AFRICAN DEVELOPMENT BANK GROUP
GROUPE DE LA BANQUE AFRICAINE DE DÉVELOPPEMENT

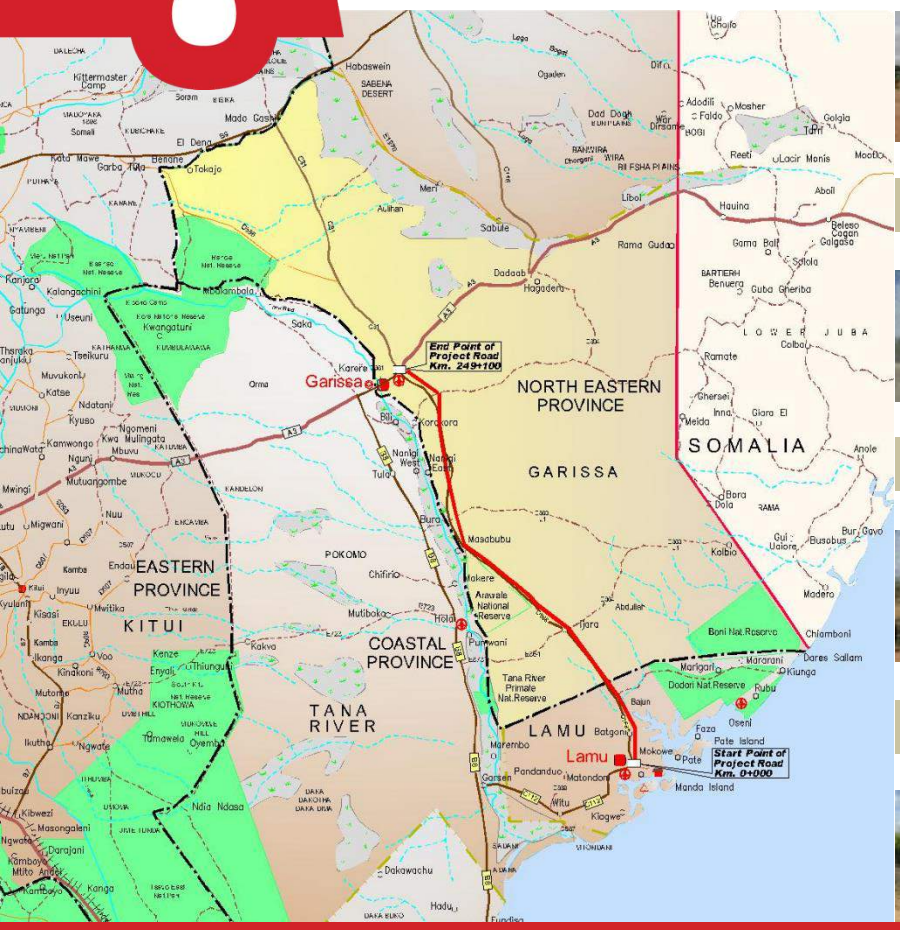
KENYA NATIONAL HIGHWAYS AUTHORITY

THE GOVERNMENT OF KENYA

April 2016

Consultancy Services for Environmental & Social Impact Assessment and Detailed Engineering Design of Lamu-Garissa Road

ESIA Study Report



SAL
SYSTRA GROUP

ESIA Study Report

Client: **Kenya National Highways Authority (KeNHA)**

Project Title: **Environmental and Social Impact Assessment and Detailed Engineering Design for Lamu Garissa Road**

Report Title: **Environmental and Social Impact Assessment (ESIA) Study Report**

We, the undersigned declare that to the best of our knowledge the information given in this ESIA Study Report is true and accurate.

The Project Proponent:

Designation	DIRECTOR GENERAL, KENYA NATIONAL HIGHWAYS AUTHORITY, BLUE SHIELD TOWERS, HOSPITAL ROAD, UPPER HILL, P.O. BOX 49712-00100, NAIROBI, KENYA.
Contacts	**TEL:** +254 020 8013842 | 020 4954000 | **CELL:** +254 0731 330336 | 0700 423606 **EMAIL:** dg@kenha.co.ke | **WEBSITE:** www.kenha.co.ke
Signature and Official Stamp	
Date	

The Consultant:

Name of Lead EIA Consultant	JENESIO I. KINYAMARIO P.O. BOX 17788-00100 NAIROBI, KENYA TEL: 0723072078 FOR **SAI CONSULTING ENGINEERS PVT. LTD.** APRICOT SUITE NO. 303,3RD FLOOR, PLOT L.R. NO.209/3356, 4TH PARKLANDS AVENUE, WANGAPALA ROAD, NAIROBI, KENYA. PHONE: +254 789 130 798 E-MAIL: kenya@saiindia.com
NEMA Registration Number	**134**
Signature	
Date	**APRIL, 2016**

ACRONYMS AND ABBREVIATIONS

AfDB - Africa Development Bank
AMCEN - African Ministerial Conference on the Environment
ARAP - Abbreviated Resettlement Action Plan
ARVs - antiretroviral drugs
ASALs - Arid and Semi-arid Lands
BP - (World) Bank Procedure
CBD - Convention on Biological Diversity
CBOs - Community Based Organizations
CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora
CSO - Civil Society Organizations
EAC - East African Community
EIA - Environmental Impact Assessment
EMCA - Environmental Management and Coordination Act
EMMP - Environmental Management and Monitoring Plan
ESAPs - Environmental and Social Assessment Procedures
ESMF - Environmental and Social Management Framework
FRAP - Full Resettlement Action Plan
GDP - Gross Domestic Product
GOK - Government of Kenya
IESIA - Integrated Environmental and Social Impact Assessment
ILO - International Labour Organization
ISPS - Integrated Safeguard Policy Statement
ISS - Integrated Safeguard System
KeNHA - Kenya National Highways Authority
KES - Kenya Shilling
KWS - Kenya Wildlife Services
LAPSSET - Lamu Port Southern Sudan-Ethiopia Transport
LAPSSETDA - Lamu Port Southern Sudan Transport Development Authority
MDGs - Millennium Development Goals
NBSAP - National Biodiversity Strategy and Action Plan
NEAP - National Environment Action Plan
NEMA - National Environment Management Authority
NEPAD - New Partnership for Africa's Development
NGEC - National Gender and Equality Commission
NGOs - Non-Governmental Organizations
NLC - National Land Commission
NMK - National Museums of Kenya
NMT - Non-motorised transport
NPEP - The National Poverty Eradication Plan
OP - Operation Policy
OS - Operational Safeguards
OSH - Occupational Safety and Health Act
PEC - Poverty Eradication Commission
PRSP - the Poverty Reduction Strategies Paper
RE - Resident Engineer
RP - Resettlement Plan
SESA - Strategic Environmental and Social Assessment
STIs - Sexually Transmitted Infections
TOR - Terms of Reference

UNCCD	- United Nations Convention to Combat Desertification
UNESCO	- United Nations Educational, Scientific and Cultural Organisation
UNFCCC	- United Nations Framework Convention on Climate Change
WB	- World Bank
WRMA	- Water Resources Management Authority
WSSD	- World Summit for Social Development

Environmental & Social Impact Assessment Study Report

Table of Contents

List of Figures

List of Annexures

Chapter 1

Executive Summary

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

1.1 Introduction

This study report is as a result of the Environmental & Social Impact Assessment (ESIA) study for the Lamu-Garissa road section of the Lamu Port Southern Sudan-Ethiopia Transport (LAPSSET) project carried out in September 2014. This report constitutes a description of possible environmental and socio-economic impacts likely to arise from the construction of the road to bitumen standard. The report consists of chapters comprising introduction; review of policy, legal and administrative framework; existing environmental conditions of the study area; public consultations; potential environmental impacts; mitigation measures, and environmental and social management and monitoring plan, and conclusions and recommendations.

The Government of the Republic of Kenya has received financing from the African Development Fund (ADF), the lending arm of the African Development Bank (AfDB), for the **Environmental and Social Impact Assessment and Detailed Engineering Design for Lamu Garissa Road** (Approximate length 250 km).

1.2 Project Background

The Lamu Port Southern Sudan-Ethiopia Transport (LAPSSET) Corridor Project was initially conceived in 1975. The project was later reviewed and included in Kenya's Vision 2030 and will involve the following components:

- Lamu Port,
- Railway line,
- Road network,
- Oil pipeline,
- Oil refinery,
- Airports (e.g. at Isiolo, Lamu), and
- Resort cities (e.g. Isiolo)

The project aims to improve access and connectivity between Kenya, South Sudan and Ethiopia. The project also intends to promote dynamic regional socio-economic development along the transport corridor especially in the Northern, Eastern, North-Eastern and Coastal parts of Kenya. Key towns in the project are Lamu, Garissa, Isiolo and Lodwar in Kenya, Juba in Southern Sudan and Addis Ababa in Ethiopia. The project road, Lamu – Garissa road, forms the initial part of LAPSSET corridor.

1.3 Objectives of the Project

The objectives of the LAPSSET Corridor Study are:

a. To identify and concretely define the dimensions of a new transport corridor complete with the above basic infrastructure meant to improve connectivity between Kenya and South Sudan and between Kenya and southern Ethiopia, stimulate commercial activities in the Northern Province as well as neighbouring countries and to some extent, beyond.

b. To evaluate and assess the future trade and transport needs and projected demand and define strategic network of transport routes and modes which will optimally satisfy the expected demand.

c. To undertake a full technical, economic and financial feasibility study on the development of the proposed Lamu Port and Manda Bay and the LAPSSET components.
d. To propose public-private partnership (PPP) options for development and implementation.
e. To advise the Government on appropriate regulatory and institutional framework to support and operationalisation of the components of LAPSSET Corridor, Lamu Port and will provide proposals for investment options, their costs and financing options.

The total width of the corridor is planned to be 200m consisting of 100m for Highway, 60m of Railway, 30m for Oil pipeline and remaining 10m for utilities. The target year for the completion and implementation of principal components such as highway, railway and pipeline is 2016 and for all components it is 2020 in tandem with Government's "Kenya Vision 2030".

1.4 Objective & Scope of the ESIA

Implementation of major projects in Kenya is preceded by the Environmental and Social Impact Assessment studies. It is a requirement to undertake the Environmental and Social Impact assessment according to the regulations stipulated in The Environmental Management and Coordination (EMCA) Act 1999 and the Environmental Impact Assessment and Audit Regulations 2003. To ensure that the above project is implemented in an environmentally and socially sustainable manner, KeNHA engaged the services of a competent Consultant to conduct an Environmental and Social Impact Assessment for the proposed project.

The proponent is required to present this ESIA Project Report to National Environment Management Authority (NEMA) for review and instruction to move to the next phase (preparation of Terms of Reference for a detailed ESIA study if required). the study report provides the following:

- Nature of project,
- The location of the project including the physical features that may be affected by the project's activities,
- The activities that shall be undertaken during the project construction and operation,
- The materials to be used, products and by-product including waste to be generated by the project and the methods of management and disposal,
- The potential environmental impacts of the project and mitigation measures to be taken during and after the implementation of the project,
- An action plan for prevention and management of possible accidents during the project cycle,
- A plan to ensure the health and safety of the workers and the neighbouring communities,
- The economic and social cultural impacts to local community and the nation in general,
- The project budget,
- Any other information that the proponent may be requested to provide by NEMA, and
- All these aspects are considered in details in this report which seeks to ensure that all the potential environmental impacts are identified and that workable mitigation measures are adopted. The report emphasizes the duties of the proponent and

contractor during the construction phase as well as the operation phase of this project.

1.5 Location of the Project

The project road, Lamu – Garissa road, forms the initial part of LAPSSET corridor. Lamu – Garissa ("Project Road") is situated at the Eastern Coastal region of Kenya and is a section of LAPSSET Corridor, having total length of about 250 Kilometre. The project road lies between 40°54'44.02"E to 39°39'30"E longitude and 2°17'27.847"S to 0°27'25"S latitude. The project road falls under the Lamu and Garissa Counties.

The road starts at Mokowe (GPS: 2◦14'S, 40◦50'E) and traverses on the eastern side of River Tana following, in some of its sections, the existing D568 Road through the trading centres of Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Nanighi, and Korakora before terminating at Junction (A3/C81), 13kms from Garissa town called as Modika (GPS: 0◦25"S, 39◦40'E).

1.6 Environmental and Socio-economic Description of Project Road

Lamu County is located in the former Coast Province of Kenya. Its county headquarters is Lamu town. The county covers a strip of north-eastern coastal mainland and the Lamu Archipelago. Lamu County has a population of 101,539 (2009 census) and its land area is 6497.70 km². Lamu Town on Lamu Island is Kenya's oldest continually inhabited town, and was one of the original Swahili settlements along coastal East Africa. Lamu town is situated 341km northeast of Mombasa. Lamu town is also a UNESCO world heritage site. Lamu is the gateway to the "LAPSSET Corridor"; a road, rail and pipeline network that will link Kenya, South Sudan and Ethiopia to improve accessibility and connectivity as well as to simulate economic activities.

Garissa County is found in the former North Eastern Province of Kenya. Its capital and largest town is Garissa. The whole county has a population of 623,060 and an area of 45,720.2 km². Garissa town is an urban centre situated on the Tana River. It is located about 350km east of Nairobi and is linked with Nairobi and Mombasa by road. Most of the inhabitants of Garissa town are ethnic Somalis.

The climate along the project road varies as the road traverses from the coastal region of Lamu and passing through a savannah and the arid and desert terrain of Garissa. Garissa has mostly arid, desert terrain, with the temperature rises up to 38.3°C during February while the coldest season experiences temperature up to 21.2°C around July. The daytime temperature typically rises above 33°C (every day) but returns to a mild temperature every night. The amount of rainfall received in Garissa is very low with an average of 150mm to 300mm an year. On the other hand, Lamu County is very close to the Indian Ocean which contributes to its weather patterns. The average temperatures experienced is 27.3°C. The average amount of rainfall is 900mm annually. The area is usually hot and humid in most times in the years. The hottest months are January, February and March when the temperatures rise up to 38.3°C while the coldest season is experienced at around June-July during which the temperature drops up to 21.2°C.

One of the factors that contribute to the climate of project area is its proximity to the equator. This results in Garissa County experiencing high temperatures as compared to other areas far away from the equator. The amount of rainfall received in the area is very low with an average of 150mm to 300mm in a year. On the other hand, Lamu County is very close to the Indian Ocean which contributes to its weather patterns. The average temperatures experienced is 27.3°C. The average amount of rainfall is 900mm annually. The

rains are usually experienced between the months of April-July while low rainfall is received in October to December. The area is usually hot, humid and dry in most times in the years.

The predominant *in-situ* soil materials throughout the road project are fine to medium coarse silty sands, with very scarce presence of clay in many areas. The soils are generally poor, highly weathered and freely draining sandy loams on the higher ridges and sandy silt loams along stream and river margins. In the river beds there are sand and silt.

1.7 Environmentally Sensitive Areas

Tana River runs along the project road and is the only permanent natural source of water for Garissa town and the surrounding areas. Seasonal streams (laghas) provide water during the wet season for both human and livestock. National Parks (N.P.), National Reserves (N.R.) and Sanctuaries that are designated by the Wildlife (Conservation and Management) Act Cap. 376 to the west of the proposed alignment area are Tana River Primate N.R. and Arawale N.R. and the Rahole N.R. To the east of the alignment area are the Dodori and Boni national reserves.

1.8 Policy, Legal and Administrative / Institutional Framework

Implementations of major projects in Kenya are preceded by the Environmental and Social Impact Assessment studies. It is a requirement to undertake the Environmental and Social Impact assessment according to the regulations stipulated in The Environmental Management and Coordination (EMCA) Act 1999 and the Environmental Impact Assessment and Audit Regulations 2003.

To ensure that the above project is implemented in an environmentally and socially sustainable manner, KeNHA engaged the services of a competent Consultant to conduct an Environmental and Social Impact Assessment for the proposed project. The ESIA for the proposed project was undertaken simultaneously with the feasibility study of the proposed project before the project implementation so as to identify Environmental and social impacts and offer mitigation measures to the anticipated impacts.

The ESIA Study, was conducted in accordance with the legal requirement stipulated in the Environmental Management and coordination Act (EMCA) of 1999 and its subsequent supplements: the Environmental (Impact Assessment and Audit) Regulation, 2003; EMCA (Waste Management) Regulations, 2006 and EMCA (Water Quality) Regulations, 2006; EMCA (Controlled Substance) Regulations, 2007; EMCA (Noise and Vibration Control) Regulations, 2009; EMCA (Emissions Control) Regulations, 2006; EMCA (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009; EMCA (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006; the Land Acts, Water Act, Irrigation Act among other pertinent legal and institutional framework regulating roads development including the World Bank Safeguard Policies. The WB safeguard policies taken into consideration during project impact evaluation are Operation Policy (OP)/Bank Procedure (BP) for Environmental Assessment (4.01); OP/BP for Natural Habitats (4.04); OP/BP for Forests (4.36); OP/BP for Pest Management (4.09); OP/BP for Indigenous People (4.10); OP/BP for Physical Cultural Resources (4.11); OP/BP for Involuntary Resettlement (4.12); OP/BP for Projects on International Water Ways (7.50), and OP/BP for Public Disclosure 17.50. This report also took into consideration the five African Development Bank's operation safeguards (namely, Operational Safeguard (OS 1): Environmental and Social Assessment; Operational Safeguard (OS 2) - Involuntary Resettlement; Operational Safeguard (OS 3) - Biodiversity and Ecosystem Services; Operational Safeguard (OS 4) - Pollution Prevention and Control, Greenhouse

Gases, Hazardous Materials and Resource Efficiency; Operational Safeguard (OS 5) - Labour Conditions, Health and Safety.

1.9 Anticipated Impacts from the Project

Anticipated impacts are both positive and negative (see **Table 1.1**). The following are the anticipated impacts from the road project.

The construction works will contribute towards poverty reduction in the affected areas through increased disposable incomes realized from employment of skilled and unskilled local labour, spending by the road contractor(s) as well as road users on purchase of supplies (consumables and road construction materials, e.g. gravel, etc.) and accommodation services. Upon completion of the project, the following benefits area envisaged

Positive impacts

(i) Reduced Travel Time
(ii) Improved marketing of agricultural produce,
(iii) Stimulation of regional commerce,
(iv) Employment of locals during construction,
(v) Accessibility to administrative and commercial centres,
(vi) Lower vehicle operating costs,
(vii) Opening up the region for other opportunities and accelerated development,
(viii) Improved road safety and comfort,
(ix) Reduced losses of perishable agricultural produce,
(x) Overall efficient transportation for people and goods,
(xi) Stimulation of urban and industrial growth,
(xii) Efficiency in provision of health and other services,
(xiii) Improved security in the region, and
(xiv) Faster provision of security by security agencies.

Negative impacts

The study found that many potential negative impacts are generally minor in significance and duration. Many of these are associated with the construction and operation phases of the project:

Construction Phase

(i) Considering the terrain's physiography or topography and soil types there is possibility of land degradation through soil erosion that may also lead to increase in sediment loads in the few streams found in the area,
(ii) Generation of dust, noise and ground vibrations, especially near urban centres and institutions,
(iii) Water resources pollution,
(iv) Loss of vegetation from material sites as well as limited removal from the road corridor,
(v) Drainage problems at major centres due to the predominant flat nature of the topography of the area,
(vi) Some degree of impact of flora and fauna due to clearance of project areas and sites during the construction phase,
(vii) Social disruption of people due to re-alignment of the road,
(viii) Conflicts over access to opportunities, and
(ix) Health concerns among construction workers and the local population from communicable diseases (for example HIV/AIDS and STIs).

Operation Phase

(i) Increased road accidents due to speeding,
(ii) Animal kills, and
(iii) Social disruption of people due to re-alignment of the road (and will need a Resettlement Action Plan),
(iv) Increased burning of charcoal and cutting of trees for firewood, and
(v) Increase in communicable diseases (for example HIV/AIDS and STIs), prostitution and crime rates.

1.10 Mitigation Measures for Negative Impacts

Mitigation measures have been suggested to reduce the effects negative impacts on the environment including:

Construction Phase

(i) Minimization of vegetation clearance to the basic minimum,
(ii) Watering the road to reduce dust,
(iii) Filling borrow pits and quarries to reduce incidences of mosquitoes and malaria and accidents to people and animals,
(iv) Adequate compensation for any acquired land and property,
(v) Cementing road drains to reduce road side erosion, and
(vi) Public awareness and education on the local population and project workers on such communicable diseases (for example HIV/AIDS and STIs).

Operation Phase

(i) Re-vegetation of cleared areas,
(ii) Discourage firewood cutting and charcoal burning,
(iii) Erection of road warning signages and bumps to reduce traffic speeds and accidents (especially in the close proximity of urban areas), and
(iv) Erection of underpasses and overpasses to facilitate animals and human crossings.

Table 1.1 : Summary of Impacts and Mitigation Measures

Construction Phase		
Sr. No.	**Impact**	**Proposed Mitigation Measures**
01	Air quality	• Water sprinkling to reduce the dust at construction site and near settlements. Sprinkle water twice a day or more when visual inspection indicates excessive dust. • Use of dust masks and goggles to operators and those working in dusty areas. • Construction machines / equipment's shall be well maintained to ensure total fuel combustion. • All the vehicles shall be frequently checked and serviced during the whole construction period so that the level of exhaust emissions is reduced. • Movement of vehicles should be kept to minimum necessary for completing the job and prohibit unnecessary idling of vehicles. • Cover all trucks hauling materials particularly sand. • Limit the speed of the vehicles to 40 kph or by placing speed bumps especially in busy areas. • Sensitise workforce. • Water should be sprayed during the construction phase on excavated areas, deviations routes, and temporary access roads leading to borrow pits, and asphalt mixing sites.

Construction Phase		
Sr. No.	**Impact**	**Proposed Mitigation Measures**
		• Water spraying on in-filling subgrade materials to moisten the material and to assist in their compaction. After compaction, water spraying should be regular to prevent dust. • Sensitise motorists/road users. • To avoid toxic fumes, residences should be at least 500 m from windward side of asphalt mixing sites.
02	Wildfires	• Install warning signs not light fires.
03	Soil erosion	• Controlled earthworks to prevent unnecessary loosening of soils. • Install drainage structures properly. • Install erosion control measures. • Landscape embankments and re-vegetate gravel sites. • Management of excavation activities. • Damaged drainage systems should be rebuilt or rehabilitated by suitable methods. • Regular maintenance to ensure efficiency of erosion control measures.
04	Noise and vibrations	• Where the noise levels is beyond 85 dB (A), ear muffs or plugs shall be provided to all those working within the construction equipment area including the operators. • Equipment shall be well maintained or fitted with noise silencers such as mufflers. • Select a site for machinery not too close to residential premises • During construction at site, the contractor should only work during the normal hours (especially activities involving noise) so that the residents living along the project road are not disturbed during sleeping and resting hours. • Control the speed of road construction equipment in residential areas • Noise reduction technologies - silencers/mufflers and provision of hearing protection devices for workers using equipment such as power saws (for vegetation clearing) and compressors. • Strict observance of the established way leaves or right of way to avoid unnecessary disturbance to other land users.
05	Vegetation clearance and Loss of Ecology	• Control clearing – avoid unnecessary clearing of vegetation. • Replant areas where vegetation is unnecessarily removed. • Landscaping and planting all disturbed areas (pits, deviations, embankments, camp sites). • Planting and grassing should be done just before the rains. • Ban Contractor's personnel from hunting bush-meat and firewood • Control clearing – avoid unnecessary clearing of vegetation. • Replant areas where vegetation is unnecessarily removed. • Landscaping and planting all disturbed areas (pits, deviations, embankments, camp sites). • Planting and grassing should be done just before the rains.
06	Garbage or Solid Wastes	• Garbage will be disposed-off periodically from labour camps. • Sufficient measures will be taken in the construction camps, i.e. provision of garbage bins and sanitation facilities. If septic tanks are installed, waste will be cleared periodically. • The Contractor to develop waste management plans and provide appropriate facilities for their operations. • Prepare signed agreements with landowners where spoil earth is to be disposed indicating conditions and responsibilities for restoration and management.

Construction Phase		
Sr. No.	**Impact**	**Proposed Mitigation Measures**
		• The spoil disposal sites should be approved by NEMA before dumping commence. • Consider re-use of used/waste asphalt concrete for public access roads in the neighbouring urban areas.
07	Resettlement	• A resettlement Action Plan shall be given. • Resettlement of people and shifting of properties and utilities where applicable
08	Water pollution	• Works on culverts to be done in the dry season. • Solid waste at construction camps, and equipment maintenance workshops should not be dumped in or near any water bodies (rivers, streams, etc.) along the project road or area of influence. • Proper handling, storage and disposal of oil and oil wastes. • Proper disposal of wastewater / sewage at Contractor's/ workmen's camps.
09	Oil pollution	• Proper storage, handling and disposal of oil and oil wastes • Maintain plant and equipment. • Maintenance works of construction vehicles should be carried out at the Contractor's camp. • Proper handling, storage and disposal of oil and oil wastes.
10	Hydrology and water quality degradation	• Clearing the project sites of excavated materials and protect excavated sections from storm water. • Avoid excavation through flood plains or into stream banks. • Create proper channels for waste water and solid waste disposal. • Develop emergency measures and procedures for protection of soils and streams downstream. • Design adequate culverts to accommodate peak flows. • Stabilize cut-surfaces with gabions, concrete walls, vegetation etc. • Identify locations with sub-surface water streams before cutting, direct all surface runoff into existing natural drains and stabilize the drains downstream, culverts and drains to accommodate peak runoff from the catchments. • Excavations should not encroach onto streams, flood plains, stream banks or springs. • Install drainage structures properly. • Regular maintenance to ensure efficiency of erosion control measures.
11	Occupational Health and Safety Issues	• Provision of security and insurance of both personnel and equipment. • Train and develop capacity especially for inexperienced labourers/workers or newly purchased equipment's. • Provide appropriate personal protective equipment, as well as ensuring a safe and healthy environment for construction workers as outlined in the EMP. • Compensate for losses and injuries. • Evaluation of risks. • Inform community members along project route on project schedule and activities, workers should be trained on health and safety procedures. • Reflective signage should be installed for safety of road users, keep public away from material sites. • Inform people living at/near the sites that the pits have been selected for exploitation. • Plan access to gravel sites.

Construction Phase		
Sr. No.	**Impact**	**Proposed Mitigation Measures**
		• Control and restrict access to gravel sites (e.g. by fencing). • Control earthworks. • Proper management of excavation activities. • Rehabilitate (Landscape, water pans, terracing, and grass sites) old and new gravel pits. • Provide adequate stream crossing to enhance safety (especially within the settled parts). • Areas populated by wild animals should be marked and communicated to construction workers. • Collaborate with Kenya Wildlife Service (KWS) for safety aspects within conservation areas and their buffer zones, provide appropriate slip roads in towns and bus stops for enhanced road safety.
12	Increase in HIV/AIDs Infection Incidences	• Provision of voluntary counselling and testing for HIV/AIDS to incoming construction personnel. • Strengthen advocacy through awareness training in HIV/AIDS and other STIs; • Encourage the use of preventive measures like condoms by availing condom dispensers to construction staff. • Sensitization and awareness campaign in the communities along the project road
13	Increased Water Demand	• Efficient use of water by sensitizing construction staff to avoid irresponsible water use. • Installation of water-conserving automatic taps and toilets within the site camps • Repair promptly any water leaks through damaged pipes and faulty taps by qualified staff • Contractor will liaise with WRMA (Water Resource Management Authority) in locating points where boreholes may be drilled for water and their use
14	Pollution due to Solid and Liquid Waste Generation	• The Contractor to develop waste management plans and provide appropriate facilities for their operations. • The spoil disposal sites should be approved by NEMA before dumping commence. • Dispose the spoil materials into the numerous borrow pits located along the project road before they are restored. • Encourage and reward employees who show good practice of solid waste management. • Ensure that all machinery working on site are not spilling lubricant., • No refuelling or repairing the machinery within 75m of the water source. • Use drip pans when leakage is noted on any standing machinery. • Ensure all waste water is treated to meet the discharge limit.s • Sufficient measures will be taken in the construction camps i.e. provision of garbage bins and sanitation facilities. If septic tanks are installed, waste will be cleared periodically. • Prepare signed agreements with landowners where spoil earth is to be disposed indicating conditions and responsibilities for restoration and management. • The spoil disposal sites should be approved by NEMA before dumping commence. • Sort waste according to their type and quality.

Construction Phase		
Sr. No.	**Impact**	**Proposed Mitigation Measures**
		• Decomposable waste can be buried on sanitary landfills and recyclable materials can be sent to the recycling stations such as used spare parts and written off or worn-out construction equipment and spare parts can be sent to foundries where metal scraps are melted to produce other materials such as reinforcing metal bars, hoes, machetes etc. • Consider re-use of used/waste asphalt concrete for public access roads in the neighbouring urban areas
15	Interference of Physical Cultural Resources	• Ensure that in communities where graves are likely to be affected by the project, these sites are to be avoided as much as possible through consultations with individual home owners.
16	Interaction and conflicts with other Cultures	• Develop programmes to enhance cohesion between project employees and the local community.
17	Interference with Community livelihoods	• Communities should be informed of intended roadwork activities, including likely dates for commencement and completion of works. • Warning signs should also be introduced on the approach to market/settlement areas. • Construction camp(s) should not be located at isolated points along the road where they will attract periphery businesses, and provide a nucleus for the growth of unplanned settlements. • Resettlement of people and shifting of properties and utilities where applicable. • Promote the participation of displaced people in the resettlement planning and assist displaced persons in their efforts to improve or at least restore their incomes and standards of living after displacement.
18	Disruption of socio-economic activities	• Employment of locals and their considerations in job allocations especially for activities requiring unskilled labour. • Resettlement of people and shifting of properties and utilities where applicable.
19	Deviations	• Install well planned deviations. • Adhere to road reserve if possible. • Obtain permission from inhabitants if deviation goes beyond right of way. • Reinstate deviations (and old tracks) to original condition. • Proper management of traffic along deviation. • Pay compensation for crops/property removed/destroyed by deviations on inhabited land.
	Fuel	• Energy sources should be identified so as not to put a strain on the local resources. • Use of firewood/charcoal to be prohibited; alternatives such as kerosene and gas should be exploited.
20	Wildfires	• Install warning signs, e.g “DO NOT LIGHT FIRES”.
	Climate change impacts (carbon dioxide, methane, nitrous oxide and fluorocarbons, principally from	• Afforestation programme based on indigenous tree. • Planting of grass on road reserve.

Construction Phase		
Sr. No.	**Impact**	**Proposed Mitigation Measures**
	the burning of fossil fuels, forest destruction and agriculture)	
Post-Construction (Operation) Phase		
21	Decommissioning of Construction Installations	• Proper removal of construction camps. • Rehabilitation of material sites. • Maintenance of proper materials batching yards. • Clean up-up at fuelling yards.
22	Soil erosion	• Plant shrubs and trees along road and on approach to the towns (e.g. *Acacia* that occur locally in the area).
23	Changes in hydrology /impeded drainage	• Install drainage structures properly • Efficiency of drainage structures
24	Separation of Communities as well as Inaccessibility to Market Centres and other Social Amenities/ Services	• Provisions for foot bridges and flyovers in areas where the railway line cuts through communities to aid in access to amenities on either side of the road. • Educate the public on use of road crossings to ensure the crossing provisions are used.
25	Accidents involving wildlife and livestock	• Construct underpasses and overpasses at strategic points for animal crossing.
26	Flooding and Surface run off	• Well-designed drainage system and re-afforestation of affected catchment areas to minimize such impacts.
27	Ensuring efficient solid waste management	• Recycling, reuse and compositing of the waste. • Waste handling facilities such as waste bins for holding waste generated to be provided along the road corridor, especially at market centres. • Put in place a well-integrated solid waste management system.
28	Permanent changes to traffic routes	• Provision of dedicated underpasses/overpasses at strategic locations throughout the corridor to ensure free movement of people and animals • Appropriate signage and information will be provided.
29	Road Safety	• Install warning signs and speed bumps on approach to the towns and settlements • Provide parking bays for heavy goods vehicles and public transport vehicles • Enforce speed limits • Enforcement of traffic Act • Install warning signs and speed bumps on approach to the towns and settlements • Provide parking bays for heavy goods vehicles and public transport vehicles • Enforce speed limits • Enforcement of traffic Act

Construction Phase		
Sr. No.	**Impact**	**Proposed Mitigation Measures**
Decommissioning Phase		
30	Decommissioning of road	• Preparation new ESIA can be instituted or an environmental and social management plan can be prepared depending on the degree of rehabilitation.

1.11 Public Consultation

Participation of Project Affected Persons (PAPs) is an important component in the efforts of identifying impacts and designing of the Resettlement and Rehabilitation Plans. The public consultation for the project was carried out with the PAPs, key Stakeholders, NGOs and public representatives in the project area especially in identifying the impact categories, magnitude of compensation package and livelihood restoration options. Care was taken to allow for greater participation of the marginalized and vulnerable groups among the PAPs

The consultants in collaboration with the respective leaders organized and facilitated PAPs consultation. During the consultations forum, local leaders, faith based organizations and PAPs participated in the discussions. Overall, 481 persons attended the meetings as shown in **Table 1.2** below

Table 1.2 : Summary of Meetings Attendance

Location	Dates	No. of Persons	Representation	Remarks
Lamu County				
1. **Roka**	23rd September, 2014	114	Chiefs, Ass. Chief, Local leaders, PAPs, FBOs, Sub-County and ward Administrators	The meetings were held in the villages with the support of local administration. In some villages like Bargoni, several meetings were held in order to develop consensus on modes of compensation especially on issues of land.
2. **Bele bele**	23rd September, 2014	8	Chiefs, Ass. Chief, Local leaders ,PAPs, FBOs Sub-County and ward Administrators	
3. **Bobo**	23rd September, 2014	25	Chiefs, Ass. Chief, Local leaders, PAPs FBOs, Sub-County and ward Administrators	
4. **Bargoni**	8th November, 2014	51	Chiefs, Ass. Chief, Local leaders, PAPs, FBOs Sub-County and ward Administrators Chiefs, Ass. Chief, Local leaders ,PAPs, Sub-County and ward Administrators	
5. **Hindi**	7th November, 2014	56	Chiefs, Ass. Chief, Local leaders, PAPs, FBOs Sub-County and ward Administrators	
Garissa County				
6. **Ijara**	9th November, 2014	99	Chiefs, Ass. Chief, Local leaders, PAPs, FBOs Sub-County and ward	In Garissa County, Ijara town

Location	Dates	No. of Persons	Representation	Remarks
			Administrators and community	attendants were from two separate sub locations.
7. **Masabubu**	22nd April,2015	8	Chiefs, Ass. Chief, Local leaders, PAPs, Sub-County and ward Administrators	
8. **Mondika**	23rd April,2015	5	Chiefs, Ass. Chief, Local leaders, PAPs, FBOs Sub-County and ward Administrators	
9. **Bura**	5th September, 2014	44	Chiefs, Ass. Chief, Local leaders, PAPs, FBOs Sub-County and ward Administrators	
10. **Bodhei**	7th November, 2014	71	Chiefs, Ass. Chief, Local leaders, PAPs, FBOs Sub-County and ward Administrators	
11. **Km 0**	20th September, 2014	Over 100 persons	This was a public barazas addressed by the ACC (Mutua, the Principal Chief and the Valuer.	The list of attendants not captured.
Total Attendance		**481**		

1.12 Specific Concerns of PAPs Associated with the Project

During the field survey, the community members were asked about their views regarding the project. In general people have very positive thinking and good hopes about the project. However, some specifics that were pointed out by the PAPs and that are in congruence with major policies are that;

- **Public Participation and Community participation -** This requires the implementation of the RAP to be carried out with the active participation of PAPs and the local stakeholders and consultation to continue at every stage of implementation of RAP process to assess the effectiveness of implementation.
- **Government Policy on Community Consultation & Participation-**Under guiding values and principles of the Land Act, every public officer must ensure democracy, inclusiveness and participation of the people in matters related to Land. Also, people should participate in determining critical land matters like land acquisition for infrastructure development.

