirements of Kenya. It is therefore recommended that the proposed Model Farm project be implemented in compliance to the legislations and planning requirements at all times. In addition, the legislative framework provided in this report must be taken into consideration, during and after the implementation of the project, as will be appropriate.

ii. Environmental and Social Management Plan (ESMP)

A comprehensive Environmental and Social Management Plan (ESMP) has been presented in this report and it is recommended that the mitigation guideline provided be followed to the later and improvements made if need be. Specifically, key negative impacts that require careful management during the rehabilitation and construction of the Model Farmôs infrastructure and operation phases be addressed.

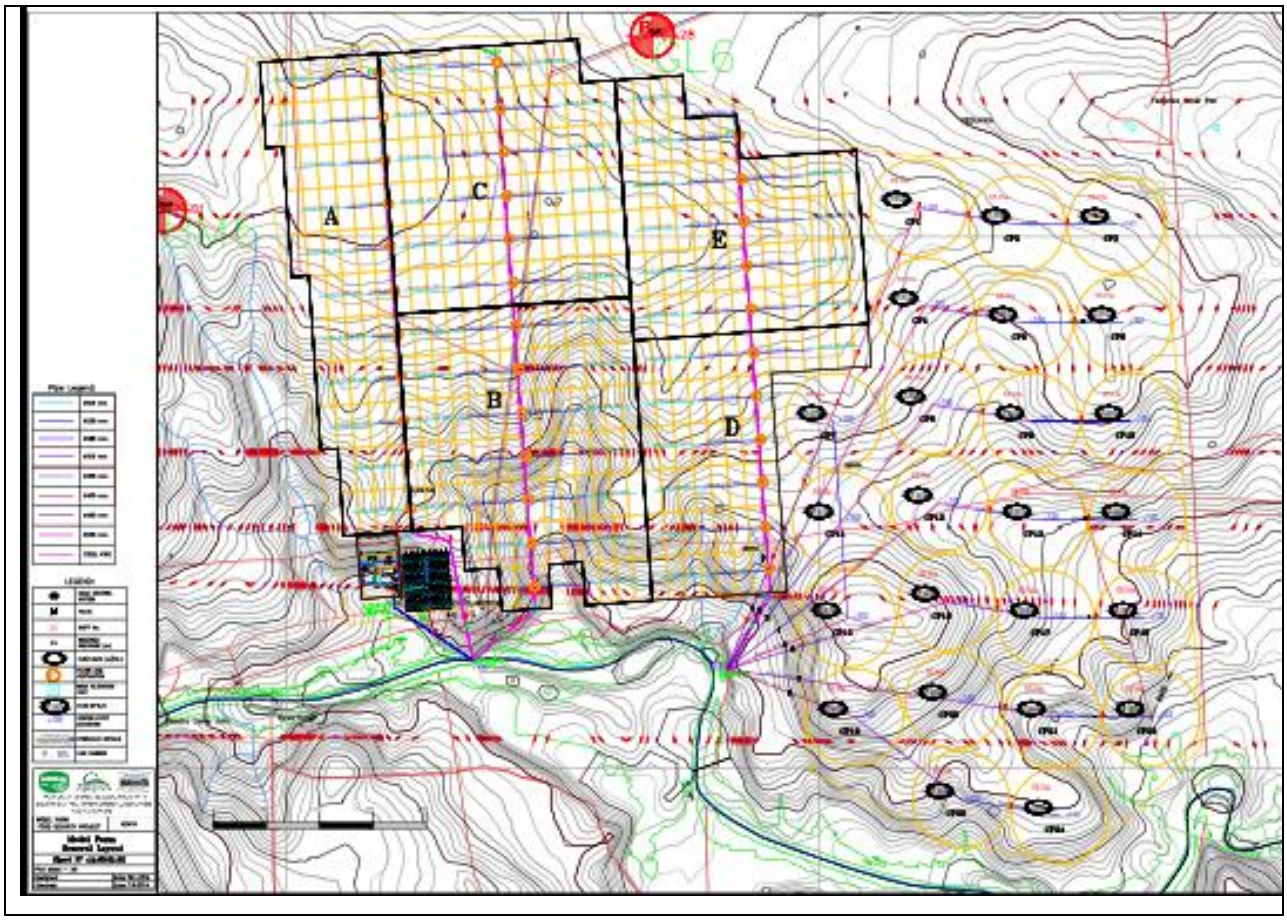
iii. Environmental Monitoring

Environmental Monitoring Programme (EMP) provided for the key issues as a result of the proposed Model Farmôs construction, operation and rehabilitation must also be followed to ensure that the construction and operation are in line with the ESIA license.

Appendices

- Layout of the Model Farm
- Water Quality Test Results
- Sample Household Questionnaire
- Focus Group Discussion Minutes
- Public Participation Form
- Second Public Participation Minutes
- Public Participation Form

Appendix 1: Proposed Layout of the Model Farm



Appendix 2: Water Quality Test Results

agriQ Quest
Member of the Bigg Group

KENAS/TL/14

AgriQ Quest Limited
P.O. Box 3097 - 00506, Nairobi, Kenya
+254 (20) 551988 / 3593140/43
www.agriq-quest.com

Analysis Report

M/s
Agri-Green Consulting Ltd.
P.O Box 985 - 00606,
Sarit Centre, Nairobi.