The concerns voiced by the PAPs through public participation were captured in the preparation of the RAP by:

a) A review of the resettlement package on alternative land, initially considered appropriate alternative to payment of monetary compensation

This process captured:

a) The views expressed by the PAPs were factored in preparing the resettlement action plan;

b) A review of the resettlement alternatives presented and the choices made by PAPs regarding options available to them, including choices related to forms of compensation and resettlement assistance to sustaining existing patterns of group organization and to retaining access to cultural property (e.g. grave yards)

c) Institutionalized arrangements by which affected persons can communicate their concerns to project authorities throughout planning and implementation, and measures to ensure that vulnerable groups like indigenous people, ethnic minorities and women are adequately represented.

1.13 Environmental and Social Management Plan (ESMP)

The Environment and Social Management Plan (ESMP) presents the key management principles that will then define a scope of the plan implementation. Broad indications of the responsibilities have also been discussed along with the possible implementation constraints anticipated. It should also be noted that the ESMP is not complete in itself and continuous reviews would be necessary throughout the project implementation period.

The scope of this environmental and social management plan (ESMP) is to give guidelines to all parties involved during construction, maintenance and utilization of the road in fulfilment of environmental and social requirements.

Table 1.3 : The Proposed Environmental and Social Management Plan

a) ESMP - Construction Phase

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
1	Air quality	✓ Ensure deviations and dry materials are kept damp at all times ✓ Materials extraction under damp conditions ✓ Establish information flow process to the communities on dusty conditions ✓ Material delivery trucks to comply with established emission standards ✓ Control speed of construction vehicles ✓ Prohibit idling of vehicles ✓ Sensitize workforce ✓ To avoid toxic fumes, residences should be at least 500 m from windward side of asphalt mixing sites ✓ Water should be sprayed during the construction phase on excavated areas, deviations routes, and temporary access roads leading to borrow pits, and asphalt mixing sites ✓ In filling sub-grade water spraying is needed to moisten the material and to assist in compaction. After compaction, water spraying should be regular to prevent dust ✓ Regular maintenance of plant and equipment ✓ Impose speed limits for all vehicles, especially at the trading centres and busy junctions ✓ Sensitize motorists/road users ✓ Undertake sampling for air quality at in pre-identified locations every 6 months	✓ Contractor(s) ✓ Resident Engineer	4,000,000
2	Changes in hydrology/ Drainage; and Use of water resources	✓ Install proper drainage structures ✓ Ensure efficiency of drainage structures ✓ Consult local residents in siting of boreholes ✓ Proper and management of water usage ✓ Plan for harvesting and storage of water during rains by construction of water pans for use later ✓ Plan works schedule according to water availability ✓ Abstraction from rivers and streams are not to be done during low flow ✓ Ensure valid permits on construction water abstraction	✓ Design Engineer ✓ Resident Engineer ✓ Contractor	10,000,000

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
		✓ Groundwater abstraction be on permits conditions (locations to be identified ✓ Ensure the public at target water sources gets priority		
3	Soil erosion	✓ Control earthworks ✓ Install proper drainage structures ✓ Install soil erosion control measures ✓ Landscape embankments and re-vegetate gravel sites ✓ Plant shrubs and trees along the road and on approach to towns (e.g. *Acacia* trees that occur locally in the area) ✓ Proper management of excavation activities ✓ Damaged drainage systems should be rebuilt or rehabilitated by suitable methods	✓ Resident Engineer ✓ Contractor	3,000,000
4	Material sites	✓ Inform people living at/near the sites that the pits have been selected for exploitation. ✓ Plan access to gravel sites ✓ Control and restrict access to gravel sites (e.g. by fencing) ✓ Control earthworks ✓ Proper management of excavation activities ✓ Rehabilitate (Landscape, water pans, terracing, and grass sites) old and new gravel pits.	✓ Contractor	9,000,000
5	Vegetation cover degradation	✓ Controlled clearing – avoid unnecessary clearing of vegetation ✓ Replant areas where vegetation is unnecessarily removed ✓ Landscaping and planting all disturbed areas (pits, deviations, embankments, camp sites) ✓ Plant shrubs and trees along road and on approach to towns (e.g. *Acacia* trees that occur locally in the area) ✓ Re-vegetation to be done just before the rains Care for planted trees/other plants	✓ Contractor ✓ Resident Engineer	3,000,000
5	Noise pollution	✓ Sensitize workforce ✓ Supervise construction traffic ✓ Sensitize drivers of construction vehicles	✓ Contractor ✓ Resident Engineer	To be covered under planning and administration costs

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
		✓ Maintain plant and equipment ✓ Workers in the vicinity of high level noises to wear safety & protective gear ✓ Impose speed limits for all vehicles, especially at the towns and settlements	✓ Traffic Police	of the Contractor
6	Garbage or Solid Wastes	✓ Garbage will be disposed-off periodically from labour camps ✓ Sufficient measures will be taken in the construction camps i.e. provision of garbage bins and sanitation facilities. If septic tanks are installed, waste will be cleared periodically ✓ The Contractor to develop waste management plans and provide appropriate facilities for their operations ✓ Prepare signed agreements with landowners where spoil earth is to be disposed indicating conditions and responsibilities for restoration and management, ✓ The spoil disposal sites should be approved by NEMA before dumping commence ✓ Consider re-use of used/waste asphalt concrete for public access roads in the neighbouring urban areas	✓ Contractor ✓ Resident Engineer	5,000,000
7	Land use changes	✓ Monitor emerging land use trends along the road during construction in liaison with planning department of the county governments of Lamu and Garissa ✓ Land use planning and zoning to commence during the construction phase and enforced immediately ✓ KeNHA to encourage the local authorities on the provisions of social amenities along the corridor in light of changing social and economic development	✓ KeNHA ✓ County Governments (Lamu and Garissa) ✓ Planning Department	This is an administrative aspect and no direct costs are anticipated on this item
8	Health (Public health and occupational safety) and Safety HIV/AIDS	✓ Special attention shall be paid to the sanitary conditions of camps ✓ Sensitization campaign on STDs &HIV/AIDS will be mandatory at the camps and in the community ✓ Preventives measures like use of condoms, voluntary testing for HIV/AIDS ✓ Provide safety programmes for material sites and working areas including emergency response mechanisms ✓ Awareness, prevention and training on HIV/AIDS and other social diseases such as TB	✓ Resident Engineer ✓ Contractor ✓ Police	3,500,000 1,500,000

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
		✓ Provide wellness centres at: • The construction camp sites • Adoption of pre-identified health centres within the road corridor ✓ Provide group medical insurance and Personal Protective Equipment (PPEs) for the construction workers ✓ Provide police security to the Contractor		
9	Road safety	✓ Install warning signs and speed bumps on approach to towns and settlements ✓ Appropriate information and warning signs shall be provided along all the deviation roads for enhanced safety ✓ Enforce vehicular speed limits ✓ Monitor road accidents ✓ Enforcement of Traffic Act	✓ Resident Engineer ✓ Contractor ✓ Traffic Police	2, 00,000
10	Socio-economic/Resettlement Action Plan ✓ The estimates for the resettlement action plan (RAP) will cover land acquisition, restoration of livelihoods and other negative impacts arising within the community as a result of the road project. the cost is calculated based on the valuation of the impacted assets and	✓ Enhance collaboration with communities on construction activities affecting them through established Community Liaison Committees ✓ Provide deviations and accesses to affected premises during construction throughout the corridor ✓ The Contractor to establish and manage environmental and social initiatives to oversee mitigation measures developed under this report ✓ Ensure effective signage and information to road users, especially on deviations and construction sections with obstacles ✓ Provide safe crossings and walkways during the construction works backed up with appropriate signage ✓ Provision for community improvement services under social responsibility including health, education, water supply, sanitation, access roads, etc. ✓ The Contractor to prepare and consult on an employment plan and implement in accordance to Kenyan labour law ✓ At least 60% of employment (casuals) to involve the local population, especially the youth and women ✓ Follow-up on the implementation of RAP	✓ Contractor ✓ Resident Engineer ✓ KeNHA – CSR (corporate social responsibility) ✓ Contractor – CSR (corporate social responsibility) ✓ Property Owners, Traders and residents	593,401,883

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
	structures, and break up of the same cost is presented in Chapter-14 of Volume VIII RAP Report.			
11	Water pollution	✓ Solid waste at construction camps, and equipment maintenance workshops should not be dumped in or near any water bodies (rivers, streams, etc.) along the project road or area of influence ✓ Proper handling, storage and disposal of oil and oil wastes ✓ Proper disposal of wastewater / sewage at Contractor's/ workmen's camps ✓ Maintenance and repair of construction vehicles/plants should be carried out at dedicated areas at the Contractor's camp	✓ Resident Engineer ✓ Contractor	To be covered under planning and administration costs of the Contractor
12	Oil pollution	✓ Proper handling, storage and disposal of oil and oil wastes ✓ Maintain plant and equipment ✓ Maintenance and repair of construction vehicles/plants should be carried out at dedicated areas at the Contractor's camp	✓ Resident Engineer ✓ Contractor	To be covered under planning and administrative costs of the Contractor
13	Wildfires	✓ Install warning signs along the road not light fires near bushes as this could result in wild fires	✓ Resident Engineer ✓ Contractor	To be covered under planning and administrative costs of the Contractor

b) ESMP Post-Construction Phase

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
1	General environmental pollution	In order to comply with established environmental standards including waste management regulations: ✓ Provide public waste receptacles at strategic locations along the route (bus stops, foot bridge landings and crossing areas) ✓ Introduce clean-up responsibilities and charges for the road users (e.g. spills from accident vehicle owners) to reduce road related environmental pollutants and visual nuisance ✓ Drainage channels to be kept clear at all times to prevent overloading with polluting materials. ✓ Drainage outfalls are to be acquired and kept free of encroachments ✓ KeNHA to consider developing and enforce vehicular emission regulations in consultations with NEMA	✓ KeNHA ✓ County Governments ✓ Traffic Police	No direct costs are anticipated (this is part of the road administration).
2	Road safety ✓Increased road accidents ✓General security aspects ✓Road safety issues ✓Vandalism of safety installations	✓ Establish road safety strategies for the road complete with sensitization programmes for the road users including motorists, pedestrian, etc. ✓ Provide parking bays for heavy goods vehicles and public transport vehicles ✓ Liaise with the Traffic Police on ways to ensure compliance with road regulations ✓ Ensure maintenance of signage, crossings, speed breaks and other facilities at all times (in view of the current challenge of vandalism of road safety installations in the country) ✓ Maintain non-motorised transport (NMT) facilities (overpasses, underpasses and crossing rumps at all times) ✓ Involve community leaders and administration in ensuring usage and sustainable utilization of NMT provisions for public safety	✓ KeNHA ✓ Traffic Police Department ✓ County Governments	No direct costs are anticipated (this is part of the road administration).
3	Health ✓ Cases of HIV/AIDS and other social diseases, ✓ Dust associated infections ✓ Noise and vibrations	✓ Enhance initiatives for information and awareness as part of the road displays ✓ Organize and implement HIV/AIDS Awareness programmes along the road corridor in liaison with relevant authorities (make it a long term initiative) ✓ Maintain on corporate social responsibility (CSR) basis the wellness centres (including the VCT Services and ARVs) located within the truck parking yards and	✓ KeNHA ✓ NEMA ✓ Land Use Planning divisions within	Part of the road administration

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
		improved public health centres for long term benefits to the communities. ✓ Introduce vegetation cover (trees and shrubs) along the road reserve as noise buffer to the immediate premises close to the road ✓ Influence land use practices and building characteristics along the road for low noise conflicts (orientation, design considerations, distance from the road) ✓ Influence County Governments policy on land use planning along the corridor with among others annuals noise monitoring to influence land use practices ✓ Sensitize motorists/road users	County Governments	
4	Social Aspects ✓ Increased population ✓ Higher traffic volumes ✓ Road safety issues	✓ Collaboration with Land Use Planning departments of the County Governments to influence collaborated land use zoning ✓ Maintain in collaboration with the County Governments social facilities within the corridor including bus bays, sanitation, waste bins, roadside drains, etc. ✓ Consider collaborated emergency response facilities within proximity of the road. The wellness centres proposed earlier are appropriate for this purpose ✓ Encourage landowners close to maintain road reserve sections in front of their premises, including beautification, drainage maintenance and vegetation clearance. This will enhance ownership and responsible use of the road	✓ KeNHA ✓ County Governments ✓ Local community small scale traders	Part of the road administration
5	Economic Aspects ✓ Land use changes due to efficient transport ✓ Mixed economic activities (general trading, industrial, institutional, etc.) ✓ Involve local youth on road maintenance to enhance income and ownership	✓ Collaborations for sustainable social and economic development ✓ Maintain truck parking yards on drainage, water supply, waste collection and lighting/security ✓ Enhance income generation opportunities for the County Governments and the local communities	✓ KeNHA ✓ County Governments ✓ Local community small scale traders	Part of the road administration

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
6	Road Maintenance: ✓ Blockage of drainage and hindrance to free storm water flow ✓ Accumulating roadside litter collection ✓ Effects on road safety from inadequate facilities and signage maintenance ✓ Encroachment into the road reserve ✓ Illegal roadside land development practices	✓ Establish modalities for the involvement of the residents in the maintenance of the road ✓ Install and maintain appropriate road signs ✓ Collaborate on the control of roadside billboards that are a safety risks ✓ Maintain trash bins at strategic locations along the roads including bus stops, foot bridge landings, under pass exits	✓ KeNHA ✓ County Governments	Costs within the road maintenance budgetary allocations

c) ESMP Decommissioning Phase

Sr. No.	Type of Impact	Management Action and Target Areas	Responsibility	Estimated Costs (KES)
1	Decommissioning of Construction Installations ✓ Removal of construction camps ✓ Rehabilitation of material sites ✓ Materials batching yards ✓ Construction equipment removals ✓ Clean up-up at fuelling yards ✓ Removal of the road pavement	✓ Carry out decommissioning audits for the camp sites and seek approval of the decommissioning plans from NEMA ✓ Prepare and submit for approval by NEMA the rehabilitation and restoration plans for all materials sites used for the project (quarry sites, borrow pits and spoil dumping areas) ✓ Rehabilitate all material sites and materials preparation yards in accordance with the approved rehabilitation plans	✓ Contractor ✓ Resident Engineer ✓ KeNHA	About 6,500,000 on decommissioning audits studies and development of decommissioning plans
2	Decommissioning of road: ✓ (Any decommissioning of the road section or its components should be preceded by preparation of removal plan)	✓ Undertake a decommissioning audits of part, sections or entire road and establish appropriate measures for prevention of environmental pollution and public safety risks ✓ Apply established decommissioning plan for the removal of part of all sections of the road	✓ KeNHA ✓ Contractor ✓ NEMA for surveillance	No direct cost estimates at this stage

1.14 Project Implementation & Environmental Mitigation Measures Costs

The estimated civil cost of the project KES 28,526,457,669 with a distribution of 42.82% as local component and 57.18% as foreign component. The current estimated cost of the **ESMP is Kshs six hundred thirty eight million, nine hundred one thousand and eight hundred eighty-three (638,901,883).** 5% physical contingency cost, 4% Construction Supervision Charges , Escalation @20% and Utility shifting cost of KES 5,000,000.00 has been added and the total works out to **KES 38,156,193,718.**

1.15 Conclusions & Recommendations

The proposed Project Road is a national flagship under the Kenya Vision 2030 and is a part of LAPSSET Project corridor, The project aims to improve access and connectivity between Kenya, South Sudan and Ethiopia. The project also intends to promote dynamic regional socio-economic development along the transport corridor especially in the Northern, Eastern, North-Eastern and Coastal parts of Kenya. Key towns in the project are Lamu, Garissa, Isiolo and Lodwar in Kenya, Juba in Southern Sudan and Addis Ababa in Ethiopia.

While appreciating the benefits and positive impact associated with the project, there are negative impacts that need to be addressed and mitigated during the construction and post-construction phases. For this reason, a comprehensive environmental and social impact assessment (ESIA) study will be necessary. Equally important will be a comprehensive resettlement action plan (RAP) considering the extent of potential displacements and disruptions along the corridor during the construction.

The ultimate goal of this ESIA study was to identify impacts resulting from the proposed project that were determined on the basis of the baseline conditions to be established during the field work and information obtained from the documents reviewed. The environmental and social impact assessment study process was designed to provide a view of the environmental and social status and establishment of the diversity on physical environment, social and ecological status in the area.

Following on the above observations, the conclusions/recommendations below were arrived at;

I. Involvement of the stakeholders and public during the project implementation, and particularly during the construction and early stages of the road use would be necessary to ensure minimized social impacts.
II. The Contractor(s) will be expected to develop construction environment and social management plan in line with the one developed under this report for purposes of supervision and continuous monitoring.
III. All material sites will have comprehensive ESIA undertaken and management plans developed such as to include extraction practices, haulage and materials management rehabilitation plans.
IV. Appropriate safety audit should be undertaken for the road to guide on the implementation and usage of the road thereafter.
V. Continuous engagement of the road users and community members on safety will be necessary on the long term management of the road section.
VI. It is recommended that any planned of the project affected persons precede the construction activities and where cash compensation payments are payable, be done in accordance with the prevailing law.

VII. KeNHA should ensure that the contractor comply with the applicable gender principles; labour laws encouraging the contractor to employ women and youth in road construction and maintenance; providing safe working conditions for both women and men workers; and ensuring that all civil work contractors engaged under the project, participate in HIV prevention and road safety programmes and; that information reaches the local communities (women, men, the youth and vulnerable groups) living and working along the road corridor.

Chapter 2

Introduction

TABLE OF CONTENTS

2. INTRODUCTION

The project road, Lamu – Garissa, is located on Northern-Eastern side of Kenya. It is part of LAPSSET corridor connecting Southern Sudan, Ethiopia and Kenya. The LAPSSET corridor project aims to integrate the transport system and land use in order to improve accessibility and regional socio-economic development along the transport corridor especially in the Northern, Eastern, North-Eastern and Coastal parts of Kenya. The project road will be a gateway to the LAPSSET corridor which will provide connectivity to other parts of Kenya through railway and highway.

This report is as an Environmental and Social Impact Assessment (ESIA) study for the Lamu-Garissa road section of the (LAPSSET) Project.

The Government of Kenya (GOK), through the **Kenya National Highways Authority (KeNHA),** has set aside funds in Kenyan Shillings towards the cost of carrying out the Social and Environmental and Detail Engineering Study of Lamu-Garissa Road, a section of the LAPSSET project. The rest of the funding of the entire project will come from African Development Bank (AfDB).

2.1 Project Justification

Uganda, Kenya, Southern Sudan and Ethiopia are emerging as major industrial hubs in the eastern part of Africa. This has necessitated upgradation of existing transportation corridors and development of new routes and related infrastructure facilities. Upgradation of existing corridors have limitations of development due to presence of already existing infrastructure. Thus new transport corridors along new corridors have become necessary. In order to meet these requirements, a new transport corridor has been proposed called the **Lamu Port Southern Sudan Ethiopia Transport (LAPSSET)** Corridor. The LAPSSET corridor forms one of the links of the **Great Equatorial Land Bridge** from Lamu (Kenya) to Douala (Cameroon), through several countries.

The objectives of the LAPSSET Corridor Study are:

a. To identify and concretely define the dimensions of a new transport corridor complete with the infrastructure meant to improve connectivity between Kenya and South Sudan and between Kenya and southern Ethiopia, stimulate commercial activities in the Northern Province as well as neighbouring countries and to some extent, beyond.
b. To evaluate and assess the future trade and transport needs and projected demand and define strategic network of transport routes and modes which will optimally satisfy the expected demand.
c. To undertake a full technical, economic and financial feasibility study on the development of the proposed Lamu Port and Manda Bay and the LAPSSET components.
d. To propose public-private partnership (PPP) options for development and implementation.
e. To advise the Government on appropriate regulatory and institutional framework to support and operationalisation of the components of LAPSSET Corridor, Lamu Port and will provide proposals for investment options, their costs and financing options.

The total width of the corridor is planned to be 200m consisting of 100m for Highway, 60m of Railway, 30m for Oil pipeline and remaining 10m for utilities. The target year for the

completion and implementation of principal components such as highway, railway and pipeline was 2016 and for all components as 2020, in tandem with Government's "Kenya Vision 2030".

2.2 Project Overview

To accelerate economic development and to increase trade and accessibility between neighbouring countries of South Sudan and Ethiopia, the Kenyan government proposed a dream project called **Lamu Port Southern Sudan Ethiopia Transport (LAPSSET) Corridor** project, which is a part of **"Kenya's Vision 2030".** This flagship project will stimulate economic activities in the northern and eastern part of Kenya.

The project was initially conceived in 1975. The project was later revived and included in Kenya's Vision 2030. In 2009, the cost of LAPSSET was estimated at $16 billion. After later studies, the cost of the project was estimated between US$22 billion and US$23 billion.

This mega billion project was officially launched on 2nd March 2012 by the President Kibaki of Kenya, President Salva Kiir of Southern Sudan, and the late Ethiopian Prime Minister, Meles Zenawi.

On 1st April 2013, Kenya's government announced the setting up of a government agency, the **Lamu Port Southern Sudan Transport Development Authority (LAPSSET)** that will manage the project on behalf of the Kenyan government

The project will involve the following components:

- Port at Manda Bay, Lamu;
- Railway line (standard gauge) connecting Lamu with Juba, the capital of South Sudan, and Addis Ababa, the capital of Ethiopia.
- Road network,
- Oil pipeline (Crude oil from Southern Sudan to Lamu, Kenya and oil Products from Lamu, Kenya to Ethiopia).
- Oil refinery at Bargoni Lamu,
- Three Airports at Lamu, Isiolo and Lokichokio,
- Three Resort cities at Lamu, Isiolo and Lake Turkana.

The project further aims to improve access and enhance inter-connectivity between Kenya, South Sudan and Ethiopia. The project intends to dynamic promotion of regional socio-economic development along the transport corridor. When completed, this will be the country's second important transport corridor other than the present Mombasa port and Mombasa – Uganda transport corridor that passes through Nairobi and much of the Northern Rift. The basic aim of the LAPSSET project is to cut over-dependence on Kenya's main port of Mombasa as well as open up Kenya's largely under-developed northern frontier, through creation of a second transport corridor.

The project road, Lamu – Garissa road, forms the initial part of LAPSSET corridor. The road project under this assignment is located in the Eastern Coastal region of Kenya, running from Lamu to Garissa towards Northern direction.

2.3 Background and Rationale for ESIA Project Report

Implementations of major projects in Kenya are preceded by the Environmental and Social Impact Assessment studies. It is a requirement to undertake the Environmental and Social Impact assessment according to the regulations stipulated in The Environmental Management

and Coordination (EMCA) Act 1999 and the Environmental Impact Assessment and Audit Regulations 2003.

To ensure that the above project is implemented in an environmentally and socially sustainable manner, KeNHA engaged the services of a competent Consultant to conduct an Environmental and Social Impact Assessment for the proposed project.

The ESIA for the proposed project was undertaken simultaneously with the feasibility study of the proposed project before the project implementation so as to identify Environmental and social impacts and offer mitigation measures to the anticipated impacts. The Environmental and Social Impact Assessment (ESIA) was to achieve the following objectives:

(i) Prepare a justification of the proposed upgrading of the road with respect to social development, economic growth (local and national) and conservation opportunities.
(ii) To identify of suitable alternatives with respect to ecological, social and economic suitability as well as political acceptability.
(iii) To identify all potential significant adverse environmental and social impacts of the road works and post commissioning activities on resources utilization, agriculture, environmental conservation, health and safety and demographic patterns and recommend relevant mitigation measures,
(iv) To evaluate road construction materials' (fills and water) sources and their potential as well as human labour,
(v) To verify compliance with the environmental and social regulations and industry's standards,
(vi) To recommend cost effective measures to be implemented to mitigate against the expected impacts,
(vii) To obtain public opinion about the road project with a view to capturing major concerns and fears as well as appreciation with a view to developing appropriate interventions to create more acceptability and enhance awareness on potential values of the road,
(viii) To prepare an Environmental and Social Impact Assessment report compliant to the environmental management and coordination Act (1999) and detailing findings and recommendations

2.4 Environmental & Social Screening and Scoping

The screening process involved an initial evaluation of the project in terms of the need for EIA study and the level of assessment required. The evaluation included a checklist of requirements such as indicated under EMCA 1999. The environmental scoping or baseline information phase of the ESIA study, focused on Literature Review, observation, physical investigation and verification/analysis of field data of the entire project road. The essence of the scoping exercise that was undertaken as an initial major milestone for the ESIA and it ensured all the main issues of the study focus were identified and addressed adequately, targeting also indirect and secondary effects arising from the proposed project. Social and cultural environment focused on population, land use, planned development activities, community structure, employment and labour market, sources and distribution of income including cultural properties.

According to the EIA Regulations (Kenya Gazette Notice No. 56 of 13th June 2003), a project report is to be prepared and submitted to NEMA providing an outline of the proposed project, anticipated impacts, mitigation actions and detailed terms of reference for conducting this full ESIA Study.

This report is the product of the above exercise and provides details on the major issues observed during the study, public interviews and documentary reviews. The process involved the steps as indicated below.

2.5 The Study Approach

Both positive and negative implications of the proposed road project were identified and appropriate measures to abate any adverse effects that may emanate from the road works. Environmental and Social Impact Assessment (ESIA) was designed to ascertain the relationship between the road project and natural environment & social fabric. The study linked the project with key environmental and socioeconomic aspects and related linkages for ease of integration in the implementation of the project from the inception stage through construction, commissioning, periodic maintenance, and eventually long term use. The methodology used for this study involved five main sub-tasks:

- A review of the existing environmental conditions,
  - Relief,
  - Geology,
  - Soils,
  - Climate,
  - Hydrology, and
  - Biological resources (flora and fauna, etc.).
- Review of the existing socio-economic environment,
  - Fieldwork coupled with collection of existing data alongside interviews with a wide spectrum of members of the society, business community, professionals and selected institutions ,
  - The socio-economic study: handled as a discrete activity using a combination of recognised tools for assessing socio-economic impacts of such projects, and
  - Situation analysis on which the relationship between construction and operation of the road against human dimensions was examined.
- Identification of the anticipated impacts (both bio-physical and socio-economic),
- Identification of appropriate mitigation measures and/or design changes to eliminate or reduce the potentially adverse impacts, and
- The formulation of an environmental management, mitigation and monitoring plans.

Fieldwork for the environmental and social impact assessment study was conducted between September, 2014 and September, 2015. Data on topographical surveys, hydrology and drainage, soils and materials investigations, and condition surveys of the project road alignment were collected and analysed.

2.6 Detailed Study Methodology

This study was carried out through desk and field investigations including public consultations. The consultant conducted extensive literature review pertaining to this project. During the field investigation, reconnaissance survey was conducted to gather information on biophysical and socio-economic aspects of the area and its environs.

In order to address these issues the study team adopted a participatory approach where the immediate surrounding communities were consulted in addition to reviews and references to sources of information including legal statutes, design and relevant project documents. Among the key activities undertaken during the assessment are:

2.6.1 Documentary Review

The project documents are among key documents being reviewed. Relevant documents were reviewed to obtain information on the baseline information in general but specifically along the main route corridor. This documentary review provided further understanding of the terms of reference, national and local micro-environmental conditions, data on demographic trends, land use practices, development strategies and plans (local and national) as well as the policy and legal documents among others. Other documents included the African Development Banks social and environment safeguards.

2.6.2 Field Investigation

Preliminary site visit of the project road was carried out with specific focus on land use patterns, biodiversity, natural resources, hydrology, climatic variations, and current environmental status with respect to physical, biological and socio-cultural perspectives through the route. The objective of Field investigation was to access the exact physical environmental features to be affected within the proximity of the road route and identifying the potential positive and negative impacts of the proposed project road on surrounding environment.

2.6.3 Public and Stakeholders Consultations

Socio-economic impact assessment forums were held at the county and sub-county levels. This was done with intent to collect baseline information, for better understanding of the potential impacts and appreciate the perspectives/concerns of the stakeholders. Information gathered was used for integration in project design and formulating mitigation measures and environmental management plan.

2.6.4 Impact Assessment

Anticipated impacts that may arise from the road project was analyzed against the baseline conditions and was fully established during the detailed fieldwork and information obtained from the documentary reviews. Effects of the project to the environment and social well being was evaluated against issues such as vegetation cover, land and soil, environmental pollution, health and safety, cultural integration and overview of benefits to the residents and country.

2.6.5 Environmental Management & Monitoring Plan

The project specific Environment Management Plan has been formulated with an aim to avoid, reduce, mitigate, or compensate for adverse environmental impacts/risks and propose enhancement measures. This includes (i) mitigation of potentially adverse impacts (ii) monitoring of impacts and mitigation measures during project implementation and operation (iii) institutional capacity building and training (iv) integration of EMP with Project planning, design, construction and operation.

2.7 The Study Team

The Consultant's team was comprised of scientists with experience in carrying out environmental studies in the road sector, and are conversant with the legislative and

regulatory requirements pertinent to this assignment. The team had the following professionals:

i) Lead EIA Expert (Environmental Scientist),
ii) Civil and Design Engineers,
iii) Ecologist/Natural Resource Expert,
iv) Sociologist/Socio-Economist,
v) Surveyor, and
vi) Land Valuer.

2.8 Contents of the ESIA Report

This ESIA Report consists, following the African Development Bank format, of pertinent chapters including the following:

1) Executive Summary;
2) Introduction;
3) Policy, Legal and Administrative Framework;
4) Description of Project and Justification;
5) Description of Project Environment;
6) Analysis of Alternatives;
7) Result of the Comparison of Alternatives
8) Potential Environmental and Social Impacts;
9) Mitigation/Enhancement Measures and Complementary Initiatives;
10) Expected Residual Effects and Environmental Hazard Management;
11) Monitoring Programme;
12) Summary of Public Consultations;
13) Environmental and Social Management Plan (ESMP);
14) Institutional Capacities and Strengthening Plan;
15) Conclusion.

Chapter 3

Policy, Legal and Administrative Framework

WTABLE OF CONTENTS

3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 Introduction

The proposed project falls under the provisions of several policy, regulations, standards, national and international laws of which the project proponent and contractors need to comply with in the execution of the project.

Implementations of major projects in Kenya are preceded by the Environmental and Social Impact Assessment studies. It is a requirement to undertake the Environmental and Social Impact assessment according to the regulations stipulated in The Environmental Management and Coordination (EMCA) Act 1999 and the Environmental Impact Assessment and Audit Regulations 2003.

To ensure that the above project is implemented in an environmentally and socially sustainable manner, KeNHA engaged the services of a competent Consultant to conduct an Environmental and Social Impact Assessment for the proposed project. The ESIA for the proposed project was undertaken simultaneously with the feasibility study of the proposed project before the project implementation so as to identify Environmental and social impacts and offer mitigation measures to the anticipated impacts.

There are many environmental problems and challenges in Kenya today. Among the cardinal environmental problems include: loss of biodiversity and habitat, land degradation, land use conflicts, human animal conflicts, water management and environmental pollution.

General environmental challenges facing Kenya include:

- Weak enforcement of existing laws and regulations, unrealistic penalties, inadequate human resources to monitor and enforce regulations, and cumbersome procedures,
- Absence of discharge standards and methods for measuring the quality and quantity of effluents,
- Inadequate incentives to encourage adoption of efficient waste management technologies,
- Insensitivity of industry to the legal requirements for health and safety in the workplace,
- Low priority and status given to waste management and sanitation, and
- Inadequate training facilities for occupational health and safety services.

3.2 Environmental Policy Framework

In the recent past, policy and legislative developments have been substantially directed at redefining the role of the state with separation of policy and regulation (state responsibility) from implementation (private sector and/or statutory bodies). At the same time, there has also been movement to redefine the role of the state vis-à-vis the individual and/or community groups. The new constitution and policies such as the National Land Policy have considerably strengthened community rights. This is critically important as developments such as the proposed project components can create social conflicts with the affected communities or individuals effectively delaying the project. This implies a need to engage the affected communities from the earliest stages of project planning.

3.2.1 The Constitution of Kenya, 2010

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

(i) Equitable access to land;
(ii) Security of land rights;
(iii) Sustainable and productive management of land resources;
(iv) Transparent and cost effective administration of land; and
(v) Sound conservation and protection of ecologically sensitive areas.

Part 2 of Chapter 5 of the Constitution is dedicated to environment and natural resources. Article 69 in Part 2 provides that the state shall;

(i) Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
(ii) Work to achieve and maintain tree cover of at least ten per cent of the land area of Kenya;
(iii) Encourage public participation in the management of, protection and conservation of the environment;
(iv) Protect genetic resources and biological diversity;
(v) Establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
(vi) Eliminate processes and activities that are likely to endanger the environment; and
(vii) Utilize the environment and natural resources for the benefit of the people of Kenya.

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

3.2.2 Kenya Vision 2030

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

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

3.2.3 National Environmental Policy 2012

This National Environment Policy aims to provide a holistic framework to guide the management of the environment and natural resources in Kenya. It further ensures that the linkage between the environment and poverty reduction is integrated in all government processes and institutions in order to facilitate and realize sustainable development at all levels.

This project has the potential to pollute the atmospheric resources that sustains life through generation of atmospheric pollutants such as greenhouse gases and dust. Some of the pollutants expected to be emitted during operation of the project are, CO_2, SO_2, particulate matter among others as described in the impacts section of this report. Increasing atmospheric concentrations of various gases such as chlorofluorocarbons and methyl bromide have contributed to the depletion of the ozone layer; while others threaten to bring about climatic changes including global warming, with consequences which are detrimental to life on earth. Kenya is party to international efforts with regard to protection of the ozone layer and the control of greenhouse gases.

Though Kenya is a signatory to the Convention on Climate Change, there is inadequate legislation on the standards or management of air quality. Management is shared by a number of institutions who administer it from their sectoral concerns. The challenges facing the implementation of the policy include absence of a comprehensive policy and supporting legislation for controlling atmospheric pollution and air quality, absence of an inventory of sources of gaseous emissions, inadequate information on characteristics of gases emitted and their impact on the environment, human health, and climate, inadequate emission standards and regulations, underdeveloped early warning systems and mitigation options on the dangers of gaseous emissions and their management and inadequate institutional capacities and coordination.

3.2.4 The Land Policy 2007

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

Conservation and sustainable management of land based natural resources: The sustainable management of land based natural resources depends largely on the governance system that defines the relationships between people, and between people and resources. To achieve an integrated approach to management of land based natural resources, all policies, regulations and laws dealing with these resources shall be harmonized with the framework established by the Environmental Management and Coordination Act (EMCA),1999.

The new land policy has a vision of "efficient, sustainable and equitable use of land". It designates all land in Kenya as Public, Community or Private; "Community land" replaces the Trust Land category. It also recognizes and protects customary land rights. Recognition of community land (formally trust land under a County Council control) is provided under section 66(d)(ii) for restitution of illegally acquired as part of trust land to the affected communities and (v) for governing community land transactions using participatory processes.

Some key relevant issues:

(i) The exercise of (these) powers (compulsory acquisition and development control) should be based on rationalized land use plans and agreed upon public needs established through democratic processes (Section 43),
(ii) Ensure that the exercise of development control takes into account local practices and community values on land use and environmental management (Section 51(f)),
(iii) Ensure effective public participation in the exercise of development control (Section 51(g)), and
(iv) Strategies for sharing benefits should be developed taking into account the nature of the resources involved and the contribution that diverse actors make to the management of the resources (Section 98).

The policy also addresses land management. Key issues include Section 3.4.3.2 – ecosystem protection (including wetlands). Measures for protection are required with sub-section 135 addressing fragile ecosystems to be managed and protected. Sub-section 137 focuses on Protection of watersheds, lakes, drainage basins & wetlands shall be guided by among other principles prohibition of settlement and agricultural activities in the water catchment areas, identification, delineation and gazettement of all water courses and wetlands as well as integrated resource management based on ecosystem structure. Section 3.4.3.3 addresses urban environment management on the face of the rapid urban development in the country. The section calls for control of waste dumping, regulation quarrying activities and rehabilitation of material dumping sites and land.

3.2.5 The National Biodiversity Strategy 2007

The overall objective of the National Biodiversity Strategy and Action Plan (NBSAP) is to address the national and international undertakings elaborated in Article 6 of the Convention on Biological Diversity (CBD). It is a national framework of action to ensure that the present rate of biodiversity loss is reversed and the present levels of biological resources are maintained at sustainable levels for posterity. The general objectives of the strategy are to conserve Kenya's biodiversity to sustainably use its components; to fairly and equitably share the benefits arising from the utilization of biological resources among the stakeholders; and to enhance technical and scientific cooperation nationally and internationally, including the exchange of information in support of biological conservation.

3.2.6 National Policy on Water Resources Management and Development

The National Policy on Water Resources Management and Development (Sessional Paper No. 1 of 1999) was established with an objective to preserve, conserve and protect available water resources and allocate it in a sustainable rational and economic way. It also desires to supply water of good quality and in sufficient quantities to meet the various water needs while ensuring safe disposal of wastewater and environmental protection. The policy focuses on streamlining provision of water for domestic use, agriculture, livestock development and industrial utilization with a view to realizing the goals of the Millennium Development Goals (MDGs) as well as Kenya Vision 2030. To achieve these goals, water supply (through increased household connections and developing other sources) and improved sanitation is required in addition to interventions in capacity building and institutional reforms.

While the National Policy on Water Resources Management and Development (1999) enhances a systematic development of water facilities in all sectors for promotion of the country's socio-economic progress, it also recognizes the by-products of this process as wastewater. It, therefore, calls for development of appropriate sanitation systems to protect people's health and water resources from institutional pollution. Development projects, therefore, should be accompanied by corresponding waste management systems to handle the wastewater and other waste emanating there from. The same policy requires that such projects should also undergo comprehensive EIAs that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighbourhood and further downstream are not negatively impacted by the emissions.

3.2.7 The National Poverty Eradication Plan (NPEP) and the Poverty Reduction Strategies Paper (PRSP)

The objective of the NPEP is to reduce the incidence of poverty in both urban and rural areas by 50% by the year 2015 as well as strengthening the capabilities of the poor and the vulnerable groups to earn income. Also it aims to narrow gender and geographical disparities and create a healthy, better educated and more productive population. The plan has been prepared in line with the goals and commitment of The World Summit for Social Development (WSSD) of 1995 and focuses on the four WSSD themes of poverty eradication, reduction of unemployment, social integration of the disadvantaged people and creation of enabling economic, political, and cultural environment. This plan is to be implemented by the Poverty Eradication Commission (PEC) formed in collaboration with government ministries; community based organizations, the private sector, non-governmental organizations, and bilateral and multilateral donors. The NPEP emphasizes the empowerment of poor people and their communities to better manage their resources for collective advancement.

The PRSP has the twin objectives of poverty reduction and economic growth. The paper articulates Kenya's commitment and approach to fighting poverty, with the basic rationale that the war against poverty cannot be won without participation of the poor themselves. Any development project that incorporates these strategies in its plans is most welcome in Kenya.

3.2.8 Other Relevant Policies

The Policy on Arid and Semi-arid Lands (ASALs) identifies and promotes available opportunities for investment in under-utilized areas.

The Private Sector Development Strategy 2006-2010 focuses on improving Kenya's productivity, trade opportunities, entrepreneurship and indigenous enterprise development through adoption of modern, appropriate technologies along with other measures.
The Strategy for Revitalizing Agriculture 2004-2014 focuses on agriculture as a key sector for growth and employment, and discusses in detail the need for increased support to agro-processing industries in rural areas and improved linkages between producers, suppliers, processors and market.

The proposed project is consistent with each of these policy statements and strategies. The project proposes to develop land located in the semi-arid Zone that is currently lying dormant and degraded. If approved, the project will provide employment opportunities in an area with high levels of under employment and poverty. The proponent will work closely with the community to ensure the project is integrated into the local economy.

Draft National Wetlands Conservation and Management 2013: The draft National Wetlands policy recognizes the importance of wetlands in development and the need to conserve and protect our wetlands. The project in question has the potential of polluting the wetlands in the area as a result of oil spills. The draft policy proposes mechanisms for protecting wetlands from agricultural, industrial and municipal activities.

Section 4.6 on Pollution, Eutrophication and Salinization of the wetland policy recognizes the threat facing wetlands due to industrial activities including power generation which have often led to oil pollution and reclamation. The draft policy recognizes that the quality of many water sources in Kenya has declined as a result of municipal, agricultural and industrial wastes/ discharges. These have negatively impacted water quality and biodiversity within the wetland ecosystems thereby reducing their values. Increased nutrient loads have led to eutrophication and episodes of algal blooms in wetlands near major settlements. In certain areas excessive abstraction of fresh waters, diversions, and catchment degradation, have led to increased salinity.

The draft Policy proposes the need for effluent discharges into wetlands and (excessive) abstraction of water be strictly regulated and requires meeting laid down standards and regulations. For this to be achieved the policy will require enhanced coordination of all leading agencies dealing with natural resource management, including local authorities and agriculture. The policy proposes the following which is relevant to this study.

(a) Appropriate measures shall be taken to protect riverbanks and lakeshores,
(b) Dumping of waste in wetlands shall be disallowed and disposal sites close to wetlands shall be subjected to EIA,
(c) Any effluent discharged into wetlands shall be treated to meet appropriate wastewater standards beforehand,
(d) Environmentally friendly farming techniques that reduce nutrient silt and pollutant loading in the wetlands shall be promoted,
(e) Public awareness on proper management of waste including reduction, reuse and recycling shall be promoted, and
(f) Coordination and enforcement of sectoral laws shall be enhanced.

The draft Policy is in response to the government's responsibilities under the Ramsar Convention. The policy takes cognizance of broader national environmental frameworks, particularly the National Environment Action Plan process and the National Biodiversity Strategy and Action Plan (NBSAP), both of which put great emphasis on the need to take proper care of the country's wetlands. The Environment Management and Coordination Act (EMCA 1999), the country's premier framework environmental law, also provides for the conservation and management of wetlands.

3.2.9 National Environment Action Plan (NEAP)

According to the Kenya National Environment Action Plan, 1994 the Government recognized the negative impacts on ecosystems emanating from economic and social development programmes that disregarded environmental sustainability. In this regard, establishment of appropriate policies and legal guidelines, as well as harmonization of the existing ones, has been accomplished, while some others are in the process of development. Under the NEAP process Environmental Impact Assessment was introduced and among the key participants identified were the institutions dealing with water resources management. Chapter 4 sub-section 4.1.3 the NEAP report recommends that EIA be made a pre-condition for approval of all projects as well as post investment impact assessment for all related operations.

The Environmental Management and Coordination Act (EMCA 1999) provides for the formulation of the National, Provincial and District environmental action plans after the duration of five years. According to the NEAP Framework of 2009 – 2013, Chapter 4 addresses environmental issues mainly as a result of trade, industry and services which should gear towards achieving sustainable development. Chapter 4, sub-section 4.4.3, addresses the transport sector whose main environmental challenges are noise, air, water pollution, clearance of vegetation, solid and liquid waste disposal. It recommends the completion and implementation of air quality regulations and implementation of Noise and Excessive Vibrations Regulations, 2007 and the enforcement of EMCA 1999 and its subsidiary regulations.

3.2.10 Environment and Sustainable Development Policy (Sessional Paper No. 6 of 1999)

Among the key objectives of the Sessional Paper No. 6 of 1999 on Environment and Sustainable Development (1993) include ensuring that development policies, programmes and projects take environmental considerations into account, ensuring that an independent environmental impact assessment (EIA) report is prepared for any development before implementation and to ensure that effluent treatment standards that conform to acceptable health standards. This paper provided the basis for the environmental Policy framework that is in the process of formulation. Under this paper, broad categories of development issues have been covered that require sustainable approach.

3.2.11 Guidelines for Prevention and Control of Soil Erosion in Road Works, 2010

The main objective of the guideline is to benefit all persons engaged in the road works (engineers, consultants, constructors and supervisors) and are not informed on the extent of damages caused by uncontrolled run-off from the road corridor. It acknowledges that road works potentially result in environmental hazard through the spillage of carbon products, contaminating the surrounding land, dust and noise pollution, interference with the drainage pattern hence extensive soil erosion. The guidelines therefore focus to minimize the damages to the environment through the use of innovative construction methods and procedures which are less damaging to the environment in controlling soil erosion. The guidelines discuss several issues on the soil and water conservation principles which entail:

(i) The design and construction of water ways and soil erosion control measures in road drainage systems,
(ii) Soil erosion control measures needed in upper and lower catchment areas,
(iii) Soil erosion and their mitigation measures against anticipated damages from the road drainage discharge,
(iv) Use of vertiver grass to stabilize and heal erosion damages, and
(v) Indicative cost of soil and water conservation measures for planning purposes.

3.2.12 Environmental Guidelines for Roads and Bridges, 2010

The guideline for roads and bridges provides detailed analysis of environmental issues arising from road works along with mitigation measures that have been used in the national and the international contexts. The main focus is on simply, fulfilling the law that requires assessing the state of environment before and after the road construction period hence achieving sound environmental management for the road transportation system. It also addresses environmental practices to be followed during the development stages starting from tender, feasibility, design, construction, operation and maintenance phase. The guidelines recommend:

(i) Preparation of full EIA study to be completed at feasibility and updated at the design stage,
(ii) The certificate for environmental compliance should be issued prior to the issuance of certificate of road completion,
(iii) The guidelines are expected to be used in conjunction with existing and future regulations and guidelines developed by the government in particular NEMA, and
(iv) Emphasizes on the environmental sustainable guidelines that calls for health and Environmental quality objectives (ecosystem protection, clean air, avoiding mobility and mortality).

3.2.13 Codes, Specifications and Standards

The Standard Specifications for Road and Bridge construction has guidelines on environmental protection and mitigation. Standard Specification Clauses 116,117,125,135,137 address protection of the environment, with regard to water, health, safety and accidents, water supply, maintenance of the engineers' staff houses, offices, laboratories, and attendance upon the engineer and his staff. The provisions of these laws, standards and codes must not be contravened during project implementation, thus the provisions are largely supportive of EMCA 1999; must form part of the legal basis for environmental mitigation, avoidance, prevention, compensation, restoration and enhancement.

3.3 Institutional Environmental Framework

At present there are over twenty (20) institutions and departments which deal with environmental issues in Kenya. Some of the key institutions include the National Environmental Council (NEC), National Environment Management Authority (NEMA), the Forestry Department, Kenya Wildlife Services (KWS) and others.

The key project responsibilities for the project implementation will the Contractor due to the physical presence and direct involvement in the project. The Project Manager and the Contractor's Environmentalist and Sociologist will take the full responsibility of analysing and implementing the ESMP as provided under the Contract by customizing the recommendations to suit the established project implementation plan. The Contractor team will consult and internalize instructions received from the Supervising Environmentalist and Sociologist.

To guide the Contractor, the Supervision Environmentalist and Sociologist will be responsible of evaluating the performance on environment and social aspects with a view to issuing improvement orders through structured instructions. Joint assessments and discussions of the ESMP and compliance will be planned with the Contractors' staff leading up to monthly progress meetings where critical issues will be tabled for consideration and policy guidance.

The overall authority over the Environment and Social implementation will be the Environment Division at KeNHA. While the Supervision represents the face if the Client, the Environment Division will be in constant consultation with the Environmentalist and Sociologist for effective and logical instructions to the Contactor. The Division will also be liaising with NEMA on compliance issues. Other responsibilities will be defined in the **Table 2.1** as follows:

Table 2.1 : Organization Responsibilities

Organization	Responsibilities
Ministry of Transport	Provide policy guidance on national transportation infrastructure
Health Ministry (Department of Occupational Health and Safety)	Surveillance on the implementation of health and safety plans for the construction workers and members of public coming into contact with the construction activities.
Health Ministry (Public Heath)	• Surveillance on public health with respect to the workers and associated communities, especially in regard to HIV/AIDS and other communicable diseases, • Identify suitable linkages of the road with health facilities such as emergency access, • Advise on roadside health facilities including wellness centres.
County Governments	• Support of the project from a social and political principles • Provide land for social facilities including markets., parking areas, drainage and access roads, • Collaborate on physical planning for relevance of the improved road • Review master plans for compatibility with the improved roads
Water Resources Management Authority (WRMA)	• Control on the usage of water resources for construction and other requirements without compromising the demand for the public • Provide appropriate water abstraction permits • Ensuring non-pollution of water from the construction of water
Lands, Housing and Urban Development/ National Land Commission	• Facilitation for land acquisition • Protection of the road reserve after the construction • Initiating the process of land use zoning along the road corridor to avoid early congestion

KeNHA is one of the established road authorities which is a corporate body with perpetual succession and common seal. The highway authority has a role of management, development, rehabilitation and the maintenance of the National roads. Enactment of the Kenya Roads Act, 2007 shows Kenya National Highways Authority as one of the road agencies and their main responsibilities on the highway roads. Part II section 4 of the Act shows the functions of the authority which includes:

(i) Constructing, upgrading, rehabilitating and maintaining roads under its control,
(ii) Controlling the national roads and road reserves and access to the road side development,
(iii) Implementing of the road policies in relation to the national roads,

(iv) Ensuring adherence to the roles and guidelines on the axle load control prescribed under the traffic act (Cap. 403) and under any regulations under these act ensuring roads quality as prescribed by the minister,
(v) Monitoring and evaluating the use of national roads, and
(vi) Liaising and coordinating with other road authorities in planning and operation with respect to roads.

3.3.1 National Environment Management Authority (NEMA)

The objective and purpose for which NEMA is established is to exercise general supervision and co-ordinate over all matters relating to the environment and to be the principal instrument of the government in the implementation of all policies relating to the environment.

3.3.2 Provincial and District Environment Committees

According to EMCA 1999 No. 8, the Minister by notice in the gazette appoints Provincial and District Environment Committees of the Authority in respect of every province and district respectively. The Provincial and District Environment Committees are responsible for the proper management of the environment within the Province and District in respect of which they are appointed. They are also to perform such additional functions as are prescribed by the Act or as may, from time to time be assigned by the Minister by notice in the gazette. The decisions of these committees are legal and it is an offence not to implement them.

3.3.3 Public Complaints Committee

The Committee performs the following functions:

- Investigate any allegations or complaints against any person or against the authority in relation to the condition of the environment in Kenya and on its own motion, any suspected case of environmental degradation and to make a report of its findings together with its recommendations thereon to the Council,
- Prepare and submit to the Council periodic reports of its activities which shall form part of the annual report on the state of the environment under section 9 (3), and
- To perform such other functions and excise such powers as may be assigned to it by the Council.

3.3.4 National Environment Action Plan Committee

This Committee is responsible for the development of a 5-year Environment Action Plan among other things. The National Environment Action Plan shall:

- Contain an analysis of the Natural Resources of Kenya with an indication as to any pattern of change in their distribution and quantity over time,
- Contain an analytical profile of the various uses and value of the natural resources incorporating considerations of intergenerational and intra-generational equity,
- Recommend appropriate legal and fiscal incentives that may be used to encourage the business community to incorporate environmental requirements into their planning and operational processes,
- Recommend methods for building national awareness through environmental education on the importance of sustainable use of the environment and natural resources for national development,
- Set out operational guidelines for the planning and management of the environment and natural resources,

- Identify actual or likely problems as may affect the natural resources and the broader environment context in which they exist,
- Identify and appraise trends in the development of urban and rural settlements, their impact on the environment, and strategies for the amelioration of their negative impacts,
- Propose guidelines for the integration of standards of environmental protection into development planning and management,
- Identify and recommend policy and legislative approaches for preventing, controlling or mitigating specific as well as general diverse impacts on the environment,
- Prioritize areas of environmental research and outline methods of using such research findings,
- Without prejudice to the foregoing, be reviewed and modified from time to time to incorporate emerging knowledge and realities, and
- Be binding on all persons and all government departments, agencies, States Corporation or other organ of government upon adoption by the national assembly.

3.3.5 Standards and Enforcement Review Committee

This is a technical Committee responsible for environmental standards formulation methods of analysis, inspection, monitoring and technical advice on necessary mitigation measures.

3.3.6 National Environment Tribunal

This tribunal guides the handling of all cases related to environmental offences in the Republic of Kenya.

3.3.7 National Environment Council (NEC)

EMCA 1999 No. 8 part iii section 4 outlines the establishment of the National Environment Council (NEC). NEC is responsible for policy formulation and directions for purposes of EMCA; set national goals and objectives and determines policies and priorities for the protection of the environment and promote co-operation among public departments, local authorities, private sector, non-governmental organizations and such other organizations engaged in environmental protection programmes.

3.4 Legal Framework

3.4.1 The Environment Management and Co-ordination Act 1999

Environmental Impact Assessment (EIA) critically examines the effects of a project on the environment. An EIA identifies both negative and positive impacts of any development activity or project, how it affects people, their property and the environment. EIA also identifies measures to mitigate the negative impacts, while maximizing on the positive ones. The assessment is required at all stages of project development with a view to ensuring environmentally sustainable development for both existing and proposed public and private sector development ventures. The National EIA regulations were issued in accordance with the provisions of Environmental Management and Coordination Act (EMCA) of 1999. The EIA Regulations must be administered, taking into cognizance provisions of EMCA 1999 and other relevant national laws.

Part II of the Environment Management & Coordination Act 1999 states that every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment. In order to partly ensure this is achieved, Part VI of the Act directs

that any new programme, activity or operation should undergo environmental impact assessment and a report prepared for submission to the National Environmental Management Authority (NEMA), who in turn may issue a license as appropriate.

Part VIII section 72 of the Act prohibits discharging or applying poisonous, toxic, noxious or obstructing matter, radioactive or any other pollutants into aquatic environment. Section 73 require that operators of projects which discharges effluent or other pollutants, to submit to NEMA accurate information about the quantity and quality of the effluent. Section 74 demands that all effluent generated from point sources be discharged only into the existing sewerage system upon issuance of prescribed permit from the local authorities or from the licensee. Finally, section 75 requires that parties operating a sewerage system obtain a discharge license from NEMA to discharge any effluent or pollutant into the environment.

Section 87 Sub-section 1 states that no person shall discharge or dispose of any wastes, whether generated within or outside Kenya, in such a manner as to cause pollution to the environment or ill health to any person, while section 88 provides for acquiring of a license for generation, transporting or operating waste disposal facility. According to section 89, any person who, at the commencement of this Act, owns or operates a waste disposal site or plant or generate hazardous waste, shall apply to the NEMA for a licence. Sections 90 through 100 outline more regulations on management of hazardous and toxic substances including oils, chemicals and pesticides.

Finally the Environmental Impact Assessment Guidelines require that a study be conducted in accordance with the issues and general guidelines spelt out in the Second and Third Schedules of the Environmental Regulations (2003). These include coverage of the issues on Schedule 2 (ecological, social, landscape, land use and water considerations) and general guidelines on Schedule 3 (impacts and their sources, project details, national legislation, mitigation measures, a management plan and environmental auditing schedules and procedures.

The Proponent has commissioned this environmental impact assessment study in compliance with the Act. The environmental management and monitoring plan in this report shall be adhered to by the Proponent.

3.4.2 The Wildlife Conservation and Management Act Cap. 376, 2013

This Act provides for the protection, conservation and management of wildlife in Kenya. The provisions of this Act should be applied in the management of the project.

Part III Section 13 subsection (I) stipulates that any person who not being an officer of Kenya Wildlife Service hunts any animal in a National Park shall be guilty of a forfeiture offence and liable to a fine or imprisonment. Subsection 2 of the Act likewise provides that any person who, without authorization conveys into a National Park, or being within the area thereof, in possession of, any weapon, ammunition, explosive, trap or poison, shall be guilty of a forfeiture offence.

The Act provides that no person is allowed to use any aircraft, motor vehicle or mechanically propelled vessel in such a manner as to drive, stampede or unduly disturb any protected animal or game animal. Therefore it will be prudent that the construction workforce is conversant with the provisions of this Act.

The Contractor in collaboration with KWS, will discourage workers from hunting for game meat and location and construction of animal passes to enable wildlife to freely cross the road from one side to the other in order to reduce animals kills.

3.4.3 The Water Act Cap. 372, 2002

Part II, section 18, of the Water Act 2002 provides for national monitoring and information system on water resources. Following on this, sub-section 3 allows the Water Resources Management Authority (WRMA) to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specific records may require to be kept by a facility operator and the information thereof furnished to the authority.

The Water Act Cap. 372 vests the rights of all water to the state, and the power for the control of all body of water with the Minister, the powers is exercised through the Minister and the Director of water resources in consultation with the water catchments boards, it aims at provision of conservation of water and appointment and use of water resources.

Part II Section 18 provides for national monitoring and information systems on water resources. Following on this, Sub-section 3 allows the Water Resources Management Authority to demand from any person, specified information, documents, samples or materials on water resources. Under these rules, specific records may be required to be kept and the information thereof furnished to the authority on demand.

Section 25 of the Act requires a permit to be obtained for among others any use of water from a water resources, discharge of a pollutant into any water resource. According to section 29 of the same Act, application for such a permit shall be subject to public consultation as well as an environmental impact assessment as per the Environmental Management and Coordination Act 1999. The conditions of the permit may also be varied if the authority feels that the water so used is causing deterioration of water quality or causing shortage of water for other purposes that the authority may consider has priority. This is provided for under section 35 of the Act.

Section 73 of the Act allows a person with a license to supply water (licensee) to make regulations for purposes of protecting against degradation of sources of water which he is authorised to take. Under the Act, the licensee could be a local authority, a private Trust or an individual and the law will apply accordingly under the supervision of the Regulatory Board.

Section 76 states that no person shall discharge any trade effluent from any trade premises into sewers of a licensee without the consent of the licensee upon application indicating the nature and composition of the effluent, maximum quantity anticipated, flow rate of the effluent and any other information deemed necessary. The consent shall be issued on conditions including the payment rates for the discharge as may be provided under section 77 of the same Act.

The proposed project shall include the construction of drainage channels for the management of waste water.

3.4.4 The Lakes and Rivers Act (Cap. 409)

This Act provides for protection of rivers, lakes and associated flora and fauna. The provisions of this Act may be applied in the management of the project as there is River Tana running to the west of the project area.

3.4.5 The Forestry Services Act, 2005

The Act led to the establishment of Kenya Forest Service which is charged with management of forests in consultation with the forest owners. The body enforces the conditions and regulations pertaining to logging, charcoal making and other forest utilization activities.

To ensure community participation in forest management, the service collaborates with other organizations and communities in the management and conservation of forests and for the utilization of the biodiversity.

Section 43 subsection 1 provides that if mining, quarrying or any other activity carried out in the forest, shall, where activity concerned is likely to result in forest cover depletion, the person responsible shall undertake compulsory re-vegetation immediately upon the completion of the activity.

3.4.6 The Public Health Act (Cap. 242)

Part IX, section 115, of the Act states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires that Local Authorities take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to be injurious or dangerous to human health. Such nuisance or conditions are defined under section 118 and include nuisances caused by accumulation of materials or refuse which in the opinion of the medical officer of health is likely to harbour rats or other vermin.

Any noxious matter or waste water flowing or discharged into a watercourse is deemed as a nuisance. The Act addresses matters of sanitation, hygiene and general environmental health and safety.

The environmental management plan (EMP) advices the Proponent on safety and health aspects, potential impacts, personnel responsible for implementation and monitoring, frequency of monitoring, and estimated cost.

3.4.7 The Occupational Safety and Health Act, 2007

Before any premises are occupied, or used a certificate of registration must be obtained from the Director of Occupational Safety and Health Services. The Act provides for the health, safety and welfare for employees at workplaces. This shall be considered at the construction, implementation and decommissioning phases of the project.

3.4.8 Health

The premise must be kept clean, daily removal of accumulated dust from floors, free from effluvia arising from any drain, sanitary convenience or nuisance and without prejudice to the generality of foregoing provision. A premise must not be overcrowded, there must be in each room 10 meters of space for each employee, not counting space 4 meters from the floor and a 3 meters floor-roof height. The circulation of fresh air must secure adequate ventilation of workrooms. There must be sufficient and suitable lighting in every part of the

premise in which persons are working or passing. There should also be sufficient and suitable sanitary conveniences separate for each sex, must be provided subject to conformity with any standards prescribed by rules. Food and drinks should not be partaken in dangerous places or workrooms. Provision of suitable protective clothing and appliances including where necessary, suitable gloves, footwear, goggles, gas masks, and head covering, and maintained for the use of workers in any process involving expose to wet or to any injurious or offensive substances.

3.4.9 Safety

Fencing of premises and dangerous parts of other machinery is mandatory. Training and supervision of inexperienced workers, protection of eyes with goggles or effective screens must be provided in certain specified processes. Floors, passages, gangways, stairs, and ladders must be soundly constructed and properly maintained and handrails must be provided for stairs. Special precaution against gassing is laid down for work in confined spaces where persons are liable to overcome by dangerous fumes. Air receivers and fittings must be of sound construction and properly maintained. Adequate and suitable means for extinguishing fire must be provided in addition to adequate means of escape in case of fire must be provided.

3.4.10 Welfare

An adequate supply of both quantity and quality of wholesome drinking water must be provided. Maintenance of suitable washing facilities, accommodation for clothing not worn during working hours must be provided. Sitting facilities for all female workers whose work is done while standing should be provided to enable them take advantage of any opportunity for resting.

Every premise shall be provided with maintenance, readily accessible means for extinguishing fire and person trained in the correct use of such means shall be present during all working periods.

Regular individual examination or surveys of health conditions of industrial medicine and hygiene must be performed and the cost will be met by the employer. This will ensure that the examination can take place without any loss of earning for the employees and if possible within normal working hours.

The (OSH) Act provides for development and maintenance of an effective programme of collection, compilation and analysis of occupational safety. This will ensure that health statistics, which shall cover injuries and illness including disabling during working hours, are adhered.

The Environmental Management Plan (EMP) advices the Proponent on safety and health aspects, potential impacts, personnel responsible for implementation and monitoring, frequency of monitoring, and estimated cost.

3.4.11 HIV/AIDS Prevention and Control Act (No.14 of 2006)

Part 11, Section 7 requires HIV and AIDs education in the work place. The government is expected to ensure provision of basic information and instruction on HIV and AIDs prevention and control to; Employees of all Government ministries, Departments, authorities, and other agencies; and, Employees of private and informal sectors. The

information on HIV/AIDs is expected to be treated with confidentiality at the work place and positive attitudes shown towards infected employees and workers.

Compliance Aspect
During the road project implementation the contractor is expected to create awareness to the employees and the local communities on the issues related to HIV/AIDs

3.4.12 Physical Planning Act 1996

The Local Authorities are empowered under section 29 of the Act to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section, therefore allows for the prohibition or control of the use and development of land and buildings in the interest of proper and orderly development of an area.

Section 24 of the Physical Planning Act gives provision for the development of local physical development plan for guiding and coordinating development of infrastructure facilities and services within the area of authority of County, municipal and town council and for specific control of the use and development of land. The plan shows the manner in which the land in the area may be used.

Section 29 of the physical Planning Act gives county councils power to prohibit and control the use of land, building, and subdivision of land, in the interest of proper and orderly development of its area. The same section also allows them to approve all development applications and grant development permissions as well as to ensure the proper execution and implications of approved physical development plans. On zoning, the act empowers them to formulate by-laws in respect of use and density of development.

Section 30 states that any person who carries out development within an area of a local authority without development permission shall be guilty of an offence and the development shall be invalid. The act also gives the local authority power to compel the developer to restore the land on which such development has taken place to its original conditions within a period of ninety days. If no action is taken, then the council will restore the land and recover the cost incurred thereto from the developer. In addition, the same section also states that no person shall carry out development within the area of a local authority without development permission granted by the local authority. At the same time, sub-section 5, re-enforce it further that, no licensing authority shall grant under any written law, a license for commercial use for which no development permission had been granted by the respective local authority.

Section 36 states that if in connection with development application a local authority is of the opinion that, the proposed activity will have injurious impact on the environment, the applicant shall be required to submit together with the application an Environmental Impact Assessment report. The environmental impact assessment report must be approved by the National Environmental Management Authority (NEMA) and followed by annual environmental audits as spelled out by EMCA 1999. Section 38 states that if the local authority finds out that the development activity is not complying to all laid down regulations, the local authority may serve an enforcement notice specifying the conditions of the development permissions alleged to have been contravened and compel the developer to restore the land to its original conditions.

The Proponent has commissioned this environmental impact assessment study for purpose of approval by NEMA.

3.4.13 Urban Areas and Cities Act 2011

Section 5 states that a municipality is eligible for a city status if it has infrastructural facilities including but not limited to roads, street lights, market and fire station and an adequate capacity for disaster management. Has infrastructure that provides national and regional connectivity.

Under section 26 (b) gives power to the council of the city or large municipality to formulate and implement a master plan for urban and physical planning and infrastructural development and provision of essential services including; provision of water, sanitation, health care, education, housing, transport, disaster management systems and facilities for safe environment.

According to section 26 (c) the council is expected to exercise control over land use, land sub-division, land development and zoning by public and private sectors for any purpose including; agriculture, industry, commerce, markets, employment centres, residential, recreational parks, entertainment, passenger transport freight and the transit stations within framework of spatial and master plans for the city and municipality.

Section 44 provides for the council to form partnership on provision of social infrastructural services with companies within and outside the country. This includes; construction of roads, environment conservation and preservation, construction of health centres and promotion of tourism and cultural events**.**

3.4.14 The Registration of Titles Act (Cap. 281)

Section 34 of this Act states that when land is intended to be transferred or any right of way or other easement is intended to be created or transferred, the registered proprietor or, if the proprietor is of unsound mind, the guardian or other person appointed by the court to act on his/her behalf in the matter, shall execute, in original only, a transfer in form F in the First Schedule, which transfer shall, for description of the land intended be dealt with, refer to the grant or certificate of title of the land, or shall give such description as may be sufficient to identify it, and shall contain an accurate statement of the land and easement, or the easement, intended to be transferred or created, and a memorandum of all leases, charges and other encumbrances to which the land may be subject, and of all rights-of-way, easements and privileges intended to be conveyed.

3.4.15 The Land Titles Act (Cap. 282)

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

3.4.16 The Land Acquisition Act (Cap. 295)

The Act provides for the compulsory or otherwise acquisition of land from private ownership for the benefit of the general public. Section 3 states that when the Minister is satisfied on the need for acquisition, notice will be issued through the Kenya Gazette and copies

delivered to all the persons affected. Full compensation for any damage resulting from the entry onto land to do things such as survey upon necessary authorisation will be undertaken in accordance with section 5 of the Act. Likewise where land is acquired compulsorily, full compensation shall be paid promptly to all persons affected in accordance to sections 8 and 10 along the following parameters:

(i) Area of land acquired
(ii) The value of the property in the opinion of the Commissioner of land (after valuation),
(iii) Amount of the compensation payable,
(iv) Market value of the property,
(v) Damages sustained from the severance of the land parcel from the land,
(vi) Damages to other property in the process of acquiring the said land parcel,
(vii) Consequences of changing residence or place of business by the land owners, and
(viii) Damages from diminution of profits of the land acquired.