Date of Report: 18/02/2014
Report No: AQ 39231
Batch No: 14/0129
Date Sample Received: 13/02/2014
Date of Analysis: 13/02/2014
Sample Identification: Irrigation Water From the River
Location: Galana River

Chemical Analysis of: Irrigation Water

			Cations: Parts Per Million (ppm)						Anions: Parts Per Million (ppm)					Trace elements: Parts Per Million (ppm)						
Analysis	**pH**	**EC**	**NH_4^+**	**K^+**	**Na^+**	**Ca^{2+}**	**Mg^{2+}**	**Si**	**NO_3^-**	**Cl^-**	**SO_4^{2-}**	**HCO_3^-**	**$H_2PO_4^-$**	**Fe**	**Mn**	**Zn**	**Pb**	**Cd**	**Cu**	**Ni**
Results	8.20	0.48	nm	11.8	37.5	4.77	6.81	nm	0.24	10.3	22.5	<0.001	21.6	0.61	0.16	0.04	<0.001	nm	0.05	nm
Low	5.2			0.5			6		17				0.005							
Target	6.8	0.7																		
High	8	1.5		10	114		24		134	70	154		5	5	0.2	2			0.7	

< less than; nm = not measured;
Reference values cited are from Farnham, Ayers and Hasek (1977), Irrigation Water Quality Guidelines

INTERPRETATION OF ANALYSIS (RESULTS)

Low levels of NO_3^-
High pH and levels of K^+ and PO_4^{2-}

Last Test Results			Cations: Parts Per Million (ppm)						Anions: Parts Per Million (ppm)					Trace elements: Parts Per Million (ppm)						
Date	**pH**	**EC**	**NH_4^+**	**K^+**	**Na^+**	**Ca^{2+}**	**Mg^{2+}**	**Si**	**NO_3^-**	**Cl^-**	**SO_4^{2-}**	**HCO_3^-**	**$H_2PO_4^-$**	**Fe**	**Mn**	**Zn**	**Pb**	**Cd**	**Cu**	**Ni**
Not sampled																				
Not sampled																				

Henry Koros
Laboratory Section Head

Jackline Kenduiywa
Quality Assurance Manager

Appendix 3: Sample Household Questionnaire

Household Questionnaire

Questionnaire Number			

SECTION A: INTRODUCTION

County:_____ Sub-County:_____

Location : _____ Village: _____

Household Number: _____ Household Head: _____

Interviewer: _____ Supervisor: _____

Interview Date: _____ Name of respondent: _____

*(**NOTE:** This questionnaire shall be administered only to the household head or any other responsible adult person in the household at the time of the survey)*

SECTION B: BACKGROUND OF RESPONDENT

B1	B2	B3	B4	B5
Sex of respondent 1. Male 2. Female	Ethnicity of the respondent 1. Mijikenda 2. Pokomo 3. Orma 4. Wardey 99 others (Specify)	How old are you? (in Years) 1. Below 18 2. 18-20 3. 21-24 4. 25-28 5. 29-35 6. 35-40 7. 41-50 8. Over 50	What is your marital status? 1. Married 2. Single 3. Separated 4. Divorced 5. Widowed	What is your highest level of education? 1. Adult Literacy Class 2. Pre-Primary 3. Lower Primary 4. Upper Primary 5. Secondary 6. Post Secondary 7. Never attended 66 N/ A 88 DK

DK - Don't Know
N/A – Not Applicable

B6	B7	B8	B9	B10
What is your family size (number)	Type of house (**enumerator to observe**) 1. Permanent 2. Semi-permanent 3. Temporary	What is your occupation? 1. Farming 2. Teaching 3. Public servant 4. Mining 5. Fishing 6. Business	What type of fuel does your household mainly use for cooking? (1) Electricity (2) Gas (3) Firewood (4) Charcoal (5) Biogas (6) Kerosene (99) Others (specify)	What is the main source of income within the household? 1. Farming 2. Kiosk/shop 3. Charcoal burning 4. Weaving 99 others (Specify)

SECTION C: LAND OWNERSHIP

C1	C2	C3	C4
Who owns the land where you stay/farm? (1) Individually (Inherited or purchased) (2) Family (3) Rented (99) Others (specify	How did you acquire the land? 1. Inheritance 2. Lease 3. Allocation by national government 4. Allocation by national government 5. Purchased (99) Others (specify)	What ownership documents do you have for the land? 1. Title deed 2. Allotment letter 3. Leasehold 4. Temporary occupation letter 5. None (99) Others (specify)	What is the size of the land? 1. <1 acre 2. 1-3 acres 3. 3.1 - 5 acres 4. >5acres

C5	C6	C7	C8	C9
How long have you stayed on/used that piece of land 1. Less than 8 yrs 2. Between 8- 12 yrs 3. Above 12 yrs	Were you born here? 1. Yes 2. No	If you migrated, where did you come from?	What activities do you carry out on your piece of land? 1. Farming 2. Livestock keeping 3. Bee keeping 4. Poultry (99) Others (specify)	Have of you heard of the proposed Galana-Kulalu Food Security Project/Farm? 1. Yes 2. No

C10	C11	C12	C13
Have you been benefiting in any way from the land proposed for establishment of the Galana-Kulalu Farm? 1. Yes 2. No	If Yes how? 1. Eco tourism 2. Grazing 3. Bee keeping 4. Farming 5. Fishing 6. Energy as fuel 99 Others (Specify)	Do you support establishment of the Farm? 1. Yes 2. No	Do you think that you will benefit in any way from Farm establishment? 1. Yes 2. No

C14

Give expected benefits

_____

_____

_____

_____

SECTION D: FOOD SECURITY

D1	D2	D3	D4	D5	D6
What is the main source of food for your household? 1. Own farm 2. Market/shop 3. Fishing 4. Gathering 5. Relief 6. Donations (99) Other (Specify)	If you purchase food, how much do you spend on food per day?	How many meals do you take in a day? 1. One 2. Two 3. Three 4. More than three	What are the most common foods taken in this area?	Are there foods you don't eat in this area? 1. Yes 2. No	If Yes, which ones?