Part II of the Act allows for the temporary acquisition of the land for utilization in promotion of the public good for periods not exceeding 5 years. At the expiry of the period, the Commissioner of Land shall vacate the land and undertake to restore the land to the conditions it was before. Any damages or reduction of value shall be compensated to the landowners.

The proponent should commit to compensate fairly all persons whose land will be acquired/affected during implementation of this road project.

3.4.17 The Land Planning Act (Cap. 303)

Section 9 of the subsidiary legislation (The Development and Use of Land Regulations, 1961) under this Act requires that before the local authorities submit any plans to then Minister for approval, steps should be taken as may be necessary to acquire the owners of any land affected by such plans.

3.4.18 The County Governments Act 2012

The County Governments Act 2012, replaced the *Local Authority Act (Cap. 265)* after the coming into effect of the New Constitution of Kenya. It created county governments instead of the former districts. The functions of county governments include inter alia running of the sub-counties (former districts), wards, municipals and townships in their area of jurisdiction. Sections 48 and 49 give the structure of the decentralised units and urban areas and cities structures. County governments are mandated, among others, to:

a) the development of policies and plans,
b) service delivery,
c) developmental activities to empower the community,
d) the provision and maintenance of infrastructure and facilities of public services;
e) the county public service, and
f) facilitation and coordination of citizen participation in the development of policies and plans and delivery of services.

3.4.19 The Building Code 1968

Section 194 requires that where sewer exists, the occupants of the nearby premises shall apply to the local authority for a permit to connect to the sewer line and all the wastewater must be discharged into sewers.

3.4.20 The Kenya Roads Act 2007

KeNHA is one of the established road authorities which is a corporate body with perpetual succession and common seal. The highway authority has a role of management, development, rehabilitation and the maintenance of the National roads. Part II section 4 of the Act shows the functions of the authority which includes:

(i) Constructing, upgrading, rehabilitating and maintaining roads under its control,
(ii) Controlling the national roads and road reserves and access to the road side development,
(iii) Implementing of the road policies in relation to the national roads,
(iv) Ensuring adherence to the roles and guidelines on the axle load control prescribed under the traffic act (Cap 403) and under any regulations under these act ensuring roads quality as prescribed by the minister,
(v) Monitoring and evaluating the use of national roads, and
(vi) Liaising and coordinating with other road authorities in planning and operation with respect to roads.

Compliance Aspect
Enactment of the Kenya Roads Act 2007 shows Kenya National Highways Authority) as one of the road agencies and their main responsibilities on the highways.

3.4.21 The Traffic Act (Cap. 403)

Section 42 Part 1 forbids any driver to drive a vehicle at a speed exceeding fifty kilometres per hour on any road within the boundaries of any trading centre, township, municipality or city: The highway authority is expected to erect and maintain traffic signs as prescribed so as plainly to indicate to drivers entering or leaving such roads or areas where the fifty kilometre per hour speed limit restriction begins and ends. Section 47 of the act states that any person who drives a motor vehicle on a road recklessly, or at a speed or in a manner which is dangerous to the public, shall be guilty of an offence and liable to a fine. Part VIII of cancelling any driving license or provisional driving license held by the offender and declaring the offender disqualified for holding or obtaining a driving license for such period as it thinks fit.

Section 52 Part 1, The driver of the vehicles are expected at all times to obey directions given by the police officer whether verbally or in signal, conform to the indications given by any traffic sign, and when any person in charge of any cattle raises his hand or in any manner signalling to stop, and keep it stationary for as long as it is reasonably necessary.

Section 52 A forbids any person who, being the driver of a vehicle from leaving the vehicle for a period in excess of the time, failing to comply with any traffic sign or leaving the vehicle in contravention of any traffic sign in any parking bay or parking area. Section 71, gives permission to the authority or the authority representative to close the roads for purpose of preventing damage caused to any road, carry out any works considered necessary in connection with maintenance/improvement of road or close whole or part of road to vehicles of particular type at any time for any period.

Under the Traffic sign rules part 13, temporary traffic sign signal unit may be used for purposes of controlling the movement of vehicles on the road where the road works are in progress or where the width of the carriageway is temporary restricted.

3.4.22 The Public Roads and Roads Access Act (Cap. 22)

Section 8 and 9 of the Act provides for the dedication, conversion or alignment of public travel lines including construction of access roads adjacent lands from the nearest part of a public road. Section 10 and 11 allows for notices to be served on the adjacent landowners seeking permission to construct the respective roads.

3.4.23 The Penal Code Act (Cap.63)

Section 191 of the penal code states that if any person or institution that voluntarily corrupts or foils water for public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence. Section 192 of the same Act says a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons /institution, dwelling or business premises in the neighbourhood or those passing along public way, commit an offence.

The Proponent shall observe the guidelines as set out in the environmental management and monitoring plan in this report as well as the recommendation provided for mitigation / minimisation /avoidance of adverse impacts arising from the project activities.

3.5 Relevant Environmental Regulations

3.5.1 Waste Management Standards (Legal Notice 121: The Environmental Management Coordination (Waste Management) Regulations)

The regulation provides that a waste generator shall use cleaner production methods, segregate waste generated and the waste transporter should be licensed. The notice further states no person shall engage in any activity likely to generate any hazardous waste without a valid Environmental Impact Assessment licence issued by the National Environment Management Authority.

Hazardous waste will not be generated from this development. The project proponent will ensure that waste is segregated and a licensed waste transporter is contracted to disposed solid waste.

3.5.2 Waste Management Standards (Legal Notice 120: The Environmental Management Coordination (Water Quality) Regulations)

This Legal Notice on Water Quality provides that anyone who discharges effluent into the environment or public sewer shall be required to apply for Effluent Discharge License. The license for discharge is KES 5,000 while annual license fee for discharge into the environment will be KES 20,000 or KES 100,000 depending on the facility. Non-compliance with the regulations attracts a fine not exceeding KES 500,000 and the polluter pay principle may apply depending on the court ruling. **Table 3.1** below give NEMA Waste Water Discharge Guidelines.

Table 3.1 : NEMA Waste Water Discharge Guidelines

Parameter	Units	Discharge into public sewers	Discharge into open water bodies
pH	-	6.0 – 9.0	6.0 – 9.0
BOD (5 days at 20° C) not to exceed	Mg/l	500	20
COD not to exceed	Mg/l	1000	50
Total suspended solids not to exceed	Mg/l	500	30
n-hexane extract not to exceed	Mg/l	Nil	30
Oils(mineral, animal & vegetable)	Mg/l	10	5
Total phenol not to exceed	Mg/l	10	2
Copper (Cu) not to exceed	Mg/l	1.0	0.05
Zinc (Zn) not to exceed	Mg/l	5.0	0.5
Lead (Pb) not to exceed	Mg/l	1.0	0.1
Arsenic (As) not to exceed	Mg/l	0.2	0.002
Total Mercury (Hg) not to exceed	Mg/l	0.05	0.005
Alkyl mercury not to exceed	Mg/l	0.01	0.001
PCB (Polychlorinated biphenyl) not to exceed	Mg/l	Nil	0.003
Pesticides residues not to exceed	Mg/l	Nil	0.05
Sulphates not to exceed	Mg/l	1000	500
Dissolved manganese (Mn)	Mg/l	-	1.0
Chromium (total)	Mg/l	1.0	0.1
Chloride not to exceed	Mg/l	1000	1000
Fluoride not to exceed	Mg/l	-	2.0
Coliform bacteria	-	-	1000/100ml
Free ammonia not to exceed	Mg/l	2.0	0.2
Sulphides (S) not to exceed	Mg/l	2.0	0.1
Cadmium (Cd) not to exceed	Mg/l	0.5	0.05
Cyanide (CN) total not to exceed	Mg/l	0.5	0.1
Organic phosphorous not to exceed	Mg/l	30	1.0
Chromium six (Cr 6) not to exceed	Mg/l	0.5	0.005
Total dissolved solids not to exceed	Mg/l	3000	1200
Selenium (Se) not to exceed	Mg/l	1.0	0.05
Nickel (Ni) not to exceed	Mg/l	3.0	1.0
Barium (Ba) not to exceed	Mg/l	10	2.0
Temperature not to exceed	-	+/- 2° of the ambient temperature of the sewer	+/- 2° C of ambient temperature of the water body
Oil/ grease	Mg/l	No trace	Nil/ no trace
Toxic substances	Mg/l	Nil	Nil
Odour	-	-	Not objectionable to the nose
Colour	-	-	Not objectionable to the eye or not to exceed 5 mg Pt/l

3.5.3 Environmental Management and Coordination (Legal Notice 61: The Environmental Management and Coordination (Noise and Excessive vibration pollution) (Control) Regulations, 2009

This regulation prohibits any person to cause unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

Part 11 section 6(1) provides that no person is shall cause noise from any source which exceeds any sound level as set out in the First Schedule of the regulations.

3.6 Multilateral Environmental Agreements

Kenya is a signatory to a number of conventions on sustainable development and is a member of various bilateral and multilateral organizations. Some of the relevant development partners in this project are African Development Bank, the World Bank and a number of United Nations agencies.

3.6.1 African Development Bank Safeguards Policies

Integrated Safeguard System (ISS)

The African Development Bank has established an Integrated Safeguard System (ISS) for a comprehensive projects review and ensuring a cross the board perspective of environmental and social linkages. The ISS comprises of four components, all that existed separately but with identifiable operational weakness. The components include:

(i) Integrated safeguard policy statement (ISPS),
(ii) Operational safeguards(OS),
(iii) Environmental and social assessment procedures (ESAPs), and
(iv) Environmental and social impact assessments (ESIAs).

Integrated Safeguard System (ISS) encompasses into five number (5NO) operational safeguards addressing the following fields:

(i) Environment,
(ii) Involuntary,
(iii) Gender,
(iv) Climate risk management and adaptation,
(v) Civil society engagement framework,
(vi) Health,
(vii) Integrated water Resources management,
(viii) Agriculture and rural development, and
(ix) Poverty reduction.

The specific safeguards are briefly described below:

Operational Safeguard 1 (OS 1)
This is the main safeguard that guides environment and social assessment as well as climate issues. The safeguard governs the process of determining a projects environment and social assessment requirement. OS is designed to identify, access and manage potential environment and social risks and impacts including climate change issues. More specifically, OS1 achieves the following:

(i) Identify and assess risks and impacts,
(ii) Avoid and/or minimize, risks and impact,
(iii) Provide for stakeholders participation,
(iv) Ensure effective management of risks and impacts, and
(v) Contribute to capacity building elements.

In the categorization requirements under OS1 – 5 are also considered as support safeguards. Under the safeguards environmental and social impacts assessment (ESIA) studies are undertaken on clearly defined projects while environmental and social management framework (ESMF) is prepared for programmes or plans with a multiplicity of uncertain projects.

Operational Safeguard 2 (OS 2)
The safeguard focuses on involuntary resettlements, land acquisition, population displacements and requirements and compensation. It consolidates the policy commitment and requirements on involuntary resettlements and incorporates improvements operational effectiveness.

Operational Safeguards 3 (OS 3)
This safeguard is designed to govern biodiversity and ecosystem services for the conservation and promotion of sustainable use of natural resources. Among the focus is on the integrated water resources management where commitments translated into operational requirements.

Operational Safeguard 4(OS 4)
OS4 governs pollution prevention and control, hazardous materials and resource efficiently. It covers a wide range of impacts arising from pollution, wastes and hazardous materials and particularly those under international conventions and regional standards. This also includes greenhouse accounting. The OS4 principles also support OS1 described above.

Operational safeguard 5 (OS 5)
Labour conditions, health and safety are a major concern in projects. The Bank therefore, has established OS 5 to address requirements concerning works conditions, rights and protection from abuse and/or exploitation.

Project Categorization

Project screening through OS 1 and in support of OS 2 - 5 leads to categorization of the project. The project categories are guided by considered linkage levels as follows:

Category 1: Bank Operations likely to cause significant environmental and social impacts
Category 1 projects are likely to induce significant and/or irreversible adverse environmental and/or social impacts, or to significantly affect environmental or social components that the Bank or the borrowing country considers sensitive. Some programme-based operations or other regional and sector programme loans that have significant adverse environmental or social risks and are deemed to be Category 1. In some cases, projects are included in Category 1 because of their potential cumulative impacts or the potential impacts of associated facilities.

Any project requiring a Full Resettlement Action Plan (FRAP) under the provisions of the Bank's policy on involuntary resettlement is also deemed to be Category 1. Category 1 programme-based operations or regional and sector loans require a Strategic Environmental and Social Assessment (SESA), and Category 1 investment projects require an ESIA, both

leading to the preparation of an ESMP. For a project requiring a FRAP, the ESIA includes, and if there are no other issues requiring assessment may be limited to, the social assessment needed to prepare the FRAP.

Category 2: Bank Operations likely to cause less adverse environmental and social impacts Than Category 1

Category 2 projects are likely to have detrimental site-specific environmental and/or social impacts that are less adverse than those of Category 1 projects. Likely impacts are few in number, site-specific, largely reversible, and readily minimized by applying appropriate management and mitigation measures or incorporating internationally recognized design criteria and standards. An operation that involves resettlement activity for which an Abbreviated Resettlement Action Plan (ARAP) is required under the ESAPs is classified as Category 2.

Most programme based operations and regional or sector programme loans designed to finance a set of subprojects approved and implemented by the borrower or client are included in this category unless the nature, scale or sensitivity of the intended pipeline of subprojects involves either a high level of environmental and social risk or no such risk. Category 2 projects require an appropriate level of strategic environmental and social assessment (SESA for programme operations, investment plans, and some corporate loans, or ESIA for investment projects) tailored to the expected environmental and social risk so that the borrower can prepare and implement an adequate ESMP (for an investment project) or ESMF (for a programme operation), to manage the environmental and social risks of subprojects in compliance with the Bank's safeguards.

Category 3: Bank Operations with negligible adverse environmental and social risks

Category 3 projects do not directly or indirectly affect the environment adversely and are unlikely to induce adverse social impacts. They do not require an environmental and social assessment. Beyond categorization, no action is required. Nonetheless, to design a Category 3 project properly, it may be necessary to carry out gender analyses, institutional analyses, or other studies on specific, critical social considerations to anticipate and manage unintended impacts on the affected communities.

Category 4: Bank operations involving lending to financial intermediaries

Category 4 projects involve Bank lending to financial intermediaries that on-lend or invest in subprojects that may produce adverse environmental and social impacts. Financial intermediaries include banks, insurance, reinsurance and leasing companies, microfinance providers, private equity funds and investment funds that use the Bank's funds to lend or provide equity finance to their clients. Financial intermediaries also include private or public sector companies that receive corporate loans or loans for investment plans from the Bank that are used to finance a set of subprojects. Financial intermediary subprojects equivalent to Category 1 and Category 2 are subject to the relevant OS requirements, as if they were directly financed Category 1 or Category 2 projects. However, if a client will use a Bank corporate loan to finance high-risk investment projects known at the time of loan approval, the loan can be considered as Category 1.

Key Environmental and Social Components

While assessment contents depend on the nature and scope of the project, plan or program, there are typical environmental and social components in the human and natural environments that should be considered.

Human Environment

The components to consider in the human environment include the elements and characteristics of the Social, Cultural and Economic environments as well as infrastructures and services and land use patterns in the project area and its zone of influence.

(i) Under the Social Environment, the Proponent must consider issues related to: population, gender, health, civil society, and societal framework,
(ii) Under the Cultural Environment, consideration should be given to issues such as: cultural heritage, customs and traditions, traditional activities, fundamental values, religious and/or ancestral beliefs, ethnic dialects, leisure, etc.; Right and use of natural resources related to cultural practices (religious sacrifices, traditional medication, etc.); Cultural factors contributing to excluding some groups from development benefits; Major concerns, opinions, interests, and aspirations of local populations; Environmental problem awareness, attitude towards nature; architectural, archaeological and landscape heritage, as well as any other heritage element protected or not by laws or regulations, and
(iii) Under Economic Environment, issues to consider include major economic activities at the local and regional levels and growth trends; Right, use and dependence on renewable natural resources; inequality patterns, economic differences and poverty determinants; Working conditions and employment situation in the region; infrastructure and services; and land use patterns.

Natural Environment

The components to consider in the natural environment include:

(i) Climate, Weather Conditions and Air Quality and regional conditions (microclimate, meso-climate or macroclimate), emphasizing aspects that may affect the project's activities,
(ii) Geology, Topography and Soil issues the local and regional levels, emphasizing vulnerable or problematic aspects of land and soils, as well as topographic characteristics which may be modified by the project.
(iii) Water and Hydrologic Cycle including surface water, ground water, near-shore waters, coastal shores and seas,
(iv) Ecosystems types, functions, protected areas and sensitive zones, integrity, interactions, conservation and protection measures,
(v) Vegetation types, characteristics, biodiversity, threats, conservation and protection measures, and
(vi) Wildlife biodiversity ecological and behavioural characteristics, threats, conservation and protection measures.

Environment and Social Impact Assessments under the AfDB Guidelines

The following provides a summary of the objectives of an ESIA in accordance with the AfDB guidelines; it presents the scope of work to be carried out and the key tasks to be undertaken during the study. Major tasks that shall be highlighted in this section because of their importance in the preparation of an ESIA include among others.

(i) Describing the proposed project by providing a synthetic description of the project relevant components and presenting plans, maps, figures and tables,
(ii) Identifying the policy, legal and administrative framework relevant to the project.

(iii) Defining and justifying the project study area for the assessment of environmental and social impacts,

(iv) Describing and analysing the physical, biological and human environment conditions in the study area before project implementation. This analysis shall include the interrelations between environmental and social components and the importance that the society and local populations attach to these components, in order to identify the environmental and social components of high value or presenting a particular interest,

(v) Presenting and analysing alternatives to the proposed project, including the "without project" option, by identifying and comparing the alternatives on the basis of technical, economic, environmental and social criteria,

(vi) For the selected alternative, identifying and assessing potential importance of beneficial and adverse environmental and social, direct and indirect, short and long-term, temporary and permanent impacts, on the basis of a rigorous method,

(vii) Defining appropriate mitigation/enhancement measures to prevent, minimize, mitigate, or compensate for adverse impacts or to enhance the project environmental and social benefits, including responsibilities and associated costs,

(viii) Developing an environmental and social monitoring program, including indicators, institutional responsibilities and associated costs,

(ix) Preparing a resettlement plan, if required,

(x) Carrying out consultations with primary and secondary stakeholders in order to obtain their views on and preoccupations about the project. These consultations shall occur during the preparation of the ESIA Report to identify key environmental and social issues and impacts, and after completion of the draft ESIA Report to obtain comments from stakeholders on the proposed mitigation/enhancement measures, and

(xi) Preparing an Environmental and Social Management Plan (ESMP). This management plan shall be presented as a distinct document from the ESIA Report.

AfDB Guidelines on Cooperation with Civil Society Organization

The AfDB considers the African civil society as a primary stakeholder and help to enhance transparency and accountability due to the need to change information disclosure policies and enhance participation of stakeholders in the bank operations. The civil society includes groups such as the; non-governmental organizations (NGOs), Community Based Organizations (CBOs), people's organization, trade unions and religion groups among others. The civil society organizations are central to the banks efforts to implement the participatory approaches especially in reaching to the poor people and women which are the priority target groups who have little influence and control over decisions and actions that affect their lives.

Africa Development Bank (AfDB) has adopted an integrated approach to environmental assessment in the so-called Integrated Environmental and Social Impact Assessment (IESIA) guidelines. The Guidelines' major objective is to provide reference material on how to adequately consider cross-cutting themes while assessing the environmental and social impacts of a project. The IESIA Guidelines assist in the project design, as many potential adverse impacts can be avoided or mitigated by modifying or adding certain project components to the initial design. They also provide guidance on how to adequately consider cross-cutting themes in both the preparation and assessment phases. The cross-cutting themes prioritized by the Bank are the following: poverty, environment, population, gender and participation. In addition, the Bank has recently adopted health priorities that are transversal issues by nature: HIV/AIDS and Malaria control. Consequently, health outcomes

are also considered as a cross-cutting theme in the IESIA Guidelines. There are several operational principles discussed in the guidelines;

(i) Gaining and providing information: The bank is expected to make available information to the public and also draw knowledge, information from them. The regional member

(ii) country authorities are expected to be responsive to the civil societies request, issues and concerns on bank supported programmes and projects,
(iii) Involvement of the civil society organizations (CSO) in policy making: The bank collaborates with the civil society organizations and the regional member country to factor in the interest of the stakeholders in both policy and project activities. The bank takes deliberate measures to remove barriers such as gender biases and other inequalities to allow effective participation,
(iv) Civil Society Participation in operation: It's the responsibility of the region member country to give responsibility to the CSO in programs financed by the bank loans,
(v) To foster effective CSO involvement the AfDB request the regional member country to provide institutional support to CSO for capacity building purposes, and
(vi) The AfDB remains optimistic and committed to effective engagement with the CSO in the future.

AfDB Policy on Poverty Reduction

Poverty is not limited to the lack of the physical resources for development, but also rooted in the inability of poor people to influence forces and decisions that shape their lives. AfDB considers the empowering of the poor people to actively participate in the development interventions for sustainable poverty reduction. The main objective of this policy is to provide a framework for action by putting the poverty reduction at the centre of bank lending and non-lending activities for the regional member country.

(i) There are several guideline principles highlighted in the policy. These include;
(ii) The bank focuses in the analysis of incidences and in-depth causes of poverty in Africa and these consequently results in formulation of policies and intervention mechanisms,
(iii) Support of national capacity building, promotion of participatory approach, development on the new forms of partnership and establishment of poverty monitoring systems,
(iv) Internal policy coherence to strengthen the existing sector policy and fill gaps in specific areas from poverty reduction,
(v) Requires a strong partnership that facilitates the consistence between the bank poverty policy and poverty reduction strategies, and
(vi) Handles the new conceptual framework that expands the concept of poverty beyond income measures and its causes; addresses the economic and non-economic causes of poverty.

African Development Bank Environment and Social Safeguards Policies

African Development Bank integrates environmental considerations into major transportation projects, i.e. those exceeding 50 km and needing major rehabilitation or upgrading. They are classified as Category I projects which require detailed ESIA investigations. The projects must meet the basic goals and objectives of AfDB environmental policies and guidelines. Further AfDB policies relevant to the project include:

AfDB Environmental Policy

AfDB policy framework on environment policy has been anchored in the concept of sustainable development. The policy stresses the anticipatory nature of sustainable development rather than the reactive responses so predominant in development related decisions.

This ESIA report for the project road was therefore carried out in consideration of sustainable development of the road project, while identifying possible negative and positive impacts on natural and human environment.

AfDB Involuntary Resettlement Policy

The primary goal of the involuntary resettlement policy is to ensure that when people must be displaced they are treated equitably, and that they share in the benefits of the project that involves their resettlement.

The objectives of the policy are to ensure that the disruption of the livelihood of people in the project's area is minimized, ensure that the displaced persons receive resettlement assistance so as to improve their living standards, provide explicit guidance to Bank staff and to borrowers, and set up a mechanism for monitoring the performance of the resettlement programs. Most importantly, the resettlement plan (RP) should be prepared and based on a development approach that addresses issues of the livelihood and living standards of the displaced person as well as compensation for loss of assets, using a participatory approach at all stages of project design and implementation.

Since the project road's alignment does not exist, disruptions to livelihoods may be experienced along the project road. Therefore a Full Resettlement Action Plan (FRAP) will be required for the project.

AfDB Environmental and Social Assessment Procedures (ESAP)

The main purpose of the Environmental and Social Assessment Procedures (ESAP) is to improve decision making and project results in order to ensure that Bank-financed projects, plans and programs are environmentally and socially sustainable as well as in line with Bank's policies and guidelines.

The primary objective of the ESAP is to provide a formal process for the internal and inter-departmental environmental and social review of Bank-financed projects, programs and plans. The procedures highlight the various steps that shall be followed to assess environmental and social risks and benefits along the project cycle.

In addition, the ESAP aim to ensure the integration of environmental and social dimensions into the public sector project cycle from country programming to post-evaluation. An integrated approach allows to take into account interrelations between environmental and social issues and to favour a multidisciplinary review of key concerns in a timely manner.

This ESIA project report for the proposed initiative complies with the AfDB ASAP main purpose and primary objectives. Impact areas and mitigation measures raised in the Environmental and Social Management and Monitoring Plan for the project are environmentally and socially sustainable---the main purpose for ESAP.

The African Development Bank categorises projects according to the appropriate type and level of environmental and social assessment and considers any project that causes significant environmental and social impacts as a Category 1 project. Any project requiring a Full Resettlement Action Plan (FRAP) under the provisions of the Bank's policy on involuntary resettlement is also deemed to be Category 1. The current project can be considered as Category 1 project as it will trigger a Full Resettlement Action Plan.

3.6.2 World Bank Environment and Social Safeguards Policies

The World Bank has well-established environmental assessment procedures, which apply to its lending activities and to the projects undertaken by borrowing countries, in order to ensure that development projects are sustainable and environmentally sound. Although its operational policies and requirements vary in certain respects, the World Bank follows a relatively standard procedure for the preparation and approval of an environmental assessment study. The World Bank Operational Policies applicable for the project will be

a. *Environmental Assessment (OP 4.01)*
    1. *Natural Habitats (OP 4.04)*
    2. *Forests (OP 4.36)*
    3. *Cultural Property (OP 11.03)*
    4. *Indigenous Peoples (OP 4.20)*
    5. *Involuntary Resettlement (OP/BP 4.12)*

3.6.3 The World Commission on Environment and Development (The Brundtland Commission of 1987)

The commission focused on the environmental aspects of development, in particular the emphasis on sustainable development that produces no lasting damage to the biosphere and to particular ecosystems. In addition to 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 is development that 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.

3.6.4 International Labour Organization

As well as conventions relating to the environment, Kenya is a signatory to various conventions established by the International Labour Organization (ILO) and has legislation dealing with employee rights. The employment act (Chapter 226 of the Laws of Kenya) fixes minimum standards of employment. The regulation of *Wages and Condition of Employment A*ct (Cap. 229 of the Laws f Kenya) creates wage fixing institutions to continuously review standards of employment on a sector-by sector basis. These Acts effectively deal with issues (such as the prohibition of forced labour, child labour and discrimination in employment) that are covered in ILO conventions which Kenya has since ratified. All Bedford employees based in Kenya will be subjected to these Acts. Convection 169 of the International Labour Organization includes consideration of land rights, requiring governments to identify lands which are traditionally occupied, and to guarantee effective protection of their rights of ownership and possession. Further it states that resettlement should only occur as an exceptional measure or with their free and informed consent.

3.6.5 The Ramsar Convention

Ramsar Convention otherwise known as the Convention on Conservation of waterfowl and waterfowl habitats was signed in the city of Ramsar in Iran in the year 1971. Kenya is signatory to the Ramsar Convention having ratified the treaty in 1974. The convention requires that contracting parties undertake to prepare wetland management plans and declare wetland areas as Ramsar conservation areas and apply guidelines that have been put out by the Convention for the conservation of such site for other wetlands but also to declare several wetlands as national parks, reserves and wetland conservation areas. The Contractor will have to adhere to these provisions to reduce and mitigate impacts on wetlands habitats in the project area, especially the Tana River Delta, which is a Ramsar site in Kenya.

3.6.6 The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)

The Convention was adopted on 23rd June 1979, but came into force on 1st November 1983. The Convention is intended to ensure that migratory species of wild animals spelt out in Appendix I and II, to that Convention are protected from extinction. The Convention requires inter-governmental co-operation to ensure that the species are allowed to migrate as their nature and their habitat is preserved. The Convention was ratified by Kenya on 1st May 1999 and its lead agency is the Kenya Wildlife Service. The provisions of the Convention are domesticated in the Wildlife (Conservation and Management) Act. Part III of the Act provides for a safe habitat for wildlife, which is achieved by creation of national parks, national reserves and sanctuaries. This allows for the perpetuation of wildlife. Kenya is a signatory to the Convention, which requires that contracting parties respect and conserve the migratory routes and resting areas of migrant species. *The Contractor will have to adhere to these provisions to reduce and mitigate impacts on wildlife habitats in the project area. The Contractor in collaboration with KWS, will discourage workers from hunting for game meat and location and construction of animal passes to enable wildlife to freely cross the road from one side to the other in order to reduce animals kills.*

3.6.7 The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

Convention on International trade in Endangered Species of Wild Fauna and Flora, also known as CITES, which Kenya is a signatory to prohibit any trade or traffic of species of flora and fauna which has been listed in what the convention describes as the three Appendices (I, II, and III). Appendix I list the species of organisms threatened with extinction and whose trade is completely banned except in exception circumstances of the convention, Appendix II lists species not threatened with extinction but whose state may be threatened if their trade is not strictly controlled at international levels. Appendix III list species that a contracting party feels its state is threatened within its own jurisdiction and requires the cooperation of the other members to manage trade at international level. The Contractor will ensure as much as possible restrict their workers from trading on any endangered wildlife in the project area. *The Hirola species found only in the Arawale National Reserve and immediate areas is endangered and will have to be protected.*

3.6.8 The Convention on Conservation of Biodiversity

Kenya is a signatory to the Convention on Conservation of Biodiversity (CBD) which provides for fair and sustainable use of biodiversity resources including sharing the benefit out of use of the biological resources. The convention provides for recognition of those with the

indigenous knowledge, providing with them with access to resources and the developed world providing the technologies to enables the developing countries to benefit from their genetic resources. *The Contractor will ensure as much as possible restrict their workers from unsustainable use or trading on the local biodiversity in the project area. They also should be discouraged from introducing any alien species into the area as these may become invasive and harm the local biodiversity. The Hirola antelope and the mangrove swamps will have to get special attention in this project.*

3.6.9 The African Convention of the Conservation of Nature and Natural Resources

This was the effort of the African Ministerial Conference on the Environment (AMCEN) which gave birth to the convention among the African states. Other that conservation of other resources the emphases was also made on the conservation of all ecosystems, the convention required that contracting parties designate conservation areas within their waters with the coming into the effect of the convention and provide a zonation plan in order to conserve the protected areas. The Contractor will discourage workers from interfering with any designated conservations areas in the project area.

3.6.10 The Cartagena Protocol on Biosafety

This Protocol is complimentary to the Convention on Biological Diversity. The objective of the Cartagena Protocol is to create a balance between the benefits that accrue from biotechnology, while safeguarding the environment and human health from the potential harmful effects that biotechnology may pose. The Protocol adopts the preventive and precautionary approaches as is envisaged by Article 1 to the Protocol which provides *inter alia-- "…to contribute to ensuring an adequate level of protection in the field of the safe transfer, handling and use of living modified organisms resulting from modern biotechnology that may have adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health, and specifically focusing on trans-boundary movements*." The Protocol was adopted on 29th January 1999 and ratified by Kenya on 24th January 2002. It has 111 parties, 103 of whom are signatories. The national focal point for the Protocol is the National Council for Science and Technology. The provisions of the Protocol are captured in EMCA 1999.

The Contractor in collaboration with KWS, will discourage workers from introducing any alien species into the area as these may become invasive and harm the local biodiversity.

3.6.11 Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC)

The Kyoto Protocol requires signatories to reduce their greenhouse gas emissions levels to 5 per cent below 1990 levels by the year 2012. The Protocol came into force on 16th February 2005, after it received the pre-requisite signatures. However, with the United States, Australia, China and India not being signatories, the future of the protocol looked uncertain though this has been renegotiated for another 7 years at Cancun Mexico in 2010 during UNFCCC's Conference of the Parties (COP 16). NEMA is the national focal point for this Protocol. The Contractor will ensure that all vehicles and machineries are well serviced to reduce emissions that may harm the climate.

3.6.12 The United Nations Framework Convention on Climate Change (UNFCCC)

The UNFCCC was adopted on 9th May 1992 and came into force on 21st March 1994. The Convention has been ratified by 189 states. Kenya ratified it on 30th August 1994. The primary purpose of this Convention is to establish methods to minimize global warming and

in particular the emission of green-house gases. Sections 78-85 of the EMCA provide for measures to preserve air quality by controlling air pollution, which could result in climate change. Any owner or operator of a trade, industrial undertaking or an establishment likely to cause air pollution must apply for an emission license to NEMA, which is also empowered to order the proprietors to carry out an environmental impact assessment study or environmental audit where it is deemed necessary to conduct one. Emissions that cause air pollution in contravention of the emission standards prescribed are prohibited. The UNFCC informs land use in so far as activities on land are required to be designed to have a minimum negative effect on factors that may result in climate change. The Contractor will ensure that all vehicles and machineries are well serviced to reduce emissions that may harm the climate.

3.6.13 The Convention on Climate Change

The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. Kenya having ratified and signed the convention has the obligation to adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases. The project falls under the Climate Change Convention due to the fact that it generates greenhouse emissions.

Article 4 of the protocol calls for development of measures to mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and measures to facilitate adequate adaptation to climate change, Promoting and development of application and diffusion, including transfer, of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol in all relevant sectors, including the energy, transport, industry, agriculture, forestry and waste management sectors, taking climate change considerations into account, to the extent feasible, in their relevant social, economic and environmental policies and actions, and employ appropriate methods, for example impact assessments, formulated and determined nationally, with a view to minimizing adverse effects on the economy, on public health and on the quality of the environment, of projects or measures undertaken by them to mitigate or adapt to climate change, promoting cooperation in scientific, technological, technical, socio-economic and other research, systematic observation and development of data archives related to the climate system and intended to further the understanding and to reduce or eliminate the remaining uncertainties regarding the causes, effects, magnitude and timing of climate change and the economic and social consequences of various response strategies and promoting cooperation in education, training and public awareness related to climate change and encourage the widest participation in this process.

3.6.14 The United Nations Convention to Combat Desertification (UNCCD)

This Convention was adopted on 17th June 1994 in Paris and came into force on 26th December 1996. Its purpose is to address the problem of the degradation of land by desertification and the impact of drought, particularly in arid, semi-arid and dry semi-humid areas. Kenya ratified the Convention on 24th June 1997. The provisions are domesticated in several Acts of Parliament. Section 46 of EMCA requires District Environment Committees to identify areas that require re-forestation or afforestation as well as to mobilize local communities to carry out these activities. The Contractor will ensure that only necessary land clearing is undertaken during road construction.

3.6.15 The Convention for the Protection of the World Cultural and Natural Heritage

This Convention was adopted in Paris on the 21st November 1972. The Convention currently has at least 178 signatories. Its primary purpose is to preserve cultural and natural heritage, which includes monuments, architectural works, cave dwellings, painting and natural formations that are universally outstanding. Kenya ratified the Convention on 5th June 1991. The National Museums of Kenya (NMK) is the national focal point. The Contractor will notify NMK of any finds of archaeological value. Of particular importance here is the Lamu Town which is a UNESCO site.