Please indicate your satisfaction level on the food source on the following scale of 1-5

Input type		Level of Satisfaction	Remarks
D7	Adequacy/Enough		
D8	Reliability		
D9	Accessibility		
D10	Sustainability		

1-Highly satisfied, 2-satisfied, **3**-Indifferent, **4**-Dissatisfied, **5**-Highly dissatisfied

SECTION E WATER RESOURCES

E1			E2	E3
What is your main source of water for? 1. River/stream 2. Borehole/well 3. Dam/river 4. Piped water supply 5. Roof catchment 99 Others(specify)			How far is your homestead from the water source? 1. <1km 2. 1.1 - 3 km 3. 3.1 – 5 km 4. Over 5.1 km	How do you ensure water is safe for drinking? 1. Boiling 2. Filtering 3. Decanting 4. Use of Chemicals 99 Others(specify)
Drinking & Household Chores	**Animals**	**Crop Activities**		

E4	E5	E6
Where do you think the water for Galana-Kulalu Project will come from? 1. Dam 2. River 3. Boreholes 4. Rainwater 99) Others (specify)	Do you think that you will benefit in any way from the dam establishment? 1. Yes 2. No	Give expected benefits

SECTION F AGRICULTURE

F1	F2	F3	F4
Do you practice crop farming? (1) Yes (2) No) **>> F11**	If no, what is the reason (s) (1) Drought (2) No Seeds (3) Insecurity (4) Lack of labour 99) Others (Specify	What does your household use to cultivate most of your farmland? (1) Hand tool (Hoe/Jembe) (2) Animal-drawn plough (3) Tractor-drawn plough (99) Others (specify)	What crops do you grow on your land? 1) Maize 2) Cowpeas 3) Sorghum 4) Greengrams 5) Tomatoes 6) Kales (99) Others (specify)

F5
What challenges do you face in your farming? 1) Lack of irrigation water 2) Insecurity 3) Transportation 4) Marketing 5) Storage 6) Floods 7) Pest and disease control (99) Others (specify)

F6	F7			F8	F9	F10
Do you keep farm records? 1. Yes 2. No	If Yes, how much of the crops farmed did the HH harvest during the last season?			Has your HH experienced surplus production of the main produce? 1) Yes 2) No	If yes in **F8**, what do you do with the surplus? 1) Sell 2) Donate 3) Store for next hungry season 4) (99) Others (specify)	If you sell in **F9**, how much do you earn per year from crop farming?
	Crop	**Unit/Acre**	**Quantity**			**Ksh.**
	Maize	90 kg Bag				
	Cowpeas	90 kg Bag				
	Sorghum	90 kg Bag				
	Greengrams	90 kg Bag				
	Tomatoes	Debe				

F11	F12		F13	F14	F15	F16
Do you practice livestock keeping? 1. Yes 2. No**>> G1**	Which animals do you keep?		From where do you graze your animals?	What challenges do you face in your livestock rearing? 1) Drought 2) Insecurity 3) Marketing 4) Parasite and disease control (99) Others (specify)	How many animals do you sell in a year?	How much does each go for?
	Type	**No**				**Ksh.**

F17			F18	F19
What is your source of labour for			Is the labour adequate? 1. Yes 2. No	If not adequate in **F18**, what are the other alternative sources?
Crop farming	**Livestock rearing**	**Domestic activities**		

SECTION G SERVICES PROVISION

G1		G2	G3	G4	G5
Have you ever received any of the following services on agricultural production? (1) Yes (2) No		Who offered the services? (1) GOK/NIB (2) NGO (3) KARI (99) Others (specify)	If received any training, what was the training about? (1) Irrigation (2) Crop agronomy (3) Water use management (4) Cooperative organizations (5) Environmental management (6) Crop marketing and market linkages. (99) Other (Specify)	How has the services impacted on the production or productivity of your farm? (1) Increased production (2) Decreased production (3) No change (4) Hard to tell	Which areas would you require further support? 1) Training 2) Input supply 3) Finances (99) Other (Specify)
Service	**Response**				
Training					
Finances					
Input supply					

SECTION H: HUMAN-WILDLIFE CONFLICTS

H1	H2	H3	H4	H5
Have crops ever been destroyed by wild animals this area? 1. Yes 2. No	If Yes, which animals (Starting with the most problematic)?	Have your livestock ever been attacked by wild animals? 1. Yes 2. No	If Yes, which animals (Starting with the most problematic)?	Has any member of your family or village been severely attached or lost their lives due to wildlife?