3.6.16 The Basel Convention - Convention on the Control of Trans-boundary Movement of Hazardous Wastes and their Disposal

The Convention was adopted on 22nd March 1989 and came into force on 5th May 1992. The Convention seeks to put in place measures that reduce the production of hazardous wastes and further to minimize their unlawful trans-boundary disposal. Kenya acceded to the Basel Convention on 1st June 2000. Section 91 of EMCA empowers the Standards and Enforcement Review Committee to classify hazardous wastes, whereupon NEMA is required to establish guidelines on the management of the waste. Section 141 of the Act makes it an offence to import, dispose or otherwise manage hazardous wastes contrary to the Act. The Contractor shall strictly adhere to the provisions and requirements of these Regulations.

3.6.17 The Bamako Convention on Hazardous Wastes within Africa

The Bamako Convention was adopted in Mali, Bamako on 30th January 1991; it came into force on 22nd April 1998. The Convention has 18 parties (ten ratifications and eight accessions). Kenya signed the Convention on 25th March 2004. The Convention has provisions for import, trans-boundary movement and management of hazardous wastes within Africa. It is intended to fortify the provisions of the Basel Convention in order to protect the African people and their environment against dumping of hazardous wastes. This regional Convention also influences the use of land in Kenya in a similar manner as the application of the Basel Convention.

3.6.18 The African Convention on the Conservation of Nature and Natural Resources

This Convention was adopted in Algiers under the aegis of the African Union, on 15th September 1968. The Convention came into force on 16th June 1969. The Convention reaffirms the importance of natural resources both renewable and non-renewable, particularly soil, water, flora and fauna. The objective is to facilitate sustainable use of these resources. Emphasize is on preventive and precautionary measures to conserve and preserve these natural resources.

3.6.19 The East African Community (EAC)

The East Africa Community (EAC) is a regional intergovernmental organization of the republics of Kenya, Uganda and Tanzania, with its headquarters in Arusha, Tanzania. The EAC aims at achieving various goals and objectives within its mandate through “Promotion of sustainable growth and equitable development of the region including rational utilization of the region’s natural resources and protection of the environment.” The Community has developed a draft Protocol on Environment and Natural Resources, which commits member states to sound environment and natural resources management. In addition, joint guidelines on Environmental Impact Assessment for Shared Ecosystems, have been adopted by the member states as an annexure to the protocol on environment and natural resources. Other specific areas of co-operation are in environment and natural resources management

arrangement. The EAC Treaty will provide an effective mechanism for the general advancement of the region. The road on the hand as part of the Northern Corridor will ease transportation between the countries in eastern Africa.

3.6.20 The New Partnership for Africa's Development (NEPAD)

The New Partnership for Africa's Development (NEPAD) adopted by the African Heads of States and Governments is an initiative based on a common vision, firm and shared conviction to eradicate poverty and place the continent on the path to sustainable growth and development as well as participate in global economic and political arena. NEPAD recognizes that the range of issues necessary to nurture the region's environmental base and sustainable use of natural resources is vast and complex; and that a systematic combination of initiatives is necessary for the development of a coherent environmental programme. The NEPAD strategic framework to promote Africa's sustainable development has been developed prepared through a consultative and participatory process under the leadership of the African Ministerial Conference on Environment (AMCEN). The plan is comprehensive, holistic and integrates sustainable development principles. The road as part of the Northern Corridor will ease transportation between the countries in eastern Africa and fits well within the goals of NEPAD.

Chapter 4

Description of The Project And Justification

TABLE OF CONTENTS

4. DESCRIPTION OF THE PROJECT AND JUSTIFICATION

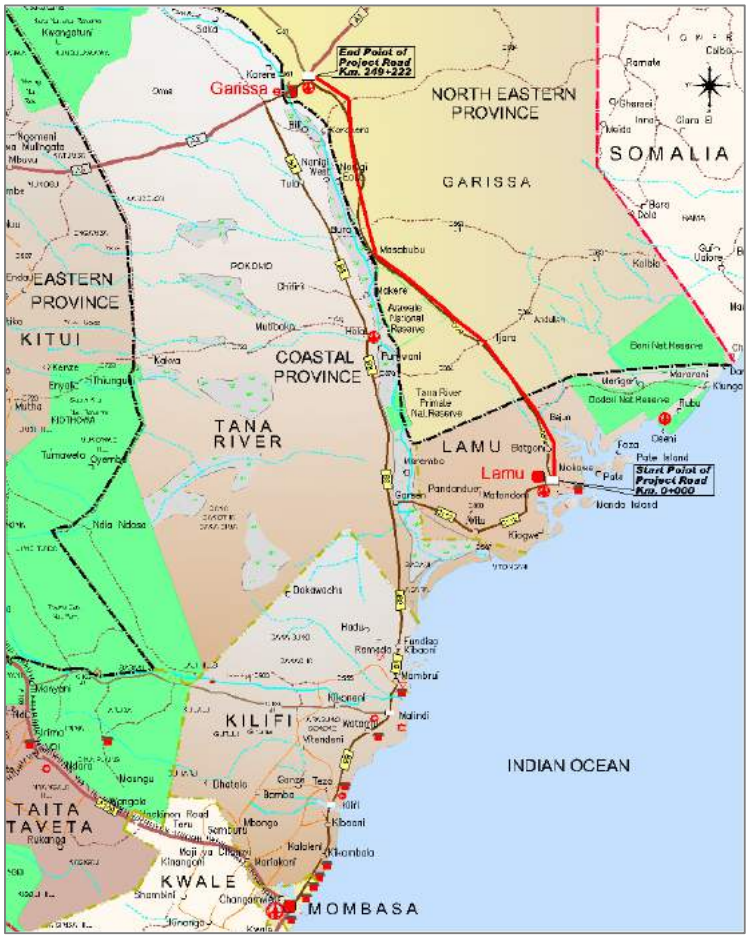
4.1 Introduction

The project road, Lamu – Garissa, is located on Northern-Eastern side of Kenya. It is part of LAPSSET corridor connecting Southern Sudan, Ethiopia and Kenya. The LAPSSET corridor project aims to integrate the transport system and land use in order to improve accessibility and regional socio-economic development along the transport corridor especially in the Northern, Eastern, North-Eastern and Coastal parts of Kenya. The project road will be a gateway to the LAPSSET corridor which will provide connectivity to other parts of Kenya through railway and highway.

4.2 Project Location

The project road, Lamu – Garissa road, forms the initial part of LAPSSET corridor. Lamu – Garissa ("Project Road") is situated at the Eastern Coastal region of Kenya (**Figure 4.1**) and is a section of LAPSSET Corridor, having total length of about 250 Kilometre. The project road lies between 40°54'44.02"E to 39°39'30"E longitude and 2°17'27.847"S to 0°27'25"S latitude. The project road falls under the Lamu and Garissa Counties. Project road starts at Lamu mainland near Hindi village, traverses through dense bushes and barren lands of Lamu and Garissa counties and terminates at Garissa. The Location Map of the project road Lamu - Garissa is shown in **Figure 4.1**.

Figure 4.1 : The Project Road (shown in thick red line from Lamu to Garissa)

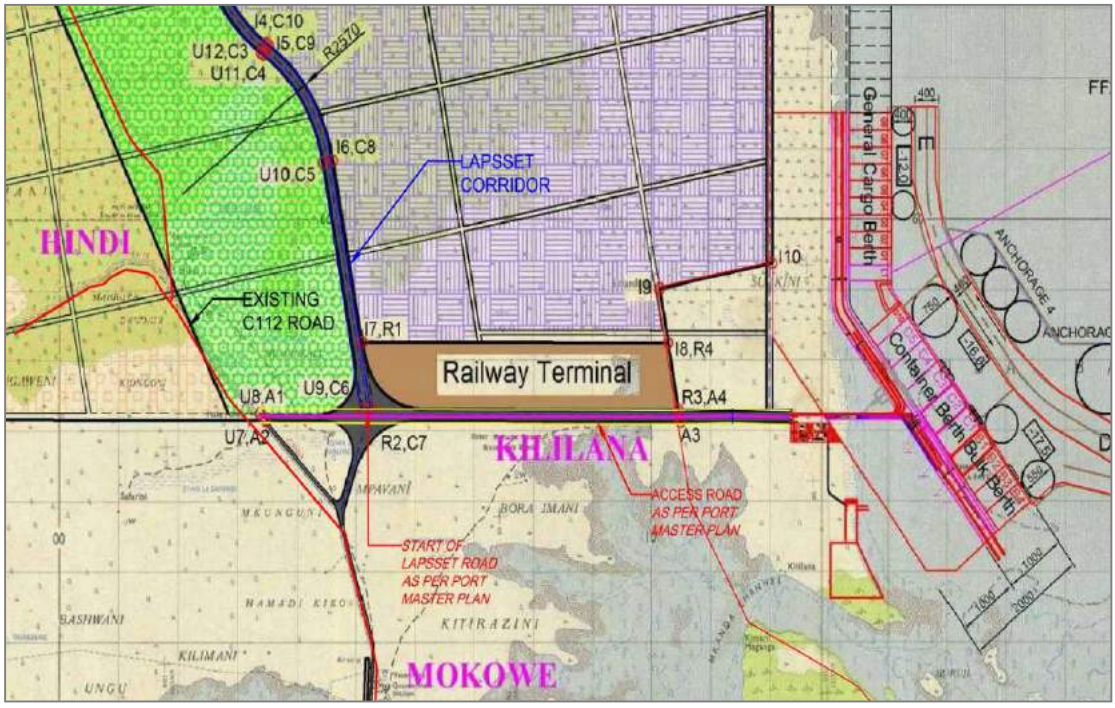


4.2.1 Start and End Point of the Project

4.2.1.1 Start Point

The Start point of the project road is in green field area near Mokowe and is away from existing C112 road. The start point forms a three legged junction with access road leading to proposed Lamu Port as shown in **Figure 4.2**. As per port planning, project road starts near proposed railway terminal which leads to port facilities. The initial stretch of project road passess through Port related industrial belt on right side and proposed green zone and urban area on the left side as per Lamu Regional Development Plan and Lamu Port Development Plan. The ground breaking ceremony for LAPSSET project was carried out on 2nd March, 2012 near the start point of project road.

Figure 4.2 : Start Point of Project Road and Proposed Lamu Port Development Plan Start Point near Mokowe-C112

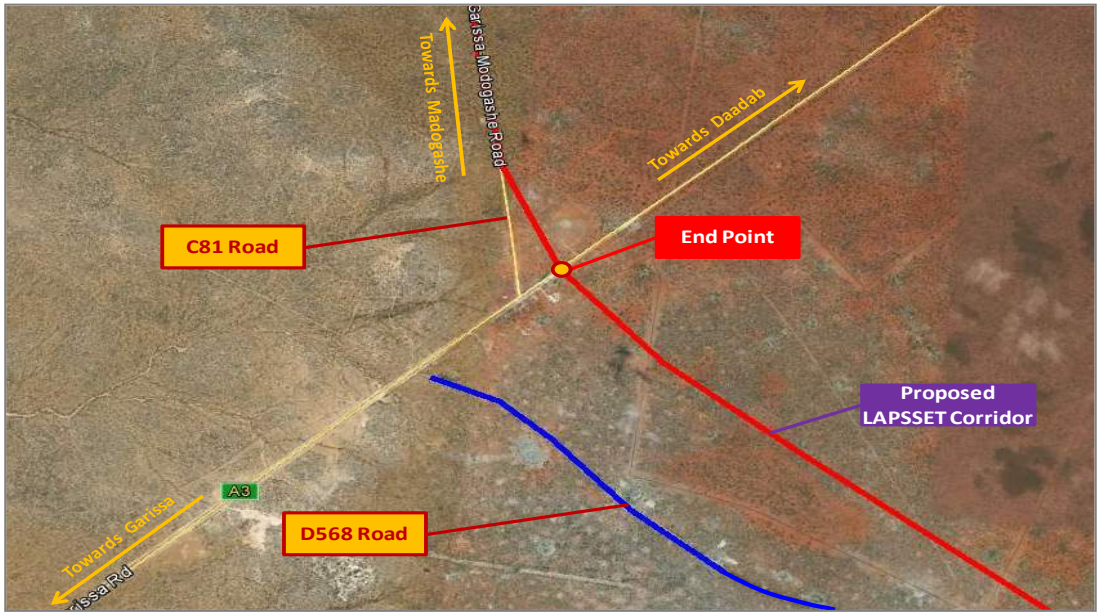


4.2.1.2 End Point

The project road terminates near Garissa at junction with A3/C81 roads, which is 13 km away from Garissa town called as Modika. It is at the junction of the roads leading towards Daadab and Madogashe as shown in **Figure 4.3**.

At the end section, project road alignment is running parallel to existing D568 road and it will create a four legged junction with A3 road around 300 meters away from existing 3-legged junction of A3/C81. There are developments around this junction which might get affected due to the proposed alignment of LAPSSET corridor. Typical development of the proposed junction is shown in **Figure 4.3**.

Figure 4.3: Typical Development of Four-Legged Junction at the End Point

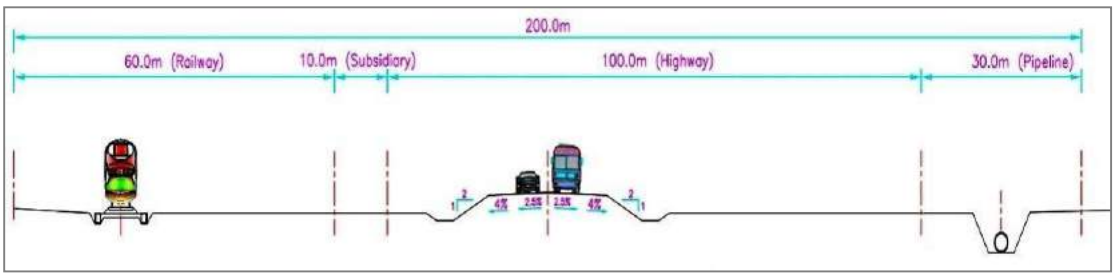


Initial 12 km section of existing C81 road has also been upgraded to two lanes with paved shoulder (7m+2m+2m) considering LAPSSET highway configuration.

4.3 Right of Way

As mentioned in Chapter 2 on Feasibility Study Review of LAPSSET Study, total 200m ROW is proposed for all the three components of railway, road and oil pipeline; out of which the Highway component has been proposed with 100m ROW at the middle of the corridor with provision of railway line (to the left edge) and oil pipe line (to the right edge) at the two ends of the proposed ROW.

Figure 4.4 : ROW of LAPSSET Corridor



Highway component comprises maximum road reserve as it is to be developed as high speed corridor with less constraint in alignment for traffic serving to the surrounding area and the new Lamu Port. The provision of ROW has also been made considering the future expansion of highway to four lanes or six lanes from the current proposed configuration of two lane highway depending on the traffic growth.

4.4 Profile of the Project Area

Kenya lies on the equator zone with the Indian Ocean to the south-east, Tanzania to the south, Uganda to the west, South Sudan to the north-west, Ethiopia to the north and Somalia to the north-east. Project road, Lamu-Garissa, is located in the Northern-Eastern part of Kenya, passing through Counties of Lamu and Garissa. This region of Kenya is not currently well developed and thus economic activities are on lower side which is a key factor for growth and development of any area.

Lamu County: Lamu County located in Northern cost of Kenya. It borders the Indian Ocean to the south, Tana River County to the southwest, Garissa County to the north and Republic of Somalia to the northeast. It lies between latitudes $1^0$40' and $2^0$30' S and longitude 4^0 15' and $4^0$38' E. The County has total area of 6,497.70 km^2 composed of main land, 65 islands, 130km coast line and water mass covering 308 km^2. The County comprises of the constituencies of Lamu West and Lamu East. Lamu west constituency covers Amu, Hindi, Mpeketoni and Witu, while Lamu East constituency covers Faza, Kizingitini, and Kiunga. The total population of County is 101,539 (according to the KNBS 2009 census). Lamu Town on Lamu Island is Kenya's oldest continually inhabited town, and was one of the original Swahili settlements along coastal East Africa. It is situated 341km northeast of Mombasa and is also UNESCO World Heritage Site. Lamu County is the gateway to start of the "LAPSSET Corridor", with a road, rail and pipeline network linking Kenya, South Sudan and Ethiopia, in order to improve accessibility and connectivity as well as to stimulate economic activities.

Garissa County: Garissa County is one of the counties through which the LAPSSET corridor passes. The County borders Isiolo to the Northwest, Wajir to the North, Republic of Somalia to the East, Tana River County to the west and Lamu County to the South. The County is located between latitude $1^0$58' N and $2^0$1'S and longitudes $38^0$34' E and $41^0$32' E. The County covers an area of 45,720.20 km^2 „ and is administratively divided into 7 sub counties. The total population of the County is 623,060 (according to the KNBS 2009 census). Most of the inhabitants of Garissa town are ethnic Somalis. The infrastructure facilities in the county are poor with only 29.9 km of bitumen surfaced roads and rest are earthen surfaced and gravel surfaced roads.

4.5 Project Description

4.5.1 Alignment

Some possible alignment options for the Lamu – Garissa section has been studied to adopt best one for the project area based on its utility, economic and financial benefits. There are three possible alternatives connecting Lamu and Garissa, out of which, two are existing alignments one on each side of Tana River (**I-2 & I-3**) while the third alignment **(I-1**) is proposed as new alternate alignment to the existing routes. The traversing paths of three alignments are given below:

Alignment I-1: This alignment alternative passes through eastern side of Tana River. It is the modified alignment of existing D568 road, passing through Bodhei and Ijara villages. Some of its section follows existing D568 road and most of the alignment is on totally new alignment.

Alignment I-2: This is the existing alignment covering Lamu -Witu-Garsen-Hola-Bura West-Garissa town/villages, passing through Western side of Tana River.

Alignment I-3: Existing D568 road passing through Bodhei, Ijara and Bura East on eastern side of Tana River. Most of the alignment is unusable.

Based on preliminary studies, the alignment option I-1 was recommended by the Consultant. KeNHA approved the proposal of alignment option I-1 during presentation of Inception Report and Preliminary Reports.

This alignment option is a modified alternative of existing D568 road proposed on eastern side of the Tana River. It is a modified alignment option which contains usage of existing D568 road with necessary re-alignment in most stretches and passes through Bodhei and Ijara villages.

The alignment is passing through plain terrain throughout its length with few settlements along the proposed corridor .It traverses two counties, i.e. Lamu County at the start and Garissa County at the end, as it progress to Isiolo. Most part of the alignment is a new green field alignment and passing through flat terrain in its entire length. It starts at Mukowe and traverses on the eastern side of River Tana following in some of its sections the existing D568 Road through the trading centres of Hindi, Bargoni, Bodhei, Ijara, Roka, Masabubu, Nanighi, and Korakora before terminating at Junction (A3/C81), 13kms from Garissa town.

4.5.2 Pavement Condition

The proposed alignment is following some sections of existing D568 road, which is earthen single/intermediate lane road. The road camber is not defined. There is no defined pavement and the condition of the earthen/gravel road is also very poor. Many deficiencies were found along existing road such as large depressions and rutting which requires improvement. The existing gravel/earth road sections are constructed without proper engineering standards and will therefore be a big impediment to flow of the high traffic expected in the corridor. The terrain is generally flat. **Figure 4.1** shows the location of project corridor.

4.5.3 Drainage

There is no definite drainage arrangement along the entire road. Water flows from west to east up to few kilometres from Lamu flowing to the Indian Ocean while, it flows from east to west on Garissa side flowing to Tana river and passing over the road. At many places the road shifts away from the river due to flooding. To avoid the drainage issues and excessive flooding due to Tana River flooding plain, the final alignment is away from Tana River.

4.5.4 Settlements

The alignment passes through major settlements like Bodhei and Ijara before termination at junction of A3/C81 near Garissa. Ijara is a large village settlement and is also the Headquarter of the Ijara District. It is located approximately 77 km north of Lamu and 172 km south of Garissa.

4.6 Road Construction Materials Availability

An investigation was carried out to determine the availability of naturally occurring materials, including gravel, sand, hard stone and construction water. The objective was to locate sufficient materials that meet specification requirements of the various pavement layers and concrete works in their natural state.

Investigations on possible gravel sites entailed excavation of trial pits at a grid of 60m and representative samples taken for laboratory testing. A visual inspection and description of each type of material found was done as well as logging of the different strata of each trial pit. The expense of the site was also determined, in a bid to determine the yield that can be obtained.

Eighteen (18) No. potential sources of gravel material were investigated, and the summary is shown in the **Table 4.1** below and the schematic presentation is given in **Figure 4.5**.

Figure 4.5 : Schematic Diagram of Sources of Embankment Soil, Subgrade and Gravel Material

Table 4.1 : Material Sites Locations and Estimated Yield

Material Site No.	Material Site Reference	Approximate Chainage (KM)	Approximate Offset (Km)	Estimated Depth of quality material	Estimated Yield m^3
1	Ms Prison	0+000	0.9	1.9	166,560
2	Ms Kiongoni	0+000	1.0	2.1	308,040
3	Ms Ndeu A	0+000	3.5	2.5	342,000
4	Ms Ndeu B	0+000	3.5	1.7	136,000
5	Ms Duwadeso	90+000	15.0	1.5	115,200
6	Ms Masabubu	151+500	19.0	1.5	57,600
7	Ms Walini	154+500	20.0	1.0	43,200
8	Ms Nanich A	172+000	8.0	1.2	51,840
9	Ms Nanich B	172+000	11.0	1.5	555,000
10	Ms Abagandere	204+500	18.0	1.2	69,120
11	Ms Kamuthe A	210+000	10.0	1.3	114,840
12	Ms Kamuthe B	210+000	13.0	1.5	259,200
13	Ms Warable A	217+500	12.0	1.4	209,440
14	Ms Warable B	217+500	12.0	1.4	75,600
15	Ms Dieso 1	230+300	0.05	1.5	162,000
16	Ms Dieso	231+000	0.168	1.4	116,480
17	Ms Km 242+000	242+000	0.240	1.4	141,120
18	Ms Modika	249+000	0.05	2.0	252,000

4.6.1 Hard Stone Source Investigations

Investigations for rock quarries were carried out and it was noted that there were no available sources of hard stones along the project road. However, the Consultant carried out more investigations beyond the project road and identified two rock quarries nearest to the project road.

The Dewadeso Quarry - This quarry site is approximately 32km from Ijara, off Chainage 124+000 of the project road. This was partially exploited, and samples were taken to ascertain its quality. The expanse found was small.

The Mwingi Quarry - This quarry is located 200km from the end of the project road, about 4.5km of the Thika-Garissa Road. This was a quarry site where a Contractor had a crushing plant already set up to be used for the construction of Mwingi-Munguu road. The area extends to about 5 acres of land and the crushing plant was operational at the time of investigation.

4.6.2 Sand Sources

The native sand readily available along the alignment is poor in grading and has silt and clay constituents which are deleterious. Adequate supply of good quality sand is however readily available for exploitation along the laghas traversed by the alignment. The following potential sand sources were established and sampled for tests:

1) Juja Sand, 6km from Hindi (km 0+000)
2) Lagha at km 175+000
3) Lagha at km 180+000
4) Warable River Sand, 12km off Chainage km 217+500

4.6.3 Sources of Water for Construction

It was noted that there are no permanent rivers or dams that cross the project road. There are however numerous river channels which indicate existence of seasonal rivers and *laghas*.

The River Tana, which is the only permanent river in the region, is about 10 - 20km from the start of the project road, and runs along the proposed route. It is one of the major sources of water in the area and can be a very good source of water for construction for the project road.

However, boreholes can also be drilled along the project road as other alternatives for the water for construction. The Consultant identified boreholes already in use along the project road, and obtained information regarding the boreholes (this is fully described in the Materials Report). It was noted that all the identified boreholes had their aquifers drawing recharge mainly from the River Tana via laminar flow.

4.6.4 Manufactured Materials

For construction of any road project, varieties of materials are used, some are naturally available material like soil, aggregate, gravel material and sand while some are manufactured materials like Cement, Steel and Bitumen. Following are the details of manufactured materials likely to be used for the construction purpose within reasonable lead of the project road.

Cement

There are number of Cement producing factories available. These include:

- Bamburi Cement Limited. It has branches in Nairobi, Mombasa and Athi River the main one being located in Mombasa

- Rhino Cement Foundation. It is located within the Athi River mining premises.
- East African Portland Cement Company. It is based in Athi river near Nairobi
- Athi River Mining Limited. It is located in Athi River region of Machakos county in Kenya
- Savanna Cement in Kenya located in Kitengela
- National Cement Company Limited. It is a member of the Devki Group of companies operates a Portland cement located in Athi River

All are in operational and cement can be made available for construction purposes from these sources.

Steel
There are numbers of steel rolling factories located in Kenya with availability of various grades of steel. The sources include:

- Apex Steel Limited. has a rolling mill division off Sofia Makadara road, Athi River
- Athi River Steel Kenya
- Devki Steel Mills Limited. It has various products like reinforcement bars (round and twisted bars). It is located along Mombasa Road near Athi River
- Accurate Steel Mills Limited. It is located along Falcon Road off Enterprise Road.

All are operational and steel can be readily available from these sources for construction purpose.

Bitumen
For the project road, it is presumed that the bitumen will be imported through Mombasa Port.

4.7 Proposed Improvement

4.7.1 Roadway Width

The project road falls in category 'A', and as the projected traffic volume is less than 15000 pcu/day, single carriageway is required to cater the traffic volume. RDM suggest type II cross section for traffic greater than 4000 PCU/Day (for 10 year) with road way width of 10m. As the design traffic volume on proposed Lamu-Garissa road based on adopted growth rate (Medium Scenario) comes out to be 5011 PCU/Day for 10 years (in the year 2029), the Cross section type II for Two lane road (Single Carriageway) will be applicable for the project road as per RDM guidelines.

The Consultant proposes to adopt a lane width of 3.5m and the shoulder width of 2.0m for the full road, considering installation of safety features and other informatory features. "LAPSSET "corridor study also proposed shoulder width of 2.0m.

The values proposed to be adopted for the roadway elements by the Consultants for the project highway are as follows:

Table 4.2: Road Cross Section

Item	Two-Lane with Surface Shoulder
Carriageways	2 X 3.5 m
Shoulder	2x 2 m
Total Formation width	11 m

4.7.2 Adopted Design Standards

Based on review of LAPSSET Study, Road Design Manual (RDM), AASHTO and IRC standards, the Consultant has adopted following design standards for Draft Final Design Stage of the project road.

Table 4.3 : Design Standards for Lamu-Garissa Road

Sr. No.	Design Element for Surface Road	Unit	Standards
1	Terrain		Plain
2	Design Speed	km/h	120
3	Level of Service		B
4	Road Way Width		11 m width for two lane carriageway
5	Road Way Element		Carriageway
			-2 lane-2x3.5
			- Shoulder-2x2.0
6	Right of Way	M	100m
7	Embankment Slope	%	For height of fall (hf), hf ≤ 1 m- 1:4 hf >1 m - 1:2
Horizontal Alignment			
8	Min. Horizontal Curve Radius (Depends on Speed)	m	1000
9	Maximum Super elevation	%	6
10	Cross fall of Carriageway	%	2.5
11	Surface Shoulder Cross fall	%	2.5
Vertical Alignment			
12	Minimum longitudinal Gradient	%	0.3
13	Maximum Longitudinal grade	%	3
14	Crest Vertical Curve K value (in general)		176
	Crest Vertical Curve K value(at location of horizontal curve and vertical curve coincides)		235
15	Sag Vertical Curve K value		90
16	Desirable Stopping Sight Distance (- 3. % Grade)	m	340
17	Desirable Passing Sight Distance	m	450

4.7.3 Improvement Proposal of Bridges and Culverts

The project road traverses through green field alignment in most of its length with few sections merging with the existing D568 road. Bridges, box and pipe culverts have been proposed to be constructed at various locations along the proposed road. Hydrological and hydraulic analysis has been carried out to determine storm water flows, velocities and depths and this has been used to select structures that will be able to convey flood flows at required capacities and free board.

The Brief details of for the proposed Bridges are as under:

Structure Type	Number	Proposed Location
40 m Multi Span Bridge	2	19+280 and 45+210
60 m Multi Span Bridge	1	34+430
80 m Multi Span Bridge	1	63+874

The Brief details of improvement proposal for Culverts are as under:

Structure Type	Number
Twin 900mm Diameter Pipe	423
5x1.5m Box Culvert	115
5x1.8m Box Culvert	80
5x2.5m Box Culvert	17
Twin 5x1.5m Box Culvert	1
Twin 5x1.8m Box Culvert	2
Twin 5x2.5m Box Culvert	1
3 Cell 5x2.5m Box Culvert	1
Total Culverts	**640**

4.7.4 Design of Animal Crossings

Some portion of the project road is passing by the side of the Reserve Forest /Wild Life Sanctuaries where movements of animals has been observed. Apart from this, animal movements were also observed along a few sections of the corridor. To ensure safe passage of animals, Animal crossings has been proposed at 8 locations along the 5 major wildlife/Forest corridors. This will prevent the animals straying to the main road. Animal Crossings has been proposed at locations listed in **Table 4.4**.

Safety fences have been proposed over certain lengths before and after the crossing points to prevent animals straying to the road. It is also recommended to provide safety fence at these five corridors all along the road length passing by the side of the sanctuary or forests areas with openings only at animal cross-over locations. No authenticated data on exact location of movement of animal across the highway could be available. Thus the locations of animal crossing underpasses have been proposed based on Environmental Impact Assessment Report. Exact locations to be finalised during construction stage in consultation with NEMA's Environmental Expert and the Environmentalist of the supervision team.

Table 4.4 : Location of Animal Crossings

Sr. No.	Corridor			Fencing	No of Animal Crossings	Tentative Location of Animal Crossing
	Chainage From	Chainage To	Length (km)			
1	35+000	41+000	6.0	Both side	1	40+720
2	57+000	67+000	10	Both side	1	61+700
3	102+100	142+800	40.7	Both side	4	108+500, 112+400, 124+425, 134+955
4	210+000	215+000	5	Both side	1	213+000
5	235+000	245+000	10	Both side	1	241+500
Total			**71.7**		**8**	
			143.4	**Both side**		

As the project road is a part of the proposed LAPSSET corridor, railway line will also run parallel to the highway. Hence the Consultant proposed to adopt the option of Animal Over pass for crossing of animals so that the same can be extended over the railway line.

As finalised during Preliminary Design Stage, circular reinforced concrete animal overpasses have been proposed due to proximity to the coastal line as steel structures are prone to corrosion. Typical Drawing for Animal Crossing has been presented in Drawing Volume and Detailed design is provided in Volume II Design Report : Part 2 – Structures.

4.7.5 Miscellaneous Designs

- As per the detailed field reconnaissance surveys, truck lay bye are proposed at the two locations.
- As the proposed project road is part of the high speed LAPSSET corridor, major rest area with facility for parking, restroom/refreshing room, trauma-care, drinking water and restaurant/food joint, have been proposed at two locations. (Near Ijara and Near Bura East).
- Bus bays/ bus shelter with pedestrian crossing facilities at suitable locations have been proposed along the project road for safe alighting and boarding of passengers.
- To facilitate the through and uninterrupted movement of traffic on the project corridor, service road has been proposed at Ijara village to separate the through traffic of the project corridor from the local traffic.
- The safety measures and devices as proposed by the consultant along the highway are described below:
  - Traffic guidance, regulation and control devices like Road Signs, Road Markings, etc.
  - Traffic Safety Measures like raised pavement markers (road studs), marker posts, flex-beam guard rails, hazard demarcation signs, etc.
  - Night Illumination at Junctions, Truck Lay bye and Bus Bye.

For notification of road features and also for safety and guidance of the road users, the project road will be provided with all the necessary traffic control and safety devices. These include:

- Traffic Signs
- Road Markings
- Marker Posts

4.8 Construction Activities

The construction project activities have been planned to flow such that conflicts with the environmental setting as well as the social and economic activities along the corridor are minimised. It is expected that upon project commencement, the Contractor will prepare a

realistic project activities schedule to share the same with the Client and the Supervisor. The conceptual activities, however, will be as follows;

4.8.1 Site Preparation

Construction process begins with the alignment surveying, pegging and clearing. This involves bush clearing, top soil stripping to be followed with earthworks. Bush clearing removes vegetation cover including grass, shrubs and young trees. Often, grown trees will also be removed and the Contractor is expected to maintain a record of the number, species and characteristics of the trees removed for compensation through planting.

4.8.2 Earthworks

Earth moving is the removal of the overburden along the alignment to give way for filling with appropriate materials. This generates significant spoil earth materials to be disposed-off or reused elsewhere. The activities will involve moving fill materials (gravel) to fill and development of the base on which the road surface will be formed.

4.8.3 Construction Camps Establishment

The Contractors will search for appropriate land to set up the construction camp sites to house among others the following:

a. Main Camp Sites;
- Consultants' offices,
- Contractors' offices,
- Workshops,
- Materials laboratories,
- Stores,
- Fuel farms,
- Truck parking yards, and
- Workmen camp site for residential quarters.

b. Materials Holding and Batching plants; and
c. Pre-cast yards.

4.8.4 Materials Sourcing and Extraction

Mobilisation of materials will be the main activities such as to include aggregate from the quarry sites, gravel from borrow areas and water from sources. Materials haulage, storage, batching and applications are major activities of the project.

4.8.5 Pavement Laying

This will be the development of the road pavement layers as per the design specifications.

4.8.6 Rehabilitation and Restorations

The Contractor will undertake the following restoration activities;

(i) Landscaping and beautification of the project road corridor,
(ii) Rehabilitation of spoil disposal areas,
(iii) Restoration of borrow areas,
(iv) Rehabilitation of quarry site, and
(v) Decommissioning of camp sites and clean-up.

Chapter 5

Description Project Environment

TABLE OF CONTENTS

5. DESCRIPTION PROJECT ENVIRONMENT

5.1 Introduction

This section gives the environmental and social profile of each county traversed by the road project. The project road is found in the Lamu and Garissa counties of Kenya.

5.2 Location

Lamu – Garissa ("**Project Road**") is situated at the Eastern Coastal region of Kenya and is a section of LAPSSET Corridor, having total length of about 250 Kilometre. The project road lies between 40°54'44.02"E to 39°39'30"E longitude and 2°17'27.847"S to 0°27'25"S latitude.

The road starts at Mokowe and traverses on the eastern side of River Tana following, in some of its sections, the existing D568 Road through the trading centres of Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Nanighi, and Korakora before terminating at Junction (A3/C81), 13kms from Garissa town called as Modika.

Lamu County is located in Kenya's former Coastal Province with its headquarter in Lamu town and is one of the six counties in the coastal region of Kenya. The County covers a strip of north eastern coastal mainland and the Lamu Archipelago. Lamu County has a population of 101,539 (2009 census) and its land area is 6497.70 km² that includes mainland and 65 Islands that form the Lamu Archipelago. Lamu Town on Lamu Island is Kenya's oldest continually inhabited town, and was one of the original Swahili settlements along coastal East Africa. It is situated 341km northeast of Mombasa and is also UNESCO World Heritage Site. Lamu County is the gateway to start of the "LAPSSET Corridor", with a road, rail and pipeline network linking Kenya, South Sudan and Ethiopia, in order to improve accessibility and connectivity as well as to stimulate economic activities.

Garissa County is located in the former North Eastern Province of Kenya. The capital and largest town of the County is Garissa. The County has a population of 623,060. The County has an area of 45,720.2 km². The Garissa town is a market centre situated on the bank of Tana River. It is located about 350km east of Nairobi and is linked by road with Nairobi, Mombasa and Alanga Arba. Most of the inhabitants of Garissa town are ethnic Somalis. The infrastructure facilities in the county are poor with only 29.9 km of bitumen surfaced roads and rest are earthen surfaced and gravel surfaced roads.

5.3 Topography & Geology

Lamu County is generally flat and lies between altitude zero and 50m above sea level, making it prone to flooding during the rainy seasons and periods of high tides. The main topographical features include coastal Island and Dudol plains, sand dunes and the Indian Ocean. The county has four major catchment areas categorized as Dodori coastal zone, Duldul, Lamu bay drainage and Tana River Delta. Garissa County is basically flat and low lying without hills, valleys and mountains. It rises from a low altitude of 23m to 400m above sea level. The major physical features are seasonal Laghas and the Tana River Basin on the western side. The River Tana has tremendous effect on the climate, settlement patterns and economic activities within the county. Given the arid nature of the county, there is great potential for expansion of agriculture through harnessing of River Tana and Laghas. The geology is predominantly composed of quaternary sediments starting with weathered corals at Lamu and weathered gypsum deposits at Garissa. The recent deposits are underlain by the Merti formation, which is a marine to pre-marine sedimentary formations of Miocene to Pliocene age. The formation is of unknown thickness, though in the Garissa area it is believed to be at least 270 metres thick.

5.4 Soil Conditions

Lamu County has soils ranging from sandy to sandy loams. The county has some pockets of clay and loamy soils that support both vegetation and crops. The type of soil and ground stability is also an important consideration because it has a bearing on the structural design of the road project. For instance areas with expansive or erodible or swampy soils will require special attention, because of their impact on construction and future maintenance.

Characteristics of soils in Garissa are less similar with large portions of the county having sandy, sandy loam and dark clay. Garissa County, in particular, have soils that range from the sandstones, dark clays to alluvial soils along the *laghas* and in River Tana Basin. Whitish and red soils are found in Balambala Constituency where the terrain is relatively uneven and well drained. However these soils have low water retention capacity but do support vegetation and have potential for crop farming. It is notable that the rest of the county has sandy soils that support scattered shrubs and grasslands which are ideal for livestock production as well as wildlife.

5.5 Physiographic and Eco-Climatic Conditions of the Project Road

The project area does not have permanent rivers (except the Tana River about 20km away), but a few seasonal water courses and seasonal streams occur. These seasonal water courses emerge during the often short rainy seasons and dry up during the dry seasons. These characteristics open the counties to flood during heavy rains.

Climatic conditions of the counties vary with Garissa County having arid and semi-arid climatic features while Lamu has coastal climate level. Temperatures of the counties are generally high and humid. Key physiographic and climatic conditions are given in **Table 5.1** below.

Table 5.1: Physiographic and Climatic Conditions of the Project Road

Factors	Lamu County	Garissa County
Topography	• Generally flat	• Basically flat and low lying
Notable features	• Lies between altitude Three and twenty three meters above sea level. • Flooding during the rainy seasons • Few seasonal streams • There is a bimodal rainfall pattern with long rains occurring from mid-April to the end of June with the highest rainfall recorded in the month of May • Annual temperature ranging between 23 Celsius and 32 Celsius.	• No hills, valleys and mountains • Altitude varies from 23 m to 250m • There are seasonal Laggas. • Existence of Tana River Basin • Temperatures range from 20 degrees centigrade to 38degrees • Rainfall averages 450mm per year and is usually unreliable.
Rock Formation		• Quaternary sediment rocks, sand clay, soils and clay.

(Source: SAI Consulting Household Survey _2014)

5.6 Agro-climatic Conditions of the Project Area

The agro-climatic zone map of Kenya (see Fig. 5-1) is a tool for assessing climatically suitable areas for various land use alternatives, with particular emphasis on the suitability for crops or crop varieties (Sombroek *et al.,* 1982). The major aspects of climate that affect plant growth are the balance between rainfall and evaporation, and temperature. With regard to rainfall, the length and intensity of the rainy and dry seasons and their variation from year to year are of particular importance. The moisture availability zones are based on the ratio of the measured average annual rainfall and the calculated average annual evaporation. **Table 5.2** shows the moisture availability zones and their characteristics along the proposed LAPSSET agricultural development corridor.

Figure 5.1: Agro-climatic Zones Map of the Proposed LAPSSET Corridor

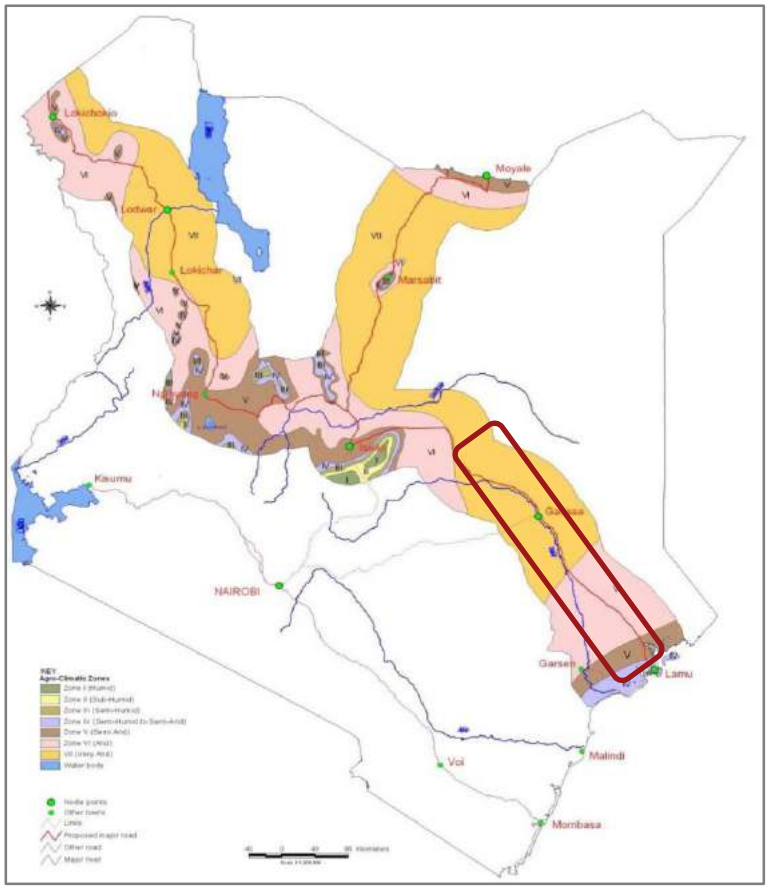


Table 5.2: Moisture Availability Zones along the Proposed LAPSSET Agricultural Development Corridor

Zone	Classification	Average annual rainfall (r) (mm)	Average annual potential evaporation (Eo) (mm)	Vegetation	Potential for plant growth
IV	Semi-humid to Semi-arid	600-1100	1550-2200	Dry woodland and bushland	Medium
V	Semi-arid	450-900	1650-2300	Bushland	Medium to low
VI	Arid	300-550	1900-2400	Bushland and scrubland	Low
VII	Very arid	150-350	2100-2500	Desert scrub	Very low

5.7 Land Use Types of Lamu / Garissa Areas

This segment of the LAPSSET agricultural development corridor extends from Lamu Port and traverses the Coastal Region (Lamu, Tana Delta and Tana River Districts) and the North Eastern Region (Ijara, Lagdera, Fafi and Garissa Districts). Due to the vastness of the area covered, the development of infrastructure and resources has not been fully exploited. Pastoralism is the dominant land use type (68.52%) followed by agro-pastoralism (21.83%) as shown in **Table 5.3**.

Table 5.3: Land Use Types Along the Lamu-Garissa LAPSSET Corridor

Land use type	Area (Ha)	Coverage (%)
Pastoralism	2,998,893	68.52
Agro-pastoralism	955,490	21.83
Exploitation of natural vegetation	420,712	9.61
Nature protection	1,781	0.04
Total	**4,376,876**	**100.00**

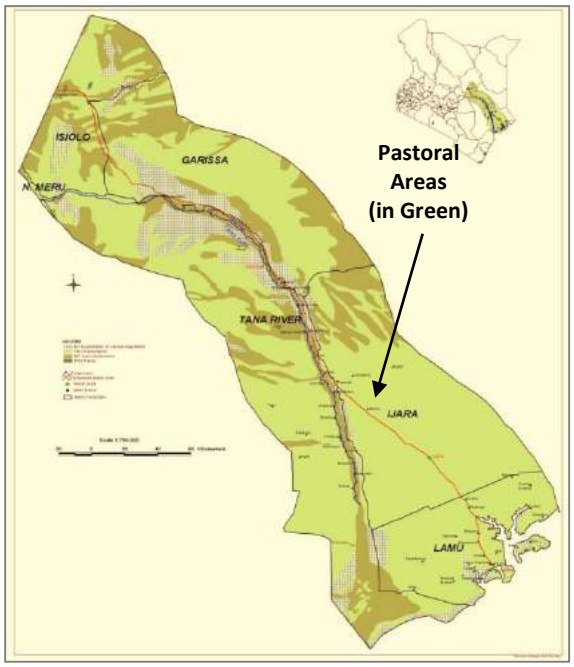
Pastoralism

This is a predominant system or occupation the project area. Under this land use type, the livestock owners do not have a permanent home and they have no regular cultivation practices as the people move with their herds. Pastoralism is a subsistence land use system based primarily on domesticated livestock production for meat, milk, hides, blood, etc. The main livestock breeds kept are indigenous cattle, sheep and goats, Orma/Galla goats, black head Persian sheep and camels. Pastoralists rely on rangelands and livestock for their livelihoods, but exhibit different levels of mobility and market involvement, and operate under a variety of different land tenure regimes.

Livestock kept in the Project Area

Pastoralists use mobility to respond quickly to fluctuations in resource availability, dictated by the dry lands scarce and unpredictable rainfall. They also employ a number of highly specialized risk-spreading strategies to safeguard their herds against drought, floods, disease and social unrest. These strategies – including building up herd sizes as insurance against times of hardship, splitting herds across different locations to spread risk, keeping different species and breeds and loaning surplus animals to family and friends – ensures the rational use of the natural resource base and also develop and strengthen social relations as a form of social capital (ODI, 2009).

Figure 5.2 : Land use Map of Lamu-Garissa LAPSSET Corridor



Agro-Pastoralism

According to Swift (1988) agro-pastoralism is the coexistence of both agricultural and grazing activities, although there may be different degrees of integration of these activities, with specific consequences for land use. Under this system, the livestock owners have a permanent home where subsistence farming is practiced and the livestock are moved to distant areas in search of pasture and water, especially during the dry seasons. However, lactating cows, calves and sick animals remains in the homestead. The movement of livestock and herders is usually towards the banks of Tana River which is the only permanent river and also to the Tana River Delta. However, serious conflicts arise between the pastoralists and the farming communities along these dry season grazing areas due to competing land uses, natural resources competition and community interests.

Exploitation of Natural Vegetation

This refers to extraction of wood fuel, timber, building poles, and other products from the vegetation or environment for domestic use. In this segment of the corridor, exploitation of vegetation is common in the Lamu Archipelago especially the extensive mangrove forests dominated by *Sonneratia alba, Rhizophora mucronata, Avicennia marina* and *Ceriops tagal*. Lamu District has the largest area of mangrove in Kenya. Mangrove forests are the cradles of various marine life and the local communities make use of the mangrove forests for fishing ground, while cutting of mangrove trees is still licensed to the local communities (GoK, 2011). These facts imply that the local communities have a right to use the mangrove forest as their property based on the law/regulations. The mangrove trees are of economic value and traded around the area for timber, poles, etc. Exploitation of natural vegetation along Tana River is also common.

Nature Protection

In areas designated as parks and reserves, they are characterized by low level of interference with the natural environment or ecosystem. The low intensity of use is towards wildlife management and tourism activities. Situated in this segment of the corridor are the following national reserves:

1) Tana River Primate National Reserve located between Garsen and Hola in Tana River District
2) Arawale National Reserve near Hola
3) Tana River Delta Ramsar Site

Tana River Delta: Where River Tana (Kenya's longest river) joins the Indian Ocean, a vast triangle of land from Garsen in the north, Kipini in the east to the Malindi road in the south and west, forms the Tana River Delta. The Delta covers an area of 130,000 ha and consists of savannah, seasonally flooded grassland, forest remnants, permanent, and seasonal fresh water pools or channels, mangroves swamps, sand dunes and beaches. This ecosystem supports several communities and enormous numbers of livestock, wildlife and birds. The people have adapted their lifestyle to seasonal extremes through cultivation on receding lake edges, seasonally fertile floodplains and other areas with fresh water sources. Tana River Delta is recognized in Vision 2030 as a key area for economic development through large-scale agricultural enterprises such as irrigated rice, sugar and bio-fuel crops. It is also a recognized wetland area under the Ramsar Convention.

According to FAO (2000), land cover is the observed (bio) physical cover on the earth's surface and in strict sense it should be confined to describing vegetation and man-made features. The land cover types were described according to the FAO land cover classification system (LCCS) during the development of the Kenya District Land Cover Atlas by FAO/Africover Programme (DRSRS, 2006). The land cover types along the former districts (now counties) traversing the proposed LAPSSET corridor are described in **Table 5.4**.

Table 5.4: Land-cover Types along Districts Traversing Lamu-Garissa LAPSSET Corridor Section

Land-cover Type	Cover per County (%)	
	Lamu	Garissa
Bare areas	0.24	**N/A**
Closed herbaceous vegetation on permanently flooded land	0.06	0.54
Closed shrubs	0.77	1.18
Closed to open woody vegetation (thicket)	35.21	9.72
Mangrove (Trees)	5.97	0
Open low shrubs (65-40 per cent crown cover)	8.22	41.22
Open shrubs (45 - 40 per cent crown cover)	3.15	9.74
Shrub savannah	0.30	9.29
Trees and shrubs savannah	1.23	3.55
Very open trees (40 - 15 per cent crown cover)	0.65	5.22

5.8 Air Quality

Air quality along a road corridor is influenced by transport activities in addition to agricultural and urban related emissions (farm machinery and domestic emissions). With the low traffic volumes plying the route comprising partly of heavy trucks, vehicular emissions are expected to be relatively low in most parts but slightly higher at urban centres, for example Garissa. The key emissions associated with the project road include carbon dioxide (CO_2), carbon monoxide (CO), Nitrogen Oxides (NO_x), Sulphur Oxides (SO_x) and Particulate Matter (PM2.5, PM5 and PM10) which comprises of hydrocarbons, fuel aerosols and soot. Air quality was spot monitored over a period of about 6 hours using the equipment's as given in the **Table 5.5**: Measured air quality levels at various sampling stations is presented in **Table 5.6**. Due to the high dispersal rates and openness of the vegetation in the entire corridor, the overall concentration of the pollutants in the air is fairly low. These are within tolerable limits according to **NEMA Air Quality Regulations 2014 guidelines**. These guidelines give the following upper limits: particulate matter (360 µg/m^3), sulphur oxides (80 ppb); nitrogen dioxide (100 ppb) and total VOC (600 ppb).

Table 5.5: Measurements of Ambient Concentrations

Parameter	Equipment	Manufacturer
Particulate matter (µg/M^3)	UCB - Particulate matter	European Tech, NV Essenlaan 7, B-9139 Kioldrecht, Belgium
Carbon monoxide (CO) (ppm	IAQ=CAL 7545 Meter	TSI Incorporated, 500 Cardigan Road, Shoreview, MN 55126, USA
Carbon dioxide (CO_2) (ppm)	As above"	TSI Incorporated, 500 Cardigan Road, Shoreview, MN 55126, USA
Nitrogen Dioxide (NO_x) (ppb)	Bacharach Air Sampler	Bacharach INC, 621 Hunt Valley Circle, New Kensington, PA 150668-9972, USA
Sulphur Dioxide (SO_x), (ppb)	Bacharach Air Sampler	Bacharach INC, 621 Hunt Valley Circle , New Kensington, PA 150668-9972 , USA
Volatile Organic Compounds (VOC) Total (Benzene, Toluene, Ethlybesene, Xylene) (ppb)	Bacharach Air Sampler	Bacharach INC, 621 Hunt Valley Circle , New Kensington, PA 150668-9972 , USA
Noise Levels (dB)	Sound Digital Hand Meter HP882A	Zhuhai Jida Huapu Instrument Co., Ltd, Guangdong, China

Table 5.6: Air Quality Levels at Various Sampling Sites

Location/ *Date of Sampling*	Particulate matter (µg/m^3)	Carbon monoxide (CO) (ppm)	Sulphur Dioxide (SO_x) (ppb)	Carbon dioxide (CO_2) (ppm)	Volatile Organic Compounds (VOC) Total (Benzene, Toluene, Ethlybezene, Xylene) (ppb)	Nitrogen Dioxide (NO_x) (ppb)
Mokowe (at Km 0+500) ***22nd Sep. 2015***	4.8	0	0.6	365	580	6.0
Bodhei (at Km 42) ***23rd Sep. 2015***	6.2	0	1.2	380	690	7.1
Ijara (at Km 83) ***24th Sep. 2015***	5.2	0	0.5	360	590	6.5
Garissa (at Km 255) ***26th Sep. 2015***	14.0	0.1	1.8	403	850	8.3

5.9 Water Quality

Water samples were collected in the field and taken to the laboratory for chemical analysis using standard methods such as ion chromatography, etc. pH was determined in the field using a pH meter. Water quality (**Table 5.7**) at the various sites were within tolerable levels according to the **NEMA Water Quality Regulations 2006 guidelines**, (Table 5.8) and shows that water is potable.

Table 5.7: Water Quality at Various Sites along the Road Corridor

Parameter Units	Units	Location/*Date of Sampling*			
		Mokowe B/water (Km 5), *22rd Sep. 2015*	**Bodhei B/water (Km 43), *23rd Sep. 2015***	**Ijara B/water (Km 84), *24th Sep. 2015***	**Garissa (River Tana water) (Km 260), *26th Sep. 2015***
pH		6.66	6.70	6.70	6.8
Colour	oH	600	400	300	650
Electrical conductivity	(µS)	327	450	500	350
Turbidity	NTU	2.40	2.50	2.60	25.0
Total Hardness	Mg/l	86	100	100	90
Total Alkalinity	Mg/l	56	60	60	40
Dissolved Oxygen	Mg/l	4.0	4.5	3.0	5.0
Iron	Mg/l	0.4	1.2	1.2	10.3
Manganese	Mg/l	Trace	0.02	0.03	Trace
Fluoride	Mg/l	Trace	0.3	0.3	Trace
Sulphate	Mg/l	90	85	80	60
Phosphate	Mg/l	0.03	0.05	0.05	0.01
Silica	Mg/l	80	85	85	70
Nitrates	Mg/l	2.0	2.6	2.5	3.0

(B/water: Borehole water)

Table 5.8: NEMA Waste Water Discharge Guidelines

Parameter	Units	Discharge into public sewers	Discharge into open water bodies
pH	-	6.0 – 9.0	6.0 – 9.0
BOD (5 days at 20° C) not to exceed	Mg/l	500	20
COD not to exceed	Mg/l	1000	50
Total suspended solids not to exceed	Mg/l	500	30
n-hexane extract not to exceed	Mg/l	Nil	30
Oils(mineral, animal & vegetable)	Mg/l	10	5
Total phenol not to exceed	Mg/l	10	2
Copper (Cu) not to exceed	Mg/l	1.0	0.05
Zinc (Zn) not to exceed	Mg/l	5.0	0.5
Lead (Pb) not to exceed	Mg/l	1.0	0.1
Arsenic (As) not to exceed	Mg/l	0.2	0.002
Total Mercury (Hg) not to exceed	Mg/l	0.05	0.005
Alkyl mercury not to exceed	Mg/l	0.01	0.001
PCB (Polychlorinated biphenyl) not to exceed	Mg/l	Nil	0.003
Pesticides residues not to exceed	Mg/l	Nil	0.05
Sulphates not to exceed	Mg/l	1000	500
Dissolved manganese (Mn)	Mg/l	-	1.0
Chromium (total)	Mg/l	1.0	0.1
Chloride not to exceed	Mg/l	1000	1000
Fluoride not to exceed	Mg/l	-	2.0
Coliform bacteria	-	-	1000/100ml
Free ammonia not to exceed	Mg/l	2.0	0.2

Parameter	Units	Discharge into public sewers	Discharge into open water bodies
Sulphides (S) not to exceed	Mg/l	2.0	0.1
Cadmium (Cd) not to exceed	Mg/l	0.5	0.05
Cyanide (CN) total not to exceed	Mg/l	0.5	0.1
Organic phosphorous not to exceed	Mg/l	30	1.0
Chromium six (Cr 6) not to exceed	Mg/l	0.5	0.005
Total dissolved solids not to exceed	Mg/l	3000	1200
Selenium (Se) not to exceed	Mg/l	1.0	0.05
Nickel (Ni) not to exceed	Mg/l	3.0	1.0
Barium (Ba) not to exceed	Mg/l	10	2.0
Temperature not to exceed	-	+/- 2° of the ambient temperature of the sewer	+/- 2° C of ambient temperature of the water body
Oil/ grease	Mg/l	No trace	Nil/ no trace
Toxic substances	Mg/l	Nil	Nil
Odour	-	-	Not objectionable to the nose
Colour	-	-	Not objectionable to the eye or not to exceed 5 mg Pt/l

5.10 Noise and Vibrations

Noise and vibrations was spot monitored over a period of about 6 hours using Sound Digital Hand Meter HP882A equipment (**Table 5.5**):

Noise levels along the corridor are mainly ambient, influenced by nature human settlement. Slight elevated levels are within markets and near urban centres where economic activities including commercial undertaking and entertainment points are located, for example these were highest at Garissa (**Table 5.9**). Along the corridor, the main source is low vehicular traffic plying the corridor. The levels, however, are confined within the vicinity of the carriageway. These are within tolerable limits according to **NEMA Noise Regulations 2009 guidelines** that stipulates that noise levels should not exceed 60dB for health facilities, educational institutions and homes; and 75 dB for other areas.

Table 5.9: Noise Levels at Various Sites along the Road Corridor

Location/Date of Sampling	Noise Levels (dB)
Mokowe (at Km 0+500), ***22nd Sep. 2015***	45
Bodhei (at Km 42), ***23rd Sep. 2015***	48
Ijara (at Km 83), ***24th Sep. 2015***	50
Garissa (at Km 255), ***26th Sep. 2015***	65

5.11 Flora and Fauna

Lamu is a region rich in both ecological and cultural diversity, which has allowed it to be recognized as a UNESCO World Heritage Site. Lamu is not only endowed with biodiversity on the mainland, but additionally has some of the richest marine ecology on the Kenyan coastline. The County has two National reserves: Dodori, and Kiunga Marine. Covering 877km^2, Dodori

is a breeding ground for the East Lamu Topi, and consists of a variety of mammals and birdlife including lions, elephant shrew, hippo, pelicans, and many more. It has the most varied species of mangrove forest in Kenya at Dodori Creek. Kiunga Marine Reserve consists of several islands rich with biodiversity including valuable coral reefs, sea grass, extensive mangrove forests, and the endangered sea turtles and dugongs. Kiwayu Island, which is part of the reserve, is deemed as having the most pristine beach in Kenya.

There are some non-gazetted indigenous forests in the Garissa county, namely Boni. Most of the forests in the county are woody trees and shrubs which are mainly browsed by camels and goats and to some extent by grazers. Some species provide forage long into the dry season in form of fallen leaves and seed pods. There are 40 Community Forest Associations (CFAs) in the county. Plants list from the coast (Lamu) to the interland (Garissa) is attached as in **Annexure 5.1.**

The main forest products are gum arabica, resins, poles/posts, firewood, charcoal and herbal medicine. At the moment, these products are marketed outside the county. Handicrafts and housing materials are also made from plant species such as *Prosopis juliflora* (an alien invasive species).

The main wildlife types found in the county are: elephant, lion, cheetah, leopard, hippopotamus, crocodile, hart beast, grants gazelle, thompson gazelle, gerenuk, jackal, spotted hyena, buffalo, zebra, topi, giraffe, dik dik and baboon. The wildlife species are not confined to parks, they move freely in the area.

Some vulnerable/ Threatened plant species and Endangered animal species found along the project area as attached in **Annexure 5.2 & 5.3**. Photographs of wildlife and livestock found in the project area Is attached as **Annexure 5.4.**

a) Coastal vegetation

b) Inland vegetation around and after Ijala and towards Garissa town

5.12 Conservation Areas in the Project Zone

5.12.1 The Arawale National Reserve

Arawale National Reserve forms the western border of the road project between Ijara and Masabubu (see Fig. 4-1,Chapter 4). The Arawale National Reserve is a designated conservation area managed by the Garissa County in assistance with the Kenya Wildlife Service. It lies 77 km south of the town of Garissa. The reserve covers an area of about 533km^2. Arawale was gazetted in 1973 with the primary purpose of protecting the Hirola or Hunter's hartebeest (*Beatragus hunteri*) an extremely rare antelope species which is found only in this region. The landscape in this area is mostly a dry thornbush savannah. The Hirola is critically endangered according to the IUCN red list of threatened species. Arawale is also a refuge for some species like elephant, giraffe, Grevy's zebra, African wild dog, cheetah, lesser kudu, buffalo, hippo and crocodile (at the Tana River area).

5.12.2 Boni National Reserve

Boni National Reserve is a conservation area that lies in the east Ijara District of Garissa County next to the Somali border (see Fig. 4-1,Chapter 4). The reserve covers an area of 1,339 km^2 and is managed by Kenya Wildlife Service. It was gazetted in 1976 as a dry season sanctuary for elephants in Ijara, Lamu and Somalia. Boni forest, after which the reserve is named, is an indigenous open canopy forest and part of the Northern Zanzibar-Inhambane coastal forest mosaic. It habours densities of plant species that are among the highest in the world, the forest has been declared a biodiversity hotspot. Common herbivores in the reserve include hippopotamus, bushpig, warthog, buffalo, common duiker, topi and waterbuck. Common carnivores in the reserve are the vulnerable African Wild Dog and the aardwolf. Although extremely rare, African elephants are also present in the reserve. As part of the East African coastal forest, it holds bird species characteristic of the coastal forests of eastern Africa. Some of which, for example the Sokoke Pipit, are threatened.

5.12.3 Dodori National Reserve

Dodori National Reserve covering an area of 877 km^2 is a protected area located in Lamu East District of former Coast Province of Kenya (see Fig. 4-1,Chapter 4). It was gazetted in 1976 and encompasses an important woodland and forest area that historically supported large populations of wildlife, including elephants, lions, buffaloes, and coastal topi. Dodori National Reserve is managed by Kenya Wildlife Service and is part of a larger area that has been recognized globally as an important cultural heritage area and conservation hotspot by international organizations such as the IUCN, Conservation International, World Wildlife Fund, amongst others. Together with the nearby Kiunga Marine National Reserve, the Dodori National Reserve was named a UNESCO Man and Biosphere Reserve in 1980. Dodori hosts a rich plant diversity consisting mainly of coastal and riverine forests, mangroves, swampy grasslands and savannah. Away from the rivers and channels, are impenetrable thorn bushes with scattered gigantic baobabs. Dodori's main wealth is its topi population, one of the largest in Kenya. Other mammals include elephants, gazelles, lesser kudus, zebras and lions. At the Dodori coastal area, waterholes are frequently visited by gazelles, antelopes and water birds.

5.12.4 The Tana Primate Reserve

This reserve is located 240km north of Mombasa in Tana River County, west of the road project (see Fig. 4-1,Chapter 4). The ecosystem consists of riparian forests, dry woodlands and savannah habitats on the east and west of the lower Tana River. The reserve was established to protect the Tana riverine forest and the two endangered primates, Mangabey and the red

colobus monkey. The two primate species are the major wildlife attraction in the reserve. The ecosystem is also a stronghold for birdlife with over 200 species recorded in the area. These include the White-winged Apalis, African Open-bill Stork, Martial Eagle, Bat Hawk, African Pygmy-falcon, African Barred Owlet, Scaly Babbler, Black-bellied Glossy-starling, and the Golden Pipit.

5.12.5 Tana River Delta

Where River Tana (Kenya's longest river) joins the Indian Ocean, a vast triangle of land from Garsen in the north, Kipini in the east to the Malindi road in the south and west, forms the Tana River Delta (see Fig. 4-1,Chapter 4). The Delta covers an area of 130,000 ha and consists of savannahs, seasonally flooded grasslands, forest remnants, permanent and seasonal fresh water pools or channels, mangroves swamps, sand dunes and beaches. This ecosystem supports several communities and enormous numbers of livestock, wildlife and birds. Tana River Delta is recognized in Vision 2030 as a key area for economic development through large-scale agricultural enterprises such as irrigated rice, sugar and bio-fuel crops. It is also a recognized wetland area under the Ramsar Convention.

5.12.6 Lamu Old Town UNESCO Heritage Site

Lamu Old Town is the oldest and best preserved example of Swahili settlement in East Africa. With a core comprising a collection of buildings on 16 ha, Lamu has maintained its social and cultural integrity, as well as retaining its authentic building fabric up to the present day. Once the most important trade centre in East Africa, Lamu has exercised an important influence in the entire region in religious, cultural as well as in technological expertise. Unlike other Swahili settlements which have been abandoned along the East African coast, Lamu has continuously been inhabited for over 700 years.

The authenticity of the Old Town is vulnerable to development and to a lack of adequate infrastructure that could overwhelm the sensitive and comparatively fragile buildings and urban spaces that together make up the distinctive urban grain of the town. Lamu Old Town is managed by the National Museums and Heritage Act 2006 (that replaced the 1983 National Museums Act Cap. 216 and Antiquities and Monuments Act Cap. 215) and the Local Governments Act (and the associated by laws). Physical construction is also subjected to the EMCA Act and the 2006 Planning Act, which recognize that archaeology is material for consideration. The Old Town has a gazetted buffer zone that includes the Manda and Ras Kitau mangroves and the Shela sand dunes, protected by the Forest Act and Water Act respectively.

5.13 Socio-Economic Profile of the Project Area

5.13.1 Administrative Setup

Lamu County: Lamu County comprises of two sub-counties; Lamu East and Lamu West. Lamu East divisions are Faza, Kiunga and Kizingitini while the Lamu West divisions are Amu, Hindi, Mpeketoni and Witu. The total number of locations in the county is 23 while the sub-locations number 38. The county headquarters is Lamu.

Garissa County: Garissa County is an administrative county in the former North Eastern provience of Kenya. Its capital town is Garissa. Garissa County has seven sub-counties (Districts).These are Fafi, Garissa, Ijara, Lagdera Balambala, Dadaab and Hulugho. The county is further divided into 23 divisions and 83 locations

5.13.2 Demographic Profile

The LAPSSET Project is intended to serve the people of Kenya who are spread in the 8 regions or former provinces. **Table 5.10** below illustrates the magnitude of each region's population. Socio-economic activities of the indicated population will determine the usage and operations of the LAPSSET.

Table 5.10 : Regional Analysis of Demographic Characteristics

Province	Area (sq km)	Population (No)	Density (/sq km)
Nairobi	695.1	3,138,369	66
Central	13,163.7	4,383,743	333
Coast	82,892.8	3,325,307	40
Eastern	153,403.9	5,668,123	40
North Eastern	126,852.3	2,310,757	18
Western	8,309.3	4,334,282	522
Nyanza	12,612.9	5,442,711	432
Rift Valley	183,383.2	10,006,805	55
Total Provinces	**581,313.2**	**38,610,097**	**66**

(Source: Kenya Population (2009 Census)

The two Counties of Lamu and Garissa are the direct beneficiaries with the project road and activities of the population will greatly affect the activities of the project. According to the 2009 Kenya Population and Housing Census the population , the population of Lamu County was 101,539 persons (53, 045 Males and 48,494 Females) with a population density of 16 people per Km^2 and an annual growth rate of 2.47%. Garissa County had a population of 623,060 persons (334,939 Males and 288,121Females) with a population density of 14 persons per square kilometre. Population data of both the county is given in **Table 5.11** & **5.12**.

Table 5.11: Lamu County Population

Constituency	2009 (Census)		2012 (Projections)		2015 (Projections)		2017 (Projections)	
	Population	Density (Km2)	Population	Density (Km2)	Population	Density (Km2)	Population	Density (Km2)
Lamu West	82,698	65.2	91,421	73	101,067	80	111,727	83
Lamu East	18,841	135.2	21,628	152	23,026	168.5	25,453	180
Total	**101,539**		**113,029**		**124,095**		**137,180**	

(Source: Kenya Census-2009)

Table 5.12: Garissa County Population

Constituency	2009 (Census)		2012 (Projections)		2015 (Projections)		2017 (Projections)	
	Population	Density (Km2)	Population	Density (Km2)	Population	Density (Km2)	Population	Density (Km2)
Garissa Township	116,953	173	131,405	194	147,642	218	159,566	236
Balambala	73,109	15	82,143	17	92,293	19	99,747	20
Lagdera	92,636	14	104,083	16	116,944	18	126,389	19
Dadaab	152,487	22	171,329	25	192,500	28	208,048	37
Fafi	95,212	6	106,977	7	120,196	8	129,904	8
Ijara	92,663	9	104,113	9	116,978	11	126,426	13
Total	**623,060**	**14**	**700,050**	**16**	**786,553**	**18**	**850,080**	**19**

(Source: Kenya Census-2009)

The population of Lamu and Garissa Counties can be described in terms of population size, distribution and composition, settlement, force and vulnerability. Key features of the population is analysed and detailed in **Table 5.13** below.