That is the end of my Interview, Thank you for your time and attention

*****END*****

Appendix 4: Focus Group Discussion Minutes

Focus Group Discussion held at Bombi Primary School on 05.01.2024

Present

1. Raymond Fundo - Assistant Chief
2. Emanuel Wange
3. Emanuel Kenga
4. Jefferson Guyo
5. Rashid - ADC Manager
6. Ayub Kazung - Village Elder

Five (5) Consultant representatives

Agendas

The discussion started with the Consultant explaining to the local leaders the main purpose of the visit. He (the Consultant) stated that the National Government was intending to start an irrigation project with the main purpose of producing food. He further explained that there was a need for local leadership who Communities around the proposed Galana Project to participate in the planning process. He therefore welcomed the local chief to give his comments. The Chief welcomed the planning team to his area. The Chief explained that the main settlers in the area have been Giriamas and Watha who have been later been joined by Ormas who moved down in search of pasture and water for their livestock.

During the discussion the following concerns were raised and they requested the team to integrate them in the plan:

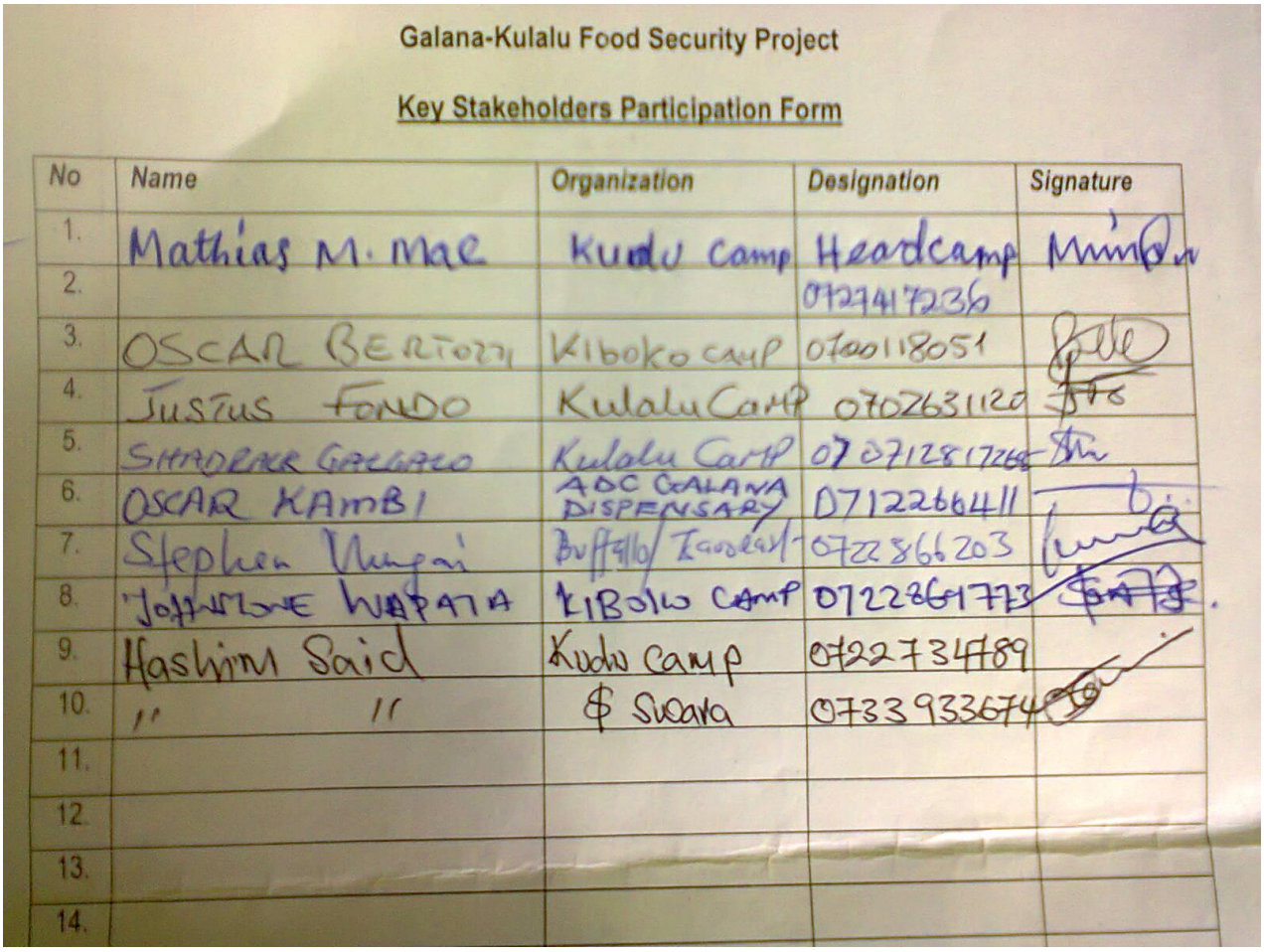
1. A road should be used to buffer the project area and the community land/settlements. The road should also be used as an access route since it will connect villages.
2. Any land to be taken from the community for constructing project related facilities will require a thorough discussion and compensation. Some of the facilities including the water pump which the group felt that it was located on communal land.
3. It was also noted that the commencement of the project may lead to wildlife human conflict. Some wildlife migratory routes are within the project area, there was a

possibility of the routes being displaced to communal land. The group requested the team to carry out a study on the same

4. The group requested the team to request the project to initiate some projects such as health and education as part of corporate responsibility.
5. There was need to offer employment opportunities to local community, they requested the team to request the project proponent to offer them jobs at rate of 70 percent.
6. The project proponent (NIB) was also requested to discuss with other Government Ministries and give locals who neighbour project area titles to their land and initiate development projects for them such as farming and business enterprise to boast their income.