Table 5.13 : Population Patterns in Lamu and Garissa County

Sr. No.	Feature	County	
		Lamu	Garissa
1	Total Population	101,539	623,060
2	Grow at rate	2.47%	3.7
3	Age group 0-9	42%	32%
4	Age group 10-19	22.5%	27%,
5	Dependency Ration	45.2%	48%
6	Youthful Population	32%	28%
7	Labour force	54.3%	49%
8	Urban Population	20%	16%

(Source: Lamu/Garissa County Data Fact Sheet)

5.13.3 Economic Activities

The Lamu county has four main livelihood zones namely; mixed farming food/cash crop/livestock livelihood, fishing and mangrove harvesting livelihood; mixed farming food/cash crops livelihood; and formal employment/casual waged labour/business livelihood zone. Livestock rearing is the backbone of the county's economy.

Agriculture

The main sources of water in the county are natural ponds, small lakes, boreholes, shallow wells, djabias (underground water harvesting structures), rivers, water pans and dams. Shallow wells, boreholes and djabias constitute 66 per cent of household water sources while natural ponds, small lakes, seasonal rivers and piped water constitute 34 per cent. The temporal water sources were recharged to about 95 per cent of their capacity due to the relatively good performance of the long rains. However, in fishing and mangrove zone, the open water sources were recharged to nearly 60 per cent. Water desalinators have also been introduced in some islands.

Garissa County is basically flat and low lying without hills, valleys and mountains. It rises from a low altitude of 20m to 400m above sea level. The major physical features are seasonal laghas and the Tana River Basin on the western side. The River Tana has tremendous effect on the climate, settlement patterns and economic activities within the county. Given the arid nature of the county, there is great potential for expansion of agriculture through harnessing of River Tana and the numerous *laghas*. The soils range from the sandstones, dark clays to alluvial soils along the *laghas*, River Tana Basin and the Lorian swamp. White and red soils are found in Balambala Constituency where the terrain is relatively uneven and well drained. The soils have low water retention capacity but support vegetation. These soils have potential for farming. The rest of the county has sandy soils that support scattered shrubs and grasslands which are ideal for livestock production. The county's land is highly erodible. The exploitation of the soil resource thus must take into account conservation measures due to their fragile nature. The mineral potential of the soils is not exactly known as no geological mapping has been done. Reconnaissance surveys have however, indicated some occurrences of clay, good quality building sand along *laghas*, lime and gypsum in places such as Benane in Lagdera Constituency and in Dadaab Constituency.

Agriculture is mainly practiced along River Tana basin and other areas that can water easily. Food crops grown are basically watermelons, mangoes, vegetables, tomatoes, paw paws,

bananas, cowpeas, simsim, maize, beans and green grams. These crops are usually produced on a small scale under irrigation farming. The small scale farming constitutes 98% 0f the total farming activities in the counties where farm sizes average 1-2 acres.

Lamu County receives a bimodal type of rainfall with long rains accounting for 80 per cent total annual crop production. There are 3 major rainfall zones in the county: the arid zones along the northern border (Kiunga) receives between 550 – 700 mm of rainfall, the semi-arid areas of Amu, Faza and Kizingitini divisions receive between 550 to 850mm and the sub humid zones covering Witu, Hindi and Mpeketoni divisions receive 850mm to 1100 mm of rainfall annually.

Crops grown for commercial purposes include mangoes, coconut, cotton, bixa and simsim. Maize and coconut contribute 37 and 20 per cent respectively to food in the fishing and mangrove zone, while maize contributes 80 per cent of food in marginal mixed farming zone. In the cash crop/dairy livelihood zone, maize, cowpeas and bananas contribute up to 50, 25 and 10 per cent of food respectively. Maize and cowpeas contribute 40 and 35 per cent to food in the mixed farming food/cash and informal/formal employment livelihood zones respectively. In all livelihood zones, actual production is lower than projected due to the short-lived rainfall experienced during the long rain season. Farmers supplemented rainfall with irrigation in areas with irrigation potential.

Garissa County is principally a semi-arid area falling within ecological zones V and VI; and receives an average rainfall of 275 mm per year. Rainfall is normally in short torrential downpour making it unreliable for vegetation growth. The southern parts of the County such as Hulugho, Masalani and Bura receive more rainfall than the northern parts. Balambala and Fafi constituencies practice rain-fed agriculture on small scale.

The crops grown in the two counties are maize, green grams, cowpeas. Current and projected levels of production are shown in **Tables 5.14** and **5.15**.

Table 5.14: Lamu County Area under Rain-Fed Crop Production

Rain fed Crop Production	Area Planted (Ha)		Production (90 kg bags)	
Crop	Current	5 Year Average Projections	Current (tons)	5 Year Average Projections
Maize	17,155	11,974	205,860	143,688
Green grams	1,748	1,580	15,732	13,500
Cowpeas	1,480	2,500	14,850	25,075

(Source: Garissa DDP 2008-12)

Table 5.15: Lamu County Area under Irrigation

Crop	Area Planted (Ha)		Production (90 kg bags)	
	Current	Short term Average (3 years)	Projected Production (tons)	Short term Average (3 years)
Tomatoes	180	100	14,325	8,000
Kales	112	40	3,047	1,080
Bananas	1,481	1,450	18,112	17,400

(Source: Lamu County Dev. Profile, May 2013)

Areas under irrigation are currently minimal but will be increased with Vision 2030 Projects being implemented in the area.

Livestock

Livestock is the main stay of some parts of Lamu County and majority of Garissa County. This sector accounts for over 90% of the economic value of all livelihood activities of the residents of the two Counties. The main livestock products are meat, milk, hides and skins. The backbone of the economic activities of the two Counties is livestock and agriculture. Agriculture consists of cereals, root crops and cash crops while livestock sector include cattle, camels, goats and sheep among others. Both agriculture and livestock sectors in the country will be expected to boost the business of the road project.

Table 5.16 : Garissa and Lamu County Livestock Production

Sr. No.	Types of Livestock	Lamu County	Garissa County
1	Cattle	69,102	87,110
2	Sheep	24,834	109,260
3	Goats	84,415	204,100
4	Camels	NA	36,270
5	Donkeys	1,515	19,000
6	Poultry	96,550	11,415
7	Beehives	NA	3,600

(Source: Garissa DDP 2008-12, Lamu County Dev. Profile, May 2013)

Fishing

Lamu is divided into three main fishing zones; marine capture fishing, fresh water capture fishing and aquaculture fishing. The main activities are found in marine waters accounting for 95 per cent. Inland fisheries are found in Witu and Mpeketoni divisions though fish farming activities are still at infant stage despite vast potential for the same. The estimated total annual production is 2,200 metric tonnes. Marine fishing account for 80 per cent of total fish production amounting to 1,800 metric tonnes valued at KES 137 million annually.

Marine fishing is predominantly practiced along the 130 kilometers coast line of Lamu stretching from Dar Salaam point in Kiunga to Ras Tenewi. Annual fresh water production from the oxbow lakes of the Tana delta and Lake Kenyatta is estimated at over 300 metric tonnes accounting for 19 per cent of the county's total production. Fishing is predominantly restricted within the sheltered areas and up to five nautical miles offshore. Aquaculture contributes to 1 per cent (5,398 kg of cultured fish harvested by December 2012) of the total annual production. The current weather conditions has affected the fishing in that fishermen now harvest less due to strong winds affecting accessibility to the deep sea. The Government supported the funding of 400 fish ponds in Lamu County under the economic stimulus program. The project had some challenges in some areas. The soils were porous and have problems with water retention.

Fish farming in Garissa County is done on a small scale along the River Tana and in fish ponds. There are five fish ponds with a total area of 1,200 m^2. The main types of fish caught are mud fish, cat fish, bone fish, tilapia and eel. There are six landing beaches found along River Tana in Garissa, Fafi, Balambala and Masalani.

Business Enterprises

Business enterprises form another major economic activity in the project area. The businesses consist of general trade, hotels business, and export of mangrove products, coconut, fishing and tourism operations. Formal and informal employment forms another key economic

activity. Major sources of formal employment are government departments, non-governmental organizations, donor agencies and business organizations. A small number of the Counties' population is self-employed which represents approximately three per cent of the total population Opportunities for self-employment are found in commerce, milk vending, jua kali, hawking and livestock selling among others.

There are no major mining activities taking place in the county. However, there is presence of gypsum traces in the county which is used in the production of cement. The viability of exploiting of this mineral has not been investigated.

The county has a high potential for tourism development. The potential include a wide range of wildlife species such as, *Hirola,* lion, giraffe, other gazelles and zebras; a rich Somali traditional culture and a highly developed hospitality industry in Garissa Town. The proximity of the county to the tourist coastal town of Lamu makes it ideal for linkage through a tourist circuit. This coupled with the rich traditional culture of the Somali people would boost tourism in the region. Garissa County heavily relies on domestic tourism from the many local and international non-governmental organizations operating in the area throughout the year.

5.13.4 Level of Education in the Counties of Lamu and Garissa

a) Lamu County

In Lamu County, the school age going population forms 32% of the total population, out of which 22 % are of primary school going age (6 – 13 years) and 10% are of secondary school going age (14 – 17 years). The County has 65 primary schools. The population of the primary school going children in 2009 was composed of 8,358 males and 7,676 females. This was projected to increase to 10,438 males and 9,586 females by the end of the plan period. This age group represents 22 per cent of the total population and has a female to male ration of 1:1.08. The increase in population of this age group will require the County to increase investment in basic education facilities and to develop more vocational training facilities to absorb any dropouts.

The County has 5 Secondary Schools. The gender bias is manifested in enrolment in primary, secondary and tertiary educational institution as well as in the workplaces, hospitals, offices, schools and individuals homes. Thus analysis of education enrolment in primary schools in the County shows a female: male enrolment ratio of 1:1. The secondary schools have a female male enrolment ratio of 1:1.3. In primary schools, 80% of children in the relevant age cohort are enrolled in school but only 78 per cent of the female attend school. In secondary schools only 17% of the secondary school going age are enrolled in school while for the female only 15 % attend school. In youth polytechnics the female male ratio is 1:0:75.

Reasons for lower female school enrolment include religion, early marriages and the low value placed on educating the girl child.

b) Garissa County

Garissa County has a total of 58 Pre-Primary schools, 47 Primary Schools, and 9 Secondary Schools. Dropout rates for primary school is 43% for females and 31% for males while in secondary schools it was reported to be 15% and 22% respectively. The pupil teacher ratio is 1:38 in primary schools and 1: 18 in secondary schools. Enrolment of girls in Pre-Primary, Primary, and Secondary Schools is higher than that of boys. The primary school going age of 6-13 years was 50,190 for males and 43,529 for females in 2002. Only 12.5% of this population is in school while others are engaged in child labour and herding cattle. The low enrolments

of this population will have a high illiteracy rate in future. The County therefore needs to build more schools to make sure that each child is given an opportunity to go to school.

The secondary school age group of 14-17 years had 22,814 males and 19,354 females in that category in year 2002. Out of all these only 20,048 are in school representing a 4.2% of the population. The secondary schools need to be expanded to cater for more students who graduate from primary schools.

The implications of the above analysis are that this situation is reflected in formal employment where females are less than males. In rural areas where women provide the bulk of the labour force, the lower levels of education are likely to have negative effect productivity, as uneducated labour is less productive. However, women have been trying to make up for this shortcoming in education by enrolling in adult education classes where they make up to 60% of the total enrolment.

5.13.5 Child Dependents

The number of children today and the number of children that are likely to be born is critical for effective social planning. The number of children determines the demand for schools, health care and other social services for children and their families.

a) Child Dependency in Lamu County

In Lamu County, 94.2% of the respondents reported they had children of their own. The average number of children per family/household was 5 children. Among the school going children, 21.1% were reported not attending classes, primarily due to lack of school fees (19.2%) while 15.4% had been married-off. Each family has average of 2.8 school-going children attending classes. This means that, there is another half of the children assumed to be home thus increasing the child-dependency ratio.

b) Child Dependency in Garissa County

In Garissa County, 93.5% of the respondents had children. The average number of children per family were 6 children (standard deviation ±4.2, minimum = 1, maximum = 26, number of respondent = 93). This is suggestive that the average family size has 8 members. This is higher than national average of 5 family members (Kenya National Bureau of Statistics, 2008). On average, 3 children of school going age were attending classes (standard deviation ±2.2, minimum = 1, maximum = 11, number of respondent = 83). The main reasons for being out of school included lack of school fees (56.8%) or lack of adequate schools in the area (27.8%). The data is suggestive that Garissa County has average of 5 children per family at home. By extension, survival of the clans could be the principal reason of having a large number of children per family. Approximately over 90% of the families had children averaging 5 per household, details see **Table 5.17** below.

Table 5.17 : Child Dependents Profile by County

	Lamu		Garissa	
	Count	**Percentage %**	**Count**	**Percentage %**
Whether respondents have any children				
Yes	113	94.2%	87	93.5%
No	7	5.8%	5	5.4%
No answer	0	.0%	1	1.1%
Total	**120**	**100.0%**	**93**	**100.0%**
Whether any child is out of school				

	Lamu		Garissa	
	Count	Percentage %	Count	Percentage %
Whether respondents have any children				
Yes	24	21.1%	50	56.8%
No	89	78.1%	34	38.6%
No answer	1	.9%	1	1.1%
Do not know	0	.0%	3	3.4%
Total	**114**	**100.0%**	**88**	**100.0%**
Reasons for child being out of school				
Lack of fees	5	19.2%	28	51.9%
Lack of inadequate schools	2	7.7%	15	27.8%
Refused to go to school	2	7.7%	4	7.4%
Married	4	15.4%	0	.0%
Working	2	7.7%	2	3.7%
Others	10	38.5%	2	3.7%
Do not know	1	3.8%	3	5.6%
Total	**26**	**100.0%**	**54**	**100.0%**

(Source: SAI Consulting Household Survey _2014

5.13.6 Health Services in Lamu and Garissa Counties

Health services in the two Counties are provided through a number of institutions comprising of hospital, health centres and dispensaries, private clinics and mobile clinic. Despite these institutions the area is quite vast and the existing facilities are inadequate to serve the population as expected.

Most of the health facilities are concentrated within the divisional headquarters and major settlement centres. A good number of the population lives in rural areas where these services are not easily accessed and have to walk long distances averaging 50 kilometres to the nearest health facility to get medical attention. In Lamu County majority of the population live over 5kms to the nearest health facility.

a) Challenges in the health Sector

Considering the available government doctors, the doctor/population ratio stands at 1:36,343 for Lamu County and 1:46,000 for Garissa County. Inadequate equipment, drugs and personnel have led to underutilization of some of the facilities. Most prevalent diseases in the counties are malaria, diseases of respiratory systems , anaemia, skin diseases and HIV/AIDs.

As stated above the health sector in Lamu and Garissa face a number of challenges that include, inadequate funding to support planned rehabilitations of health facilities, limited capacity in procurement building and supervision, inefficient supply chain management system, matching supply of skilled human resources with the high rising demand for public health services, compounded by high population growth rate and lack of data and information on community health. The National and County Governments are taking key measures to ensure the community receives the best medical attention through the recent devolved government services.

5.13.7 HIV/AIDS Situation in the Counties of Lamu and Garissa

HIV/AIDS situation in the project counties is of concern. The low level of awareness of the disease due to illiteracy and denial due to, cultural beliefs and poverty are some of the major factors that have contributed to the rise in infection rates in the counties.

Information on the spread and effects of this disease in the two counties is scarce, however by the end of 2011, there were 10,563 people living with HIV in Garissa County where children constituted 16% of those living with HIV in the County. [1]Despite the fact that there is limited statistics on this pandemic it is reported that in 2007 the proportion of men living with HIV in Garissa County was higher than that of women. Notwithstanding the great importance of HIV testing as a way to increase prevention and treatment, about 71 per cent of people in Garissa County had never tested for HIV by 2009 as shown in **Table 5.18** below.

Table 5.18 : HIV Burden in Garissa

Indicator	Total	Rank in the Country
Total population (2009)	623,060	18
HIV adult prevalence (overall)	2.6%	7
Number of adults living with HIV	8,839	10
Number of children living with HIV	1,736	16
Total number of people living with HIV	10,563	11

Source: Garissa/Lamu County HIV and AIDS Profile

Coping mechanisms and important steps in reducing the sexual transmission of HIV are HIV counseling and testing, care and treatment, consistent and proper use of condoms. It is estimated that proper application of these methods can reduce the risk of HIV and other sexually transmitted infections by more than 90%.

There is a need to scale up HIV testing in the County, to counsel and reduce the risk for those who test negative, and to link those who test positive to care and treatment programmes.

In Lamu County by the end of 2011, there were 849 people living with HIV in Lamu County, children accounting for 13% of those living with HIV in the County. The status of the pandemic in the County is illustrated in **Table 5.19** below.

Table 5.19 : HIV Burden in Lamu

		Rank
Total population (2009)	101,359	1
HIV adult prevalence (overall)	1.3%	3
Number of adults living with HIV	732	2
Number of children living with HIV	117	1
Total number of people living with HIV	849	2

Source: (Lamu County HIV and AIDS Profile)

There are a number of institutions as well as the National and County Governments that are involved in the fight against the spread of this endemic. Some of the key institutions are the Ministry of Health, NACC and some NGO's. In a concerted effort these institutions need to address a number of issues that work negatively towards reduction of the disease. Some of the issues included, increased cases of STI/HIV/AIDS infection, slow behavioral change, inadequate care and support for the infected and affected and high costs and Availability of ARV (Anti Retro Vital Drugs)

In this respect, the institutions and agencies should equally develop strategies that reduce incidence of HIV infection, promote behaviour change, establish support and care for the infected and affected with HIV/AIDS and avail ARVs and reduce their prices.

5.13.8 Energy and Power Supply

Sources of energy and power supply in Lamu and Garissa Counties are firewood, charcoal, electricity, solar, biogas, kerosene and low pressure gas (LPG). The choice of use of these sources is depended on the socio-economic status of the residents. Analysis of the proportional usage of these sources in Lamu County homes for cooking and lighting is given in the **Table 5.20** below.

Table 5.20 : Sources of Energy in Lamu and Garissa Counties

Sr. No.	Source of Energy	Lamu _% age Use	Garissa _% age Use
1	Firewood	79	71.1
2	Charcoal	22.6	18
3	Electricity	16.8	0.7
4	Kerosene	82	33.2

(Source: SAI Consulting Household Survey _2014)

Plans are underway to introduce other forms of energy which are currently in very small use. These include solar, biogas, low pressure gas and diesel generators.

5.13.9 Poverty and Income Levels

Poverty in the project area is perceived as the inability to afford minimum basic human needs such as food and non-food items like clothing and shelter. Poverty conditions may be as a result of inability to access other factors. For instance, lack of access to health services may be due to high cost of medication or mobility to reach the health facilities due to the poor condition of the roads, and unreliability of sea transport on which majority of the residents depend. Poverty is also manifested through inability to obtain potable water and have access to sanitation. This also includes poor access to basic services for instance education, health, water and sanitation.

Therefore poverty rates in Garissa and Lamu are quite high due to lack of assured means of livelihoods. In Garissa and Lamu Counties on the basis of the Welfare Monitoring Surveys the rates of poverty are generally very high. Garissa County poverty is given as 68 per cent of the total population and that of Lamu County as 60 per cent of the total population.

Contributory factors to these high levels of poverty are banditry that causes insecurity, cattle rustling and specifically due to frequent and prolonged droughts that wipe out the communities only main and source of livelihoods, livestock. Therefore, the Counties need to make serious efforts to design appropriate poverty reduction strategies to tackle the problems associated with poverty.

5.13.10 Gender Inequality

Gender can be defined as the role, rights and obligations that culture and society attach to individuals according to whether they are male or female. This understanding translates into privileges enjoyed by either sex. In normal cases the society attaches values, norms and roles to males and female that causes gender disparities that are seen in all areas of daily life. Identified gender disparities in the counties include marginalization of women in education, income and property rights and lack of credit.

Key challenges to gender balance in a society may be summarized as, minimal participation of women in development decision-making, preferential (bias) treatment of boys when it comes

to education, low enrolment rate of the girls leading to disparity in literacy between boys and girls, disparity in wealth ownership, prevalence of negative cultural practices such as wife inheritance and early marriages.

Analysis of institutions involved in gender issues showed a number institutions and agencies are involved in the promotion of gender education and awareness. Some of these include, MOEST, MOH, FPAK, DSDO, NTANIRA, CBOs such as MYWO, Churches, Provincial Administration and Children Department. To improve gender balance in the society there is need to develop and promote gender oriented programmes.

5.13.11 Security

In the recent past (2005) the project counties were relatively security friendly and there were few cases of banditry or other forms of insecurity. The Kenya Integrated Household Budget Survey (KIHBS 2005) indicated that 69 per cent of the population felt very safe while only 10 per cent of the Counties' population felt unsafe. This compares well with the rest of the country where only 34 per cent of the population felt safe. However the situation in the project counties is fast changing and currently there are many cases of invasions by local and external bandits. Other incidences of insecurity, assault and bhang smoking were reported and on the increase. These are a major cause of concern to the security agencies and community in general. Infiltration of illegal weapons and refugees are main causes of this changing scenario. The recent cases of terrorist attacks in Lamu, Garissa and Mandera have left the region very insecure and the situation is worrying.

Chapter 6

Analysis of Alternatives

TABLE OF CONTENTS

6. ANALYSIS OF ALTERNATIVES

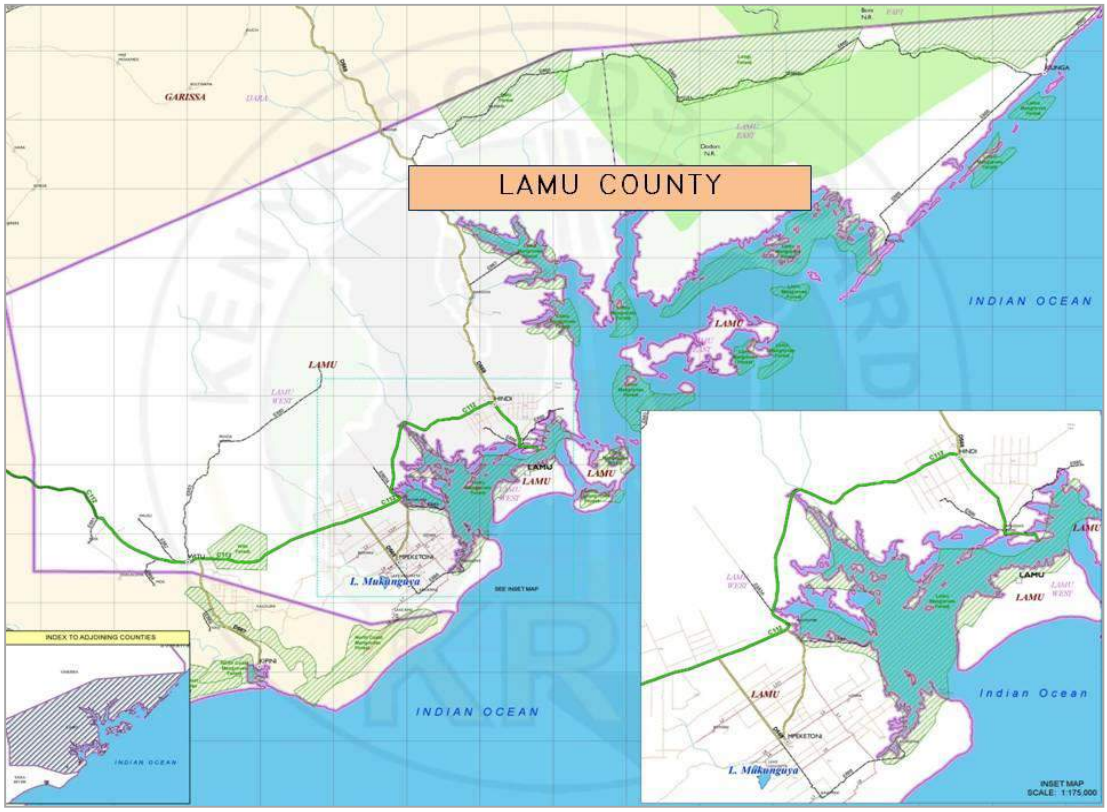
This chapter mainly describe about comparison of alternative alignment options, details of existing features enroute, merits and demerits of alternate options and recommendation for the most suitable option.

6.1 General

Kenya lies on the equator zone with the Indian Ocean to the south-east, Tanzania to the south, Uganda to the west, South Sudan to the north-west, Ethiopia to the north and Somalia to the north-east.

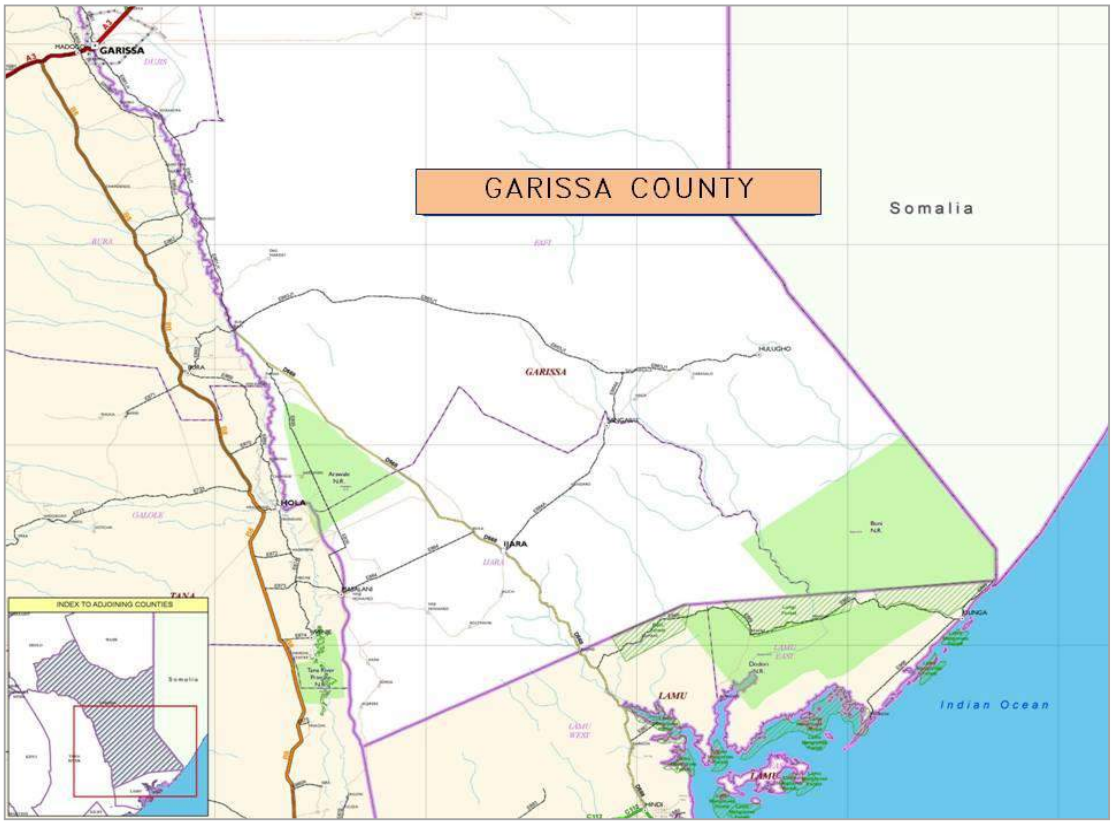
Project road, Lamu – Garissa, is located in the Northern-Eastern part of Kenya, passing through Counties of Lamu and Garissa. This region of Kenya is not currently well developed and thus economic activities are on lower side which is a key factor for growth and development of any area. Lamu County is located in Kenya's former Coastal Province with its headquarter in Lamu town and is one of the six counties in the coastal region of Kenya. The County covers a strip of north eastern coastal mainland and the Lamu Archipelago. Lamu County has a population of 101,539 (2009 census) and its land area is 6,167 km² that includes mainland and 65 Islands that form the Lamu Archipelago. Lamu Town on Lamu Island is Kenya's oldest continually inhabited town, and was one of the original Swahili settlements along coastal East Africa. It is situated 341km northeast of Mombasa and is also UNESCO World Heritage Site. Lamu County is the gateway to start of the "LAPSSET Corridor", with a road, rail and pipeline network linking Kenya, South Sudan and Ethiopia, in order to improve accessibility and connectivity as well as to stimulate economic activities. The map of Lamu County is shown in **Figure 6.1**.

Figure 6.1: Map of Lamu County



Garissa County is located in the former North Eastern Province of Kenya. The capital and largest town of the County is Garissa. The County has a population of 623,060. The County has an area of 45,720.2 km². The Garissa town is a market centre situated on the bank of Tana River. It is located about 350km east of Nairobi and is linked by road with Nairobi and Mombasa. Most of the inhabitants of Garissa town are ethnic Somalis. The infrastructure facilities in the county are poor with only 29.9 km of bitumen surfaced roads and rest are earthen surfaced and gravel surfaced roads. The map of Garissa County is shown in **Figure 6.2**.

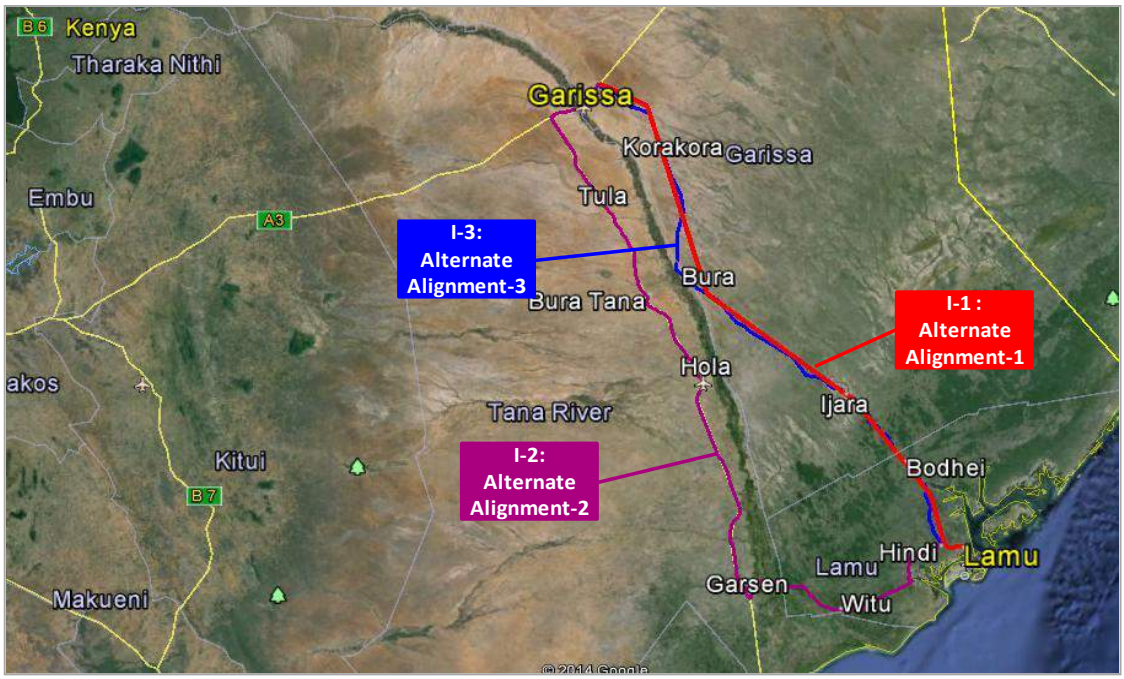
Figure 6.2: Map of Garissa County (County Part Corresponding to Project Road)



6.2 Alignment Options

During feasibility study, different alternatives for whole LAPSSET corridor were studied to identify most economic option for the project. The alternatives were studied for the area served by each alternative, cost of construction, travel time, geometric features, etc. The Consultant has also investigated the possible alternatives for the Lamu – Garissa section to adopt best one for the project area based on its utility, economic and financial benefits. As shown in **Figure 6.3**, there are three possible alternatives connecting Lamu and Garissa, out of which, two are existing alignments one on each side of Tana River (I-2 & I-3) while the third alignment (I-1) is proposed as new alternate alignment to the existing routes. The traversing paths of three alignments are given below:

Figure 6.3 : Alignment Alternatives



Alignment I-1:- This alignment alternative passes through eastern side of Tana River. It is the modified alignment of existing D568 road, passing through Bodhei and Ijara villages. Some of its section follows existing D568 road and some of them are expected to be on totally new alignment.

Alignment I-2:- This is the existing alignment covering Lamu-Witu-Garsen-Hola-Bura West-Garissa towns/villages, passing through western side of Tana River.

Alignment I-3:- Existing D568 road passing through Bodhei, Ijara and Bura East on eastern side of Tana River.

All the three alignments will be discussed in details in further section of this chapter.

6.2.1 Alignment I-1

Modification of Existing D568 Road, Passing Through Bodhei and Ijara on Eastern Side of Tana River

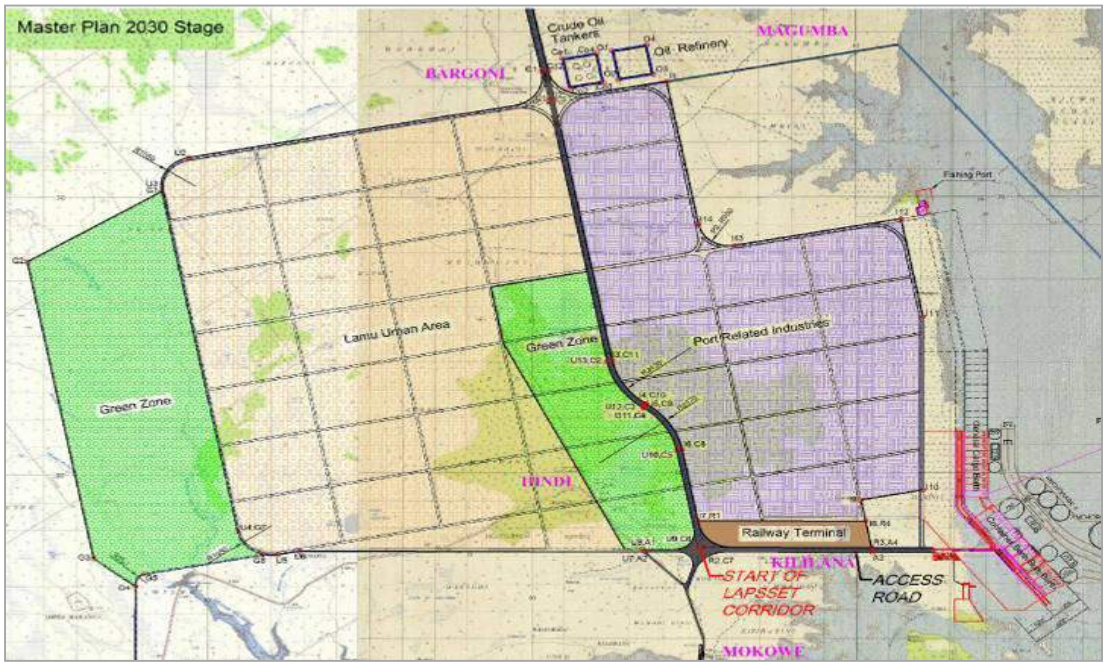
This alignment option is a modified alternative of existing D568 road proposed on eastern side of the Tana River. It is a modified alignment option which contains usage of existing D568 road with necessary re-alignment in most stretches and passes through Bodhei and Ijara villages. The alignment passes through plain terrain throughout its length with few settlements along the proposed corridor.