The discussion ended at 4.00pm with the community members stressing that the requests above need to be considered.

Appendix 5: Public Participation Form



Galana-Kulalu Food Security Project

Key Stakeholders Participation Form

No	Name	Organization	Designation	Signature
1.	Mathias M. Mae	Kudu camp	Headcamp 0727417236	
2.				
3.	OSCAR BERTOZZI	Kiboko camp	0700118051	
4.	JUSTUS FONDO	Kulalu Camp	0702631120	
5.	SHADRACK GACHARA	Kulalu Camp	07 07128 17266	
6.	OSCAR KAMBI	ADC GALANA DISPENSARY	0712266411	
7.	Stephen Mungai	Buffalo/Tsavo	0722866203	
8.	JOHNSON WAPATA	KIBOKO CAMP	0722861773	
9.	Hashim Said	Kudu Camp	0722734789	
10.	" "	& Swara	0733933674	
11.				
12.				
13.				
14.				

Appendix 6: Public ConsultationMinutes

MINUTES OF ESIA CONSULTATIVE MEETING OF GKFSP HELD AT AT BOMBI PRIMARY SCHOOL ON 3RD AUGUST 2015

PRESENT

1.	Eng. M Thuita	NIB Chief Irrigation Engineer
2.	Mr. Samuel Kimani	NIB Environmentalist
3.	Dr. Mary Kimani	Consultant Enviroplan
4.	James Murimi	Consultant Enviroplan
5.	Dorcus Ndunge	Consultant Enviroplan
6.	Ahmed Rashid	ADC Manager
7.	Joshua	Security ADC
8.	Christopher Chengo	Irrigation Officer Kilifi
9.	Mr. Duncan Okoth	NEMA Environment Officer, Kilifi
10.	Mr. Edward Edward	Kilifi County Government environmental officer
11.	Mr. Mwalimu Menza	CEC Agriculture
12.	Ayub Kazungu -	Village Elder
13.	Mathias M. Mae	Kudu Camp
14.	Oscar Bertozi	Kiboko Camp
15.	Justus Fondo	Kulalu camp
16.	Shadrack Galgalo	Kulalu Camp
17.	Oscar Kambi	ADC Galana Dispensary
18.	Stephen Mungai	Bufallo Camp
19.	Josephine Wapata	Kiboko Camp
20.	Hashim Saidi	Swara Camp
21.	Hashim Saidi	Kudu Camp
22.	Mr. Gedion M.Ombogi	Deputy County Commissioner, Malindi
23.	Mr. Richard Karan	Deputy County Commissioner, Magarini
24.	Mr. Wilson SAAYA	Deputy County Commissioner, Ganze
25.	Mr. Shardrack Charo	DIOCPD
26.	Raymond Fundo -	Assistant Chief

27. Mr.Paul Njoroge	Vice chairman GATHIMA group
28. Kazungu Matayo	Farmer Bakaye Village
29. Gladys Zaina Charo	Farmer Bakaye Village
30. Jefferson Guyo	Farmer Bombi Village
31. Thomas Fundo	Farmer Bombi Village
32. Priscilla Kahati	Farmer Kwa Pembe Village
33. Fondu Kalama Ruwa	Farmer Kwa Pembe Village
34. Yaad Baya	Farmer Garsemke Village
35. Abdalla Ndema	Farmer Chakama Village
36. Beatrice Ngalla	Farmer Chakama Village
37. Celestine Salama	Farmer Katana Hakeye Village
38. Chengo Thoya	Farmer Mchekenzi Village
39. Mistanze Kange	Farmer Ruruma Village
40. Kazungu Matano	Farmer Katsangani Village
41. Gladys Ndolo	Farmer Divayo Village
42. Chausiu Salim	Farmer Habura Village
43. Mr. Taari J. R	ACC, Langobaya
44. Mr. Abdalla Salim	WDCs office
45. Mr. Kipkemboi Rop	DCIO Malindi
46. Mr. Assad Sheyumbe	SCA Malindi
47. Ms. Elina Mapenzi	SAOSP
48. Mr. Ronald Mbunya	CNC
49. Ms. Margaret Jefwa	CDA Kilifi
50. Mr. Geoffrey w. Mokaya	C.O.I
51. Mr. Erick Ochieng	Deputy officer in charge Malindi prison
52. Mr. Kelvin Kwema	Research scientist KEFRI-Malindi
53. Mr. Taari J.R	ACC langobaya

MIN GKFSP-MODEL FARM/1/AUGUST/2015: AGENDA

The following agenda was presented by the Consultant for discussion and adoption.

1. Introduction of Participants
2. To Present the Galana Kulalu Food Security Project (GKFSP to Key Stakeholders
3. To collect views of the Galana Kulalu Food Security Project (GKFSP) and its impact on the Environment from Key Stakeholders
4. Identify both positive and negative social/socio-economic and environmental impacts emerging from the implementation, commissioning and operation of the Farm
5. Design and prepare appropriate mitigation measures and action plans to address all the possible environmental and social impacts of the project

MIN GKFSP-MODEL FARM/2/AUGUST/2015: INTRODUCTION

The meeting started at 10.30am with a word of prayer led by Ms. Magaret Jefwa the Kilifi CDA. The Dr. Mary Kimani introduced the members of the Consultant team while Eng. Thuita introduced the members of NIB. The Consultant requested that other members present do self-introduction stating the institutions they represented.

MIN GKFSP/3/AUGUST/2015: PRESENTATION OF GKFSP-MODEL FARM

Eng. Thuita gave an overview of the National Irrigation Board (NIB) history elaborating on NIBôs mandate, policy as well as the programmes and the projects that NIB is currently implementing in various parts of the country.

Eng. Thuita informed the stakeholders that the National Government intended to start an irrigation project with the main purpose of producing food to meet the food security needs of the country. He further explained that there was a need for the local leadership and Communities around to support the proposed Galana Project and participate in the planning process of the project. He then presented to the stakeholders the status and features of the Galana-Kulalu Food Security Project (GKFSP) i.e. the Pre-feasibility study, the detailed design of the 10,000 acre model farm and the detailed design of the Dam for the 100,000 acre Pilot farm.

Eng. Thuita informed the stakeholders that the proposed Galana-Kulalu Food Security Project would be implemented in three phases.

1. Phase one is the development of a 10,000 acres Model Farm. The 10,000 acres Model Farm would be used to test technologies and practices that would be used to develop the project to full potential. Test of suitable crop varieties will be carried out in this model farm in small scale under the actual conditions. The model farm will implement all the elements required for agriculture development for the larger Galana-Kulalu Food Security Project i.e. design, soil preparation, growing, harvesting and processing in order to give a basis for the rolling out of the next development phases.
2. Phase two is the development of a 100,000 acres Pilot Farm. This would follow the successful implementation of the Model Farm. The development of the 100,000 acres would be aided by the construction of a dam to store water for the irrigation.
3. Third phase will be the up-scaling of the project to the 400,000 acres through public private partnerships.

Eng. Thuita informed the participants that according to the pre-feasibility study, the soil in the project area was suitable for agricultural production though it was low in phosphorus content but she said that it had been recommended that this be overcome by use of organic fertilizer high Phosphorus content. The study also found that based on the soils about 1 million acres were suitable for agricultural production but there was a limitation of water. Due to this water limitation the pre-feasibility study found that only about 400,000 acres could be put under production. The study proposed that water be sourced from the Galana River with additional water stored in a dam to be constructed. However the National irrigation had decided to begin with a model farm of 10,000 acres for which the ESIA was now being carried out.

Eng. Thuita invited the Lead ESIA Consultant to present the highlights of the detailed design for the 10,000 acres Model Farm for which the ESIA was being conducted. The following key issues of the Model Farm emanating from the detailed design report were highlighted;

- According to the hydrological study Galana River was found to have sufficient water to irrigate the 10,000 acres without the requirement for storage.

- Two intake stations (A and B) and 2 pumping stations were found to be necessary and hence they were designed. Intake A is to support open drip system while intake B is to support centre pivot system and part of the drip system. Intake A has 9 pumps while B has 13 pumps.
- Two irrigation methods, drip irrigation (on open fields and greenhouses) and centre pivot irrigation were identified for use in the Model Farm;.
- The crops to be planted include maize (under center pivot and drip irrigation methods) and vegetables (under drip irrigation & greenhouses).
- High yields are expected from the proposed crops i.e. between 27 and 40.5 bags of 90kg each per acre in one season for maize production.
- Other infrastructure in the model farm will include agro-processing factories such as maize milling factory, offices, factory garage and social development infrastructure such as a health facility, a school, a police station, worship places and banks.
- Employment will be created by the implementation of the Model Farm for both skilled and unskilled personnel within and without the project area. It was agreed in an earlier stakeholders consultation that 40% of the work/employment will go to the counties; Tana and Kilifi with each county having 20% labour force and the remaining 60% be from the whole country and other nations if need be.

MIN GKFSP/4/AUGUST/2015 ANALYSIS OF IMPACTS

Enviroplan Lead Expert Dr. Mary Kimani presented the anticipated impacts from the implementation of the model farm as revealed by the initial project study report. She asked members to give additional impacts. She emphasized the need to be free and open in sharing the impacts as this will be the only way to come up with all the impacts and the proper measures to enhance the positive impacts as well as measures to mitigate the negative impacts.

The positive impacts analysed included:

1. Improved Food Security: Upto 80 percent of the total model farm acreage of the model farm will be planted with maize which is the model farm would be Kenyaôs staple food. The Model Farm will employ improved agricultural technologies and coupled with irrigation will lead to high yields (32 bags of maize per season translating to over 500,000

bags per year (with two planting seasons)) thus leading to improved food security situation.

2. Training and capacity building of local farmers so that they can improve their agricultural production.
3. Improved security emanating from the security infrastructure such as police station that is designed for in the project.
4. Improved livestock production due to incorporation and introduction of improved livestock breeds in the project and the region.
5. The introduction of a fisheries component in the project will help diversify the production and economy of the region.
6. Job creation: The project will create job opportunities for skilled and unskilled labor during project implementation and operation phases. Some of the personnel required include contractors, casual laborers for construction, rehabilitation and operation of the Model Farm, security personnel, cooks and cleaners, irrigation engineers, agronomists, food technologists, farm managers, accountants among others. About 40% of the workforce will be sourced from the counties. However some stakeholders felt that employment opportunities should be offered on a 60% and 40 % basis for locals and whole country respectively as the locals will bear the bulk of the impacts. They stakeholders requested that the local communities should be given first priority for employment opportunities. If members of the communities are unskilled they should be trained through the capacity building initiatives to enhance their capacities to take up employment with the project. Fair opportunities for employment will be given to all without decimation on any basis. Equal payment will be given for equal work done. Contractors will capacity build people as part of training the unskilled workers. Pipe layers were trained on the job.