6.2.1.1 Alignment Description

As this alignment option is a new alternative alignment to existing route, there is no existing road except at some sections where disjointed tracks exist using the existing D568. Based on the engineering factors, segment length and considering railway and pipeline design along with highway, most of the section of road is expected to be totally on new alignment where very few, small, sparsely spaced settlements are developed. This alignment will provide free flow movement to the road users due to limited number of villages/settlements along the proposed road. This also minimizes conflict points.

At the initial point, alignment starts from the junction with Access road leading to Lamu Port and is passing through the green field area of Lamu region. The road is already constructed from C-112 to the proposed new Lamu port to give access to the port berths. The Initial 10 km of the project road is passing through settlement plots and community lands on the left side of road and port based industrial area on right side of road as per port planning shown in Master Plan of Lamu Port. The alignment is lying on the eastern side of the existing D568 road up to km 30. The agricultural experimental plots are also found between km 10 to km 14. **Figure 6.4** represents the alignment at the start point near existing Lamu Port and the Master Plan of Lamu Metropolis area

Figure 6.4 : Start Point of Alignment and Master Plan of Lamu Metropolis



Existing Access Road to Lamu Port

Proposed Access Road to Lamu Port alignment in green field area

Proposed Alignment Crosses Existing D568 Road at Km 26

Bodhei Village at Km 41

The initial 30 km of the alignment passes through green field area bypassing Bargoni from the eastern side running almost parallel to D568 road. Around km 26, alignment is crossing existing D568 road and moving towards western side of the existing D568 road improving the geometric deficiencies of existing road. Around km 41, alignment is bypassing Bodhei village from the eastern side of the village. The alignment traverses through sandy soil up to Bodhei village. The alignment crosses water stream around km 37 where provision of minor bridge is required.

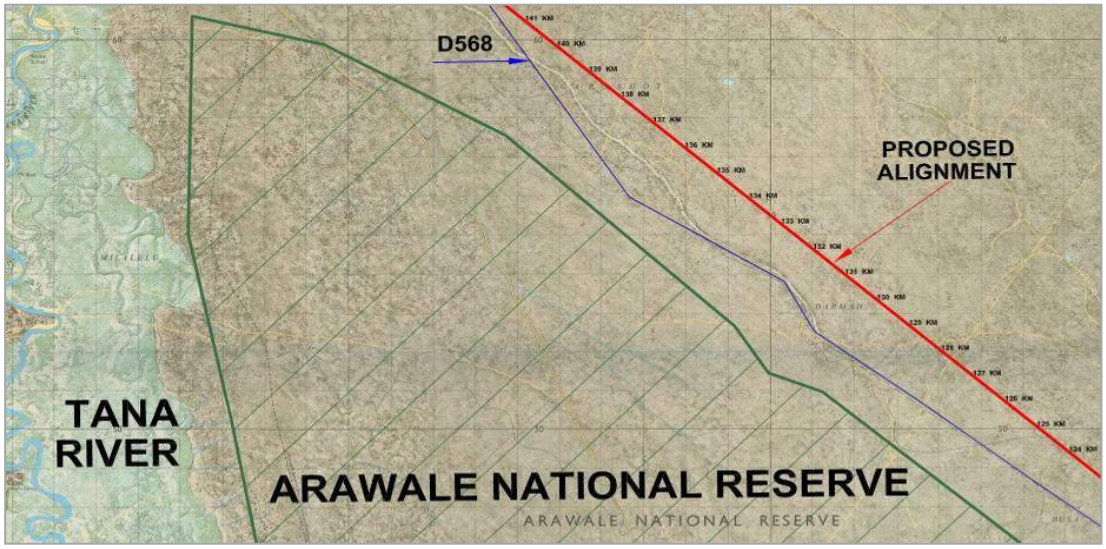
Then alignment is moving forward and continues to western side of existing D568 road and bypasses Ijara village around km 77. There is a check post as well as Ijara air strip at this location. Wild animals are found in this section. In this section, marshy and black soil is found at isolated sections. Zone of black soil exists in approximately 2 km length at km 70, which may require improvement and raising of pavement.

Ijara Village at Km 77

Wild Animals along the Road

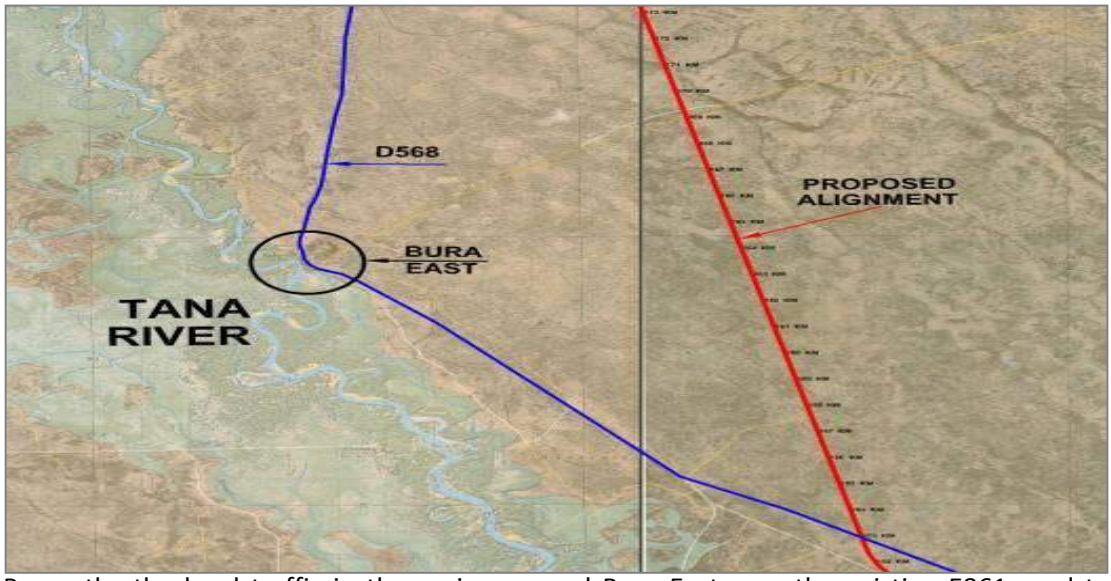
After Ijara village, the alignment crosses existing D568 road at km 81 and then proceeds on the eastern side of existing D568 road and leading towards Bura East. From km 102 to km 142 alignments is bypassing National Arawale Wild life reserve. The alignment is approximately 1 km away from the National Arawale reserve boundary and going parallel to the eastern side of Reserved Forest boundary area. Wild animals are also observed in this section of project road. Pug marks of bigger animals like elephants were observed in this zone. **Figure 6.5** represent the Arawale Reserve Forest with the proposed alignment at the periphery.

Figure 6.5 : Arawale National Reserve with the Proposed Alignment



The proposed alignment runs parallel to existing forest boundary and existing road on eastern side with straight alignment up to km 139, where alignment crosses the existing D568 road, going western side of existing road for few kilometres and then again crosses existing D568 road around km 146 and moving towards eastern side. From this point, near Fafi Constituency, the alignment takes detour and moves away from the low lands of Tana River catchment to bypass the flooding zone avoiding water logging areas which cause damaging effect on pavement structure. Being away from the Tana River, this bypass also reduces the number and size of cross-drainage structures. This also bypasses Bura East town. The alignment joins back the D568 road around km 180. **Figure 6.6** indicates the location of proposed alignment in this zone.

Figure 6.6 : Proposed Alignment Bypassing Bura East and Away from Tana River



Presently, the local traffic in the region around Bura East uses the existing E861 road to travel between Bura East and Garissa. As this road is going very close to Tana River, in rainy season, water flows over the existing road and creating several road blockages. Distinct marks of water flowing over the road have been found at isolated sections between Km 215 to km 222 of E861 road (chainage considered from Lamu). Long Causeways are also visible along this road.

Between Bura East and Garissa, there is another road, parallel to E861 road, which is presently not in use because of dense buses. To avoid problems on E861 road and provide all weather connectivity between Garissa and Bura East, KeRRA (Kenya Rural Road Authority) is now developing the part of D568 road between Bura East and Garissa to have access to Bura East and Ijara during rainy seasons. Bush clearance is already under progress on D568 road and along with it, restoring of existing road is also in progress with earthen material. It has been reported that already 20 km road is being cleared from Garissa end. Red moorum is observed in this section, especially near Garissa end.

Bush clearance at Bura East on D568

Bushes cleared from Garissa End

The proposed alignment ends at Garissa near A3/C81 junction crossing A3 road, forming four legged junction.

6.2.1.2 Carriageway and Pavement

As discussed, this alignment is modified alignment of existing D568 road. The proposed alignment is following some sections of existing D568 road, which is earthen single/intermediate lane road. The road camber is not defined. There is no defined pavement and the condition of the earthen/gravel road is also very poor. Many deficiencies were found along existing road such as large depressions and rutting which requires improvement. At some places, the alignment is not motorable due to dense bushes and marshy land.

6.2.1.3 Drainage

Presently, there is no definite drainage arrangement exists as such. Water from west to east flows to Tana river over the road. At many places the road shifts away from the river due to flooding. To avoid the drainage issues and excessive flooding due to Tana River flooding plain, the alignment passes away from Tana River at many places.

Swampy areas scattered over length of about two kilometres were observed around km 12 and km 70. It is felt that the drainage of these areas would be a challenging task and require to be taken care by proper stabilization technique.

At km 12, large swamp of almost 200m length was observed during site investigation. Also, near km 70, the proposed alignment is passing through the swampy section from km 70+000 up to km 72+200, which also requires attention while constructing the road.

6.2.1.4 Utilities

No existing utilities were observed during site visit along the proposed alignment. The Consultant traversed along proposed alignment avoiding the dense bush areas where it was not possible to reach inside.

6.2.1.5 Settlements

The alignment passes through major settlements like Bodhei and Ijara before termination at junction of A3/C81 near Garissa. Ijara is a large village settlement and is also the Headquarter of the Ijara District. It is located approximate 100 km north of Lamu and 180 km south of Garissa.

6.2.1.6 Major and Minor Intersections

As this option of alignment is passing though the green field area with some sections of the existing D568 road, minor junctions will appear at villages/small settlements. The only major junctions will be at start and end point of the project road and one at junction of port road near Bargoni village which leads to Hindi, which is the current access point to sea front to Lamu islands. At start point, the junction of the proposed project road with Lamu port access road (proposed in Lamu Port Development Plan) will be developed near Mokowe and at end point four legged junction will be developed with A3 road. The junction near Bargoni will be 4-legged junction as per proposed development planning in port area as shown in Port Master Plan.

6.2.1.7 Existing Bridges and Culverts

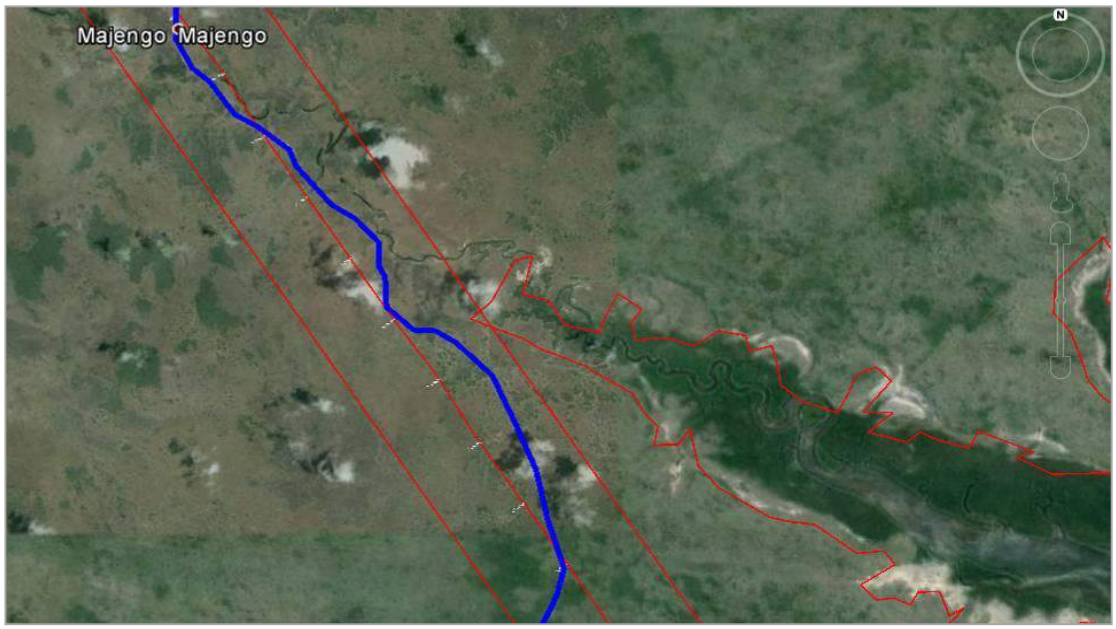
Some sections of alternative alignment I-1 pass through portion of existing D568 road. From Lamu to Bodhei village, most of the portion of D568 road does not have any culverts; some culverts have been constructed recently as the drainage condition along existing D568 road is very poor. These culverts are merely drainage culverts to avoid flooding on the right side of the existing road and have been constructed without any consideration of vertical geometry of the road.

Pipe Culverts at Km 33

Pipe Culverts at Km 35

A creek is crossing alignment Alternative I-1 at proposed km 32, where balancing culverts have to be proposed. **Figure 6.7** shows a section of alignment between km 26 and km 35 where the alignment follows the existing road in general with improved geometry.

Figure 6.7 : Section of Alignment between Km 26 and Km 34



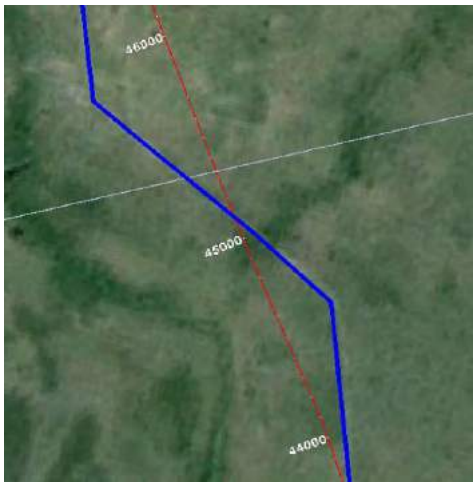
Minor Bridge Parallel to Km 21/000
1 Span of 8.0 m

Minor Bridge Parallel to Km 36/000
2 Spans of 10.50 m

There are two existing minor bridges from Lamu to Bodhei village on D568 road near proposed km 21 and 36, which are in fair to good condition but having inadequate width.

However, both the bridges have to be newly aligned as per design of the proposed alignment and also designed to withstand the loading of the new Highway.

Apart from above, streams/rivers are crossing alignment of Alternative I-1 at proposed km 45/750 and 63/500 in skew directions, where Minor Bridge and Major Bridge have to be proposed respectively.



Stream Crossing at Km 45/250

River Crossing at Km 63/500

From Bodhei village to Ijara, most portion of road does not have any bridges and culverts. However few culverts are being constructed near Ijara village. Drainage condition in the entire section is very poor.

Portion of D568 - Bodhei Village to Ijara Town without Culverts

Pipe Culverts at km 76

The portion of road from Ijara to Bura East does not have any culverts and bridges. Hence drainage condition is very poor.


D568 - Ijara village to Bura East Without Culvert and Bridge

As already mentioned in earlier paragraphs the alignment option Alternative I-1 is bypassing Bura East town and meeting D568 around km 185. There is no major stream or river crossing except some pipe culverts between Bura East and Garissa.

6.2.2 Alignment I-2

Lamu-Witu-Garsen-Hola-Bura-Tula-Garissa

This is the second option for Lamu - Garissa road section of LAPSSET corridor. This option is the existing road connecting Lamu and Garissa through western side of Tana river using existing road sections of C112, B8 and A3 through Witu, Grasen, Bura West and Hola. This alignment option passes through plain terrain with substandard geometric features having sharp horizontal curvatures. This alignment is the longest route amongst all three options with a total length of 330 km from Lamu to Garissa. Alignment passes through many small and large village settlements which will create conflicts points for the through traffic travelling on the proposed dedicated LAPSSET Corridor.

6.2.2.1 Existing Alignment

This alternate alignment traverses through the western side of Tana River. This alignment is the only existing route to travel from Lamu to Garissa. The start point of alignment is at Mokowe. The alignment joins the existing B8 road, popularly known as Mombasa-Malindi-Garissa road, at Garsen using C112 road having substandard geometry passing through Witu village. Maximum travel speed on the C112 road is around 50-70 kmph.


Poor Geometry on B8 Road

From Garsen, the alignment follows the existing road section of 2 lane B8 road with the travel speed of 30 kmph to 50 kmph due to substandard geometric features with few straight alignment sections up to Garissa. On this portion of alignment, there are many villages on the way, which can create conflicts on the proposed high speed LAPSSET corridor.

From Garissa, junction of B8/A3 road, the alignment follow A3 road towards East to meet the endpoint of the proposed Lamu-Garissa road at Junction of A3/C81 roads.

6.2.2.2 Existing Carriageway and Pavement

Presently, the condition of existing road links of this option is very poor. The alignment uses sections of existing C112, B8 and A3 roads. The existing carriageway section between Mokowe and Witu is 2-lane gravel road. This section of C112 road is in fair condition. Travel speed up to 60 kmph can be achieved on this section mainly due to low volume of traffic. From Witu village, the road condition deteriorates with large pavement depressions and rutting. This pavement condition continues up to 20 km with travel speed of 30 kmph to 50 kmph. After around 20 km from Witu towards Garsen, the road is in fairly good condition with BT surface. The riding quality up to Garsen is good, where the C112 road joins the B8 road.

Road from Witu to Garsen

BT Road near Garsen

From Garsen to Hola, the existing road is having two-lane/intermediate carriageway. The road condition varies from poor to fair condition in this section. Initial 20 km road is bituminous surfaced road with many potholes, cracks and local settlements. Some of these are in the process of repairing. The remaining existing alignment is a gravel road. Heavy bushes were observed on both side of the road in the initial stretches. Some of the stretches in this section are damaged which requires improvement for better riding quality. Lot of sandy material are lying on the top surface of existing road, probably due to improvement schemes. However due to these materials, travellers face visibility problems while travelling on this stretch. Again near Hola, the road has a bituminous surface with good riding quality and having 2-lane carriageway. Hola is situated around 100 km from Garsen.

Poor Gravel Road Towards Garsen

BT Road Near Hola

From Hola to Bura, existing road is having a two-lane/intermediate lane carriageway. This section is in poor condition. The road is totally damaged with large pavement settlements and potholes. Some of the stretches of these sections are badly damaged and are not motorable. Some of the stretches were reported to be overtopped in the rainy season. Vehicles are observed travelling off the road on side tracks due to bad condition of road. The

traffic was observed to be very low in this section. This section of B8 road is very poor and requires immediate repair. Maintenance works are going on in isolated sections. Soil profile varies in this section. Expansive soil was also encountered in some stretches.

Poor road Condition forces Vehicles to Travel on Road Side Path

Poor Road Condition Generally Visible in this Section

From Bura to A3/B8 junction existing road is in poor to fair condition. The existing carriageway is 2-lane, gravel surfaced road in most of its length. The road is under maintenance due to poor road surface condition and drainage condition. It was reported that several sections were overtopped during rainy season. It was also observed at many locations where, overtopping has caused serious pavement problems like scouring of edges, large potholes, etc. On closer scrutiny, it was observed that the entry and exits of the cross-drainage structures were covered with bushes, hence obstructing the free flow of water. This is one of the reasons for overtopping at these locations. Also, there are sections, where no cross drainage structures are provided at all for considerable length of 5-10 km and this may be the cause for overtopping problems. Lot of patches and big ruts are observed in this section. Red moorum soil with good CBR is observed along the road.

Overtopping Section, Recently Repaired

Generally Poor Road Condition

The road from Garissa (A3-B8 Junction) to the junction of A3-C81 (Road A3) is typical two lane carriageway. The surface condition is in fair with paved surface. The road crosses the Tana River through a major bridge which is in good condition. The alignment option follows the existing road section and passes through dense settlement of Garissa town before meeting end point of Lamu-Garissa section of LAPSSET corridor.

A3 Road in Good Condition

Garissa Town with Dense Settlement

6.2.2.3 Drainage

Drainage is a big area of concern on entire B8 road. Drainage condition is very poor throughout the length of the road. No side drains were observed on the entire road section from Garsen to Garissa on the B8 road. As mentioned earlier, there are very few cross drainage structures sparsely places along the road. Even most of the cross drainage structures have blocked waterway with dense bushes and inadequate size of drainage structure, which are causing overtopping of the road at certain locations. However, some of the submerged sections are being improved presently by local authority.

Blocked waterway due to Bushes

Overtopping Section Leading to Washout

6.2.2.4 Utilities

This alignment uses existing road passing through many small and large villages. As this area of Kenya is not much developed, settlements in the region lack sufficient utility facilities. There are no major utilities found along the B8 road except at Hola village where electric lines are passing on the left hand side of road travelling from Lamu to Garissa.

6.2.2.5 Settlements

There are many small and large settlements along the existing alignment between Lamu and Garissa. The major settlements along the road are Witu, Garsen, Hola and Bura West. Witu is a small market in the Coastal Province of Kenya. It is on road C-112 between Mkunumbi (33 kilometres to the east) and Garsen (44 kilometres to the west).

Garsen is a small village in the Tana River District, situated on the right (west) bank of the Tana River with a population of 2904 (Urban Population as per 2009 census). Garsen is the main junction point leading to Lamu Island through C112 road.

Hola, also known as Galole, is a small town with a population of 6932. Hola is the capital of the Tana River District. It is a busy market town and portal to Ijara District and North-eastern

province by local canoe ferry across the Tana River. People are involved in many small and large economic activities and it is one of the fastest developing economic centres in this region. It has the Hola agricultural irrigation scheme, District Hospital and a Kenya Prisons facility located within the town.

Garsen Town

Hola Town

Bura West is a town on B8 road in the Tana River District of Coast Province in Kenya. There are two Bura Town population clusters, Bura West and Bura East, situated on either side of the Tana River. Bura West is falling along the proposed alignment option and has an irrigation scheme and a Health Centre. Similar to Hola, here also many economic activities are going on following the path of regional development and growth.

6.2.2.6 Major and Minor Intersections

This alignment alternative covers many economic centres passing through villages and towns along the existing roads. Traffic generating from Lamu is very low as it is just a tourist place and lack major economic activities in the vicinity. Also the traffic on existing road is very low due to the poor condition of road. The major junctions are at Mpekatoni, Garsen (junction of existing C112 and B8 roads) and Garissa (junction of existing B8 and A3 roads). Some minor junctions are at Hola, Bura west, Tula and other small roads leading to villages. None of the villages and settlements attracts significant traffic.

Major Junction at Garsen

Major Junction at A3/B8

Major Junction at Hola

Major Junction at Bura

6.2.2.7 Existing Bridges and Culverts

From Lamu to Garsen through Witu on existing C112 road there are about 5 Minor Bridges and 1 Major Bridge. The Major Bridge across Tana River is in good condition, however has inadequate width.


Major Bridge across Tana River on C112 Road

From Garsen to Hola on existing B8 road, there are no culvert and bridge and hence drainage condition is very poor.


tion of B8 - Garsen to Hola Without Culvert

Also from Hola to Bura west on existing B8 road, there are only few culverts and hence drainage condition is very poor.


Portion of B8 - Hola to Bura West with Poor Condition of Road Due to Inadequate Drainage


From Bura west to Tula, there are very few existing culverts. At some of the locations construction of new culverts are under progress for improving drainage condition.


Construction of New Culverts

Several streams, which are tributaries of river Tana are crossing the B8 road between Tula to Garissa. At these locations nos. of Box culverts, Box Type Minor Bridges and one T-Beam type Minor Bride are observed. It is observed that cross-drainages structures are covered with lot of bushes hence water way is blocked between Bura to A3/B8 junction.


Box Culverts


B

ox Type Minor Bridges


T-beam Type Minor Bridge

6.2.3 Alignment I-3

Lamu-Ijara-Bura East-Garissa

This alignment option is the third possible alternative for the Lamu – Garissa road. This alternative is the existing D568 road, part of which is not in used since last 15-20 years as reported. The alignment passes through plain terrain with substandard geometric features having sharp horizontal curvatures. The alignment passes through Bura East and ends near Junction of A3-C81. This alignment option is having total length of 260km from Lamu to Garissa and traverse through the eastern side of Tana River.

6.2.3.1 Existing Alignment

As this alignment option is the existing alignment of D568 road, the start point of the road is Hindi market near Mokowe. The road is two-lane/intermediate lane/single lane with gravel/dirt surface through its length. The road is passing through the eastern side of Tana River and much closer to Tana River near Bura east compared to alignment option I-1. Due to frequent flooding of the area the road is in very poor condition. The surface is earth/gravel and the geometry of the entire road is poor with sharp horizontal curves. An average travel speed of 20 to 30km /hr is observed on the existing road.

At the beginning, the D568 road passes through heavy dense bushes on the both sides between Hindi and Bodhei. Near Hindi, Community lands and agriculture experiment plots are observed in the initial stretches as part of Lamu Port Development Scheme under LAPSSET corridor project. The initial soil profile is sandy because of coastal region. Wild animals are observed between Bodhei and Ijara village and also near Arawale National reserve forest. Arawale national reserve forest is going parallel to western side of the road from km 110 to km 142.

From Ijara, alignment goes towards Bura East, running parallel to Arawale National Reserve boundary. Wild animals like Giraffe, Warthog and Impala can be observed during travel through the road. At the Bura East, the road is going very close to Tana River. At Bura East, existing D568 road makes junction with E681. From here, alignment goes far away from the Tana River and meets the A3 road at Garissa. This section is same as the Alignment Opition-1.

Bushes on both side of Road at Start

Community Land on both side of Road

Dense Bushes on Road Side

6.2.3.2 Existing Carriageway and Pavement

The existing D568 road is unpaved two-lane/intermediate lane/single lane road. The condition of the road is very poor with large pavement depressions. Almost throughout the length the surface is earth or gravel with patchworks done with moorum or gravel. At some of the locations road is not motorable due to heavy bushes and muddy land especially around Arawale National Reserve after Ijara village. As mentioned earlier, the existing road from Bura East to Garissa was not in used from last 15-20 years and many people are even unaware of this road.

6.2.3.3 Drainage

The drainage condition along the alignment is very poor and needs to be improved. Few drainage structures and some seasonal laghas are observed along the project road. Due to flat and low lying area and poor drainage condition existing road is affected by flood. Between Bodhei (km 41) and Ijara (km 77), some sections become muddy, slippery during rainy season and does not remain motorable. Similarly, during site visit it was noticed that

the road was not motorable between Ijara (km 77) to Bura East (km 159) due to effects of heavy rain.

Section between Ijara to Bura East

6.2.3.4 Utilities

During site visit, electric lines were observed on right side of alignment at Bura east. Other than these no prominent utilities were observed anywhere along the alignment. The ditches are excavated near Bargoni village for water supply line around km 26.

Bargoni Village around Km 17

Ditch for Water Supply Line at km 26

6.2.3.5 Settlements

The road is not connecting any major town in the area, but there are few small settlements like Bargoni, Bodhei, Ijara, Bura East etc residing along the existing alignment. Bargoni is a small market place and is located at a distance of 17 km from Hindi. It has army barracks as well as landing facility for small aircrafts. NYS Training School is also located at Bargoni.


Bodhei village is located on the way from Lamu to Ijara at km 41 having population range less than 1000. Just before Bodhei village at km 40, there is a junction leading to Kiunga and Ijara.


Bodhei village around Km 41 **Ijara Village around Km 77**

Ijara is a large village settlement and is also the Headquarter of the Ijara District. It is located around 100 km north of Lamu and 180 km south of Garissa. Bura East is located around 218 km on eastern side of Tana River. Both, Ijara and Bura East are under the administration of Garissa County.

6.2.3.6 Major and Minor Intersections

Start junction near Hindi with Lamu Port access road and junction of A3-C81 at the end point are the only major junctions of project road. As the area is under-developed, only small settlements with low population density are residing in the region. As the road condition is either poor or not motorable, traffic is very limited which does not require any junction/intersection development. Some of the Minor intersections found during the site visit are listed below:

- Junction at Hindi Market with C112
- Junction at Km 40 leading to Kiunga and to Ijara
- Junction at km 86 leading to Masalani and Anonotu
- Junction at km 148 with road to Masalani
- Junction at km 159 with road E861 leading to Garissa

Junction of C112 and D568

Junction at Km 41

Junction at Km 148

Junction at Km 159

6.2.3.7 Existing Bridges and Culverts

From Lamu to Bodhei village, most of the portion of road does not have any culverts; some of the culverts have been constructed recently as the drainage condition along with existing D568 road is very poor.

Pipe Culverts at km 38

Pipe Culverts at km 40

There are two existing minor bridges from Lamu to Bodhei village on D568 road near proposed km 20 and 35, which are in fair to good condition but having inadequate width.

Minor Bridge parallel to Km 20/000
1 Span of 8.0 m

Minor Bridge parallel to Km 35/000
2 Spans of 10.50 m

From Bodhei village to Ijara village, most of the portion of road does not have any culverts; however some of the culverts are being constructed recently near Ijara village. There are no Bridges from Bodhei to Ijara. Drainage condition is very poor in this section.

Portion of D568 - Bodhei village to Ijara village without Culverts

The portion of road from Ijara village to Bura East does not have any culvert and bridge; hence drainage condition is very poor.

D568 - Ijara village Portions of road in Bura East Without Culvert and Bridge

The portion of road from Bura East to Garissa is currently not in use because of dense bushes, but now KeRRA has cleared 20 km road from Garissa. Few pipe culverts exist between Bura East and Garissa.

Chapter 7

Results of Comparisons of Alternatives

TABLE OF CONTENTS

7. RESULTS OF COMPARISONS OF ALTERNATIVES

7.1 Introduction

This chapter mainly describe merits and demerits of alternate options and recommendation for the most suitable option.

7.2 Comparison of Proposed Three Alternate Alignments

As described in above sections in this chapter, there are three possible alternate alignments between Lamu and Garissa. For the overall growth of the area and also, to minimize the infrastructure cost, it is very important to select an option which is most economically viable with maximum benefits. In order to evaluate an efficient route, the Consultant has studied possible options to arrive at best viable alignment for the project road. Following general factors were considered for the evaluation of the most viable option:

- Objective of the project road;
- Safeguarding the environment;
- Least disturbance to land use in the area; and
- Cost effectiveness.

Factors controlling the above Criteria are listed as follows:

Objectives

- Accessibility;
- Service to highway users;
- Network connectivity;
- Traffic Demand.

Engineering features

- Horizontal alignment
- Vertical alignment
- Soil condition
- Swampy Portion
- Likely rocky area
- Average travel speed
- Nos. of Bridges
- Flood zone area of Tana River

Environment

- Impact on environment;
- Rehabilitation and resettlement;
- Water and Air quality;
- Noise pollution;
- Preservation of culture; and
- Protection of flora and fauna.

Land Use

- Impact on agricultural activities;
- Impact on commercial activities;
- Consideration of future land use plan.

Financial

- Cost effective construction;
- Cost of construction; and

The above factors are presented in the form of evaluation matrix for each of the alignment option and recommendations for the selected option have been made accordingly.

The comparison of various parameters of route for all three alternate alignments is given below in **Table 7.1**.

Table 7.1 : Comparison of Alternative Alignments for Lamu – Garissa Road

Corridor Parameter	Description	Alternative I-1	Alternative I-2	Alternative I-3
Total length	-	250 km	330 km	260 km
Objectives	Accessibility	Good	Fair but longer	Poor
	Service to highway users	Will provide safe, efficient and speedy movement	Lower speed due to substandard geometry and longer travel time	Lower speed due to sub-standard geometry
	Network connectivity	2 major roads A3 & C81	4 major roads A3, C81, B8 & C112 and other village roads	2 major roads A3 & C81 and other village roads
	Traffic demand	Will attract future port cargo traffic and tourist traffic	Will be less attractive to port and tourist traffic	Will attract existing and future port cargo and tourist traffic
Engineering features	Horizontal alignment	Almost straight, minor improvements require in existing stretches	Some moderate curve involved, many improvements require for development	Many sharp curves involved, major improvements require for development
	Vertical alignment	No major issue as the terrain is flat		
	Soil Condition (Swampy area)	60 km	40 km	60 km
	Likely rocky area	0 %	0 %	0 %
	Existing Travel speed	N.A.	40 to 60 kmph	20 to 50 kmph
	No of Junctions	Least no of junctions	Maximum junctions on this alignment	Moderate no. of junctions
	Nos. of Bridges	4	10	2
	Effect of Flood zone area of Tana River	Minimum	Maximum	Moderate
Environment	Impact on environment	Minor	Major	Major
	Rehabilitation and resettlement	Minimum impact as most portion of alignment passes through Greenfield area	Moderate impact as alignment passes through existing trunk route B8 and built-up sections	Maximum impact as it passes through many built-up sections
	Water and air quality	Minor impact	Moderate impact	Moderate impact
	Noise pollution	Minor as less no. of villages are traverse	Major as alignments passes through many villages	Major as alignments