7.Flood Control: Implementation of the proposed Model Farm will help in reducing inundation downstream. Use of water in irrigation and other activities within the Farm will be a way of controlling water flow downstream of the project area. The construction of a dam in the area will bring about control of flood.

8.Improved Micro Climate: Crops such as Sugarcane, horticultural tree crops, greenhouses, maize and, green and recreation areas proposed enterprises within the Model Farm. This

will lead to improved vegetation cover within the project area leading to improved micro-climate hence encouraging growth and multiplication of biodiversity in the area.

9. Domestic and International Trading Opportunities: Through Selling of the farm produce and by-products for the Model Farm, there will be improved trading opportunities both locally and international.
10. Improved Infrastructure: Implementation and operation of the Model Farm will necessitate establishment and improvement of other social amenities like schools, trading centres, roads, hospitals, and recreation facilities, financial and religious institutions within the project area. This will benefit the people working within and living around the project area.

The anticipated negative impacts included

1) Deforestation/reduction of tree cover during the clearing of the 10,000 acres to be farmed as well as all the other areas to be cleared in the future.
2) Biodiversity Loss**:** Removal of natural vegetation will also lead to loss of biodiversity. The project will incorporate horticultural tree crops, sugarcane, green areas and forestation within the recreational areas to ensure maintenance of biodiversity.
3) Due to use of chemicals in the farm there will be reduction of water quality in the river when the irrigation water is released to the river.
4) Stakeholders were concerned that there will be reduction of water quantity in the river. They were informed that the use of fertilizer and other chemicals will well monitored to reduce incidences of pollution, also there will be regular testing of water quality at some points along the river course to check for pollution.
5) There was concern that there the project will cause soil degradation through soil erosion, silting of the river, salinization and soil contamination. However the stakeholders were informed that the about 75% of the bed load silt will be captured be trapped by the proposed dam. Soil conservation structures such as gabions and strip planting of grass terraces will be build to prevent erosion will be put in place. A distance of about 500 meters will be left between the farm and river to reduce the possibility erosion by surface run-off.

6) The area occupied by the camps will be submerged by the reservoir. This will greatly affect the tourism industry. The lodges are leased to the investors renewable every five (5) years. The leases are not yet over which are not yet over for some and it will be a great loss to vacate without compensation. He proposed the way forward to be compensation of the investors.
7) Human wildlife conflicts: The stakeholders were concerned that the commencement of the project may lead to wildlife human conflict. Some wildlife migratory routes are within the project area, there was a possibility of the routes being displaced to communal land. They said that because of the project migration pattern of the Elephant has changed greatly
8) Loss of Grazing land: Due to opening up of land for farming the grazing lands for the pastoralists thus increasing conflicts. Currently the pastoralists use the ADC farm and its environs to graze their livestock.
9) Influx of people/informal settlement
10) Air pollution: This is from the equipment that will be used during the construction works from dust and exhaust fumes from vehicles and equipment used. This may endanger the health and safety of the workers and the surrounding communities if not mitigated appropriately.
11) Noise Pollution: This will arise from on-site construction activities especially from machinery and heavy vehicles. This is likely to be noise (short term) to the households living around the Model Farm and the wildlife in the bordering Tsavo National Park.
12) Occupational health effects/Occupational Hazards: There are likely to be accidents during the construction of the Model Farmôs infrastructure and both the skilled and unskilled workers at project site will be prone to the various accidents. The safety of workers can therefore be guaranteed through awareness creation on dangers, risks and safety and also training on first aid.
13) Public Health: Construction and rehabilitation works and traffic during operation will create dust, air and noise pollution, which can have an impact on public health. Oil wastes from vehicles can also impact on public health if they find their way into water sources. The leaded compounds will accumulate on any vegetation planted for

consumption purposes. Sanitation and hygiene in the workmenôs camp are also issues of concern, and if not properly addressed can lead to outbreaks of illness such as hepatitis, typhoid, intestinal worms, etc. Construction works are associated with an increase in sexually transmitted diseases such as STDs and, HIV/AIDS due to the influx of workmen interacting with the local people. Construction teams can also cause social upheaval among communities near the project area.

14) Population Influx: Currently the project area is not a human settlement area. Establishment and operation of the project will lead to population influx within the area. People will migrate from the neighbouring areas and other areas to be part of the actors within the Farmôs operations. This may lead to culture change and increased conflicts over resources and public and social services. This will be mitigated be enforcing by-laws, rules and regulations concerning movement in and out of the Farm which will be coordinated through the area administration office. Development of infrastructure for housing, electricity, domestic water supply, water treatment, roads, sanitation, bridges, schools, health facilities among others will be important within the farm so as to support the population increase.
15) Effects on the Tourism Sector: Malindi town which is at the downstream of the project is one of the most visited tourist town in Kenya, implementation and operation of the project may negatively affect the tourism sector within the area in the following ways:
    - Increased operation at the proposed projectôs site may cause disturbance to the existing camp sites and other tourist attraction sites nearby the project hence reducing the number of tourists.
    - Increased sediment load in River Sabaki resulting from agricultural activities in the proposed project may lead to increased siltation and destruction of Malindi beach and on the beaches of Malindi due to sedimentation of humus. Sediment deposits reduce the aesthetic quality of the beaches reducing visits by tourist.
    - The Malindi ï Watamu Marine National Park receives water from Sabaki River. Increased sediment and nutrients from the Sabaki River associated with increased agricultural activities upstream may result in loss of

biodiversity in the Malindi - Watamu national park and other marine parks drawing water from Sabaki River, this in turn may lead to reduced tourist visit to the parks.

- The Sabaki River Mouth is one of the most important bird areas on the Kenyan coast and has been identified as a globally important site under the ócongregationsôcategory of the Important Bird Area (IBA) criteria. The sandbanks at the mouth of the river are roosting sites for tens of thousands of gulls and terns, while the intertidal mudflats provide a feeding ground for thousands of shorebirds and lesser numbers of other waterbirds. Destruction of the birdôs habitat and pollution in Sabaki River may result in loss of biodiversity, this will inter result in fewer tourist visits in the area depriving the district and country gains through tourism.

To mitigate the above impacts it is planned to preserve the existing campsites and other tourists sites near the project site as well as upgrading them to attract more tourists. Proper soil management practices within the Farm will be observed as well as incorporation of soil conservation structures within the project. Chemicals (herbicides, fungicides and fertilizers) used within the Farm will be properly handled.

There being no other business for discussion the meeting ended with a prayer by

Chairman:é ..Dateé é é é é é é é ..

Secretary:é é é é é é é é é é é é é é é é é é é ...Dateé é é é é é é é ..

Appendix 7: Public Participation form

ESIA CONSULTATIVE MEETING OF GKFSP HELD AT AT BOMBI PRIMARY SCHOOL ON 3RD AUGUST 2015 – ATTENDANCE SHEET

ATTENDANCE

SNO.	NAME	ORGANISATON	SIGN.
1	Eng. M Thuria	NIB Chief Irrigation Eng	
2	Mr. Samuel Kimani	NIB	
3	Dr. Mary Kimani	Consultant Enviroplan	
4	James Murimi	Consultant Enviroplan	
5	Dorcus Nduge	Consultant Enviroplan	
6	Ahmed Rashid	ADC Manager	
7	Joshua	Sucurity ADC	
8.	Christopher Chengo	Irrigation office Kilifi	
9.	Mr. Duncan Okoth	NEMA, Kilifi	
10.	Mr. Edward	Kilifi C.G.E.O	
11.	Mr. Mwaimu Menza	CEC Agriculture	
12	Ayub Kazungu	Village Elder	
13	Mathias M. Mae	Kudu Camp	
14.	Oscar Bertozi	Kiboko Camp	
15.	Justus Fondo	Kalulu Camp	
16.	Shadrack Galgalo	Kalulu Camp	
17.	Oscar Kambi	ADC Galana Dispensary	
18.	Stephen Munga	Buffallo Camp	
19.	Josphine Kapaya	Kiboko Camp	
20	Hashim Saidi	Sabara Camp	
21	Hashim Saidi	Kudu Camp	
22	Mr. Gedion M. Ombagi	DCC, Malindi	
23.	Mr. Richard Karan	DCC, Magarini	
24.	Mr. Kilson Shaya	DCC, Ganze	
25.	Mr. Shadrack Charo	DIOC PD	
26.	Raymond Fundo	Assistant Chief.	
27.	Mr. Paul Mjoroge	V.C Gathima group	

	NAME	ORGANISATON	SIGN.
28.	Kazungu Matayo	Farmer Barkaye village	
29.	Gladys Zaina Charo	Farmer Barkaye village	
30.	Jefferson Guyo	farmer Kombi village	
31.	Thomas fundo	Farmer kombi village	
32.	Priscilla kenetti	Farmer kwa pembe	
33.	Fondu kalama Ruwa	Farmer kwa pembe	
34.	Yaad Baya.	Farmer Garsemka	
35	Abdalla Ndema	Farmer Chakama	
36	Beatrice Ngalla	Farmer Chakama	
37.	Celestine Salama	Farmer Katana Hakeye	
38.	Chenge Thoya	Farmer Mchekenzi	
39.	Mistanze Kenge	Farmer Kuruma	
40.	Kazungu matano	Farmer Katsangani	
41.	Gladys Ndolo	Farmer Dirayo village	
42.	Chausiu Salim	Farmer Habura village	
43.	Mr. Taari J. R	ACC, Langobaya	
44.	Mr. Abdalla salim	KIDCs office	
45.	Mr. Kipkemboi ROP	DCIO Malindi	
46.	Mr. Assad sheyumbe	SCA Malindi	
47.	Ms. Elina Maperci	SAOSP	
48.	Mr. Ronald Mbunya	CNC	
49.	Ms. Margaret Jefwa	CDA Kilifi	
50.	Mr. Geoffrey Ku. Matayo	C.O.I	
51.	Mr. Erick OChieng	D.O Malindi prison	
52.	Mr. Kelvin Kwema	KCEFH - Malindi	
53.	Mr. Taari J. R	ACC Langobaya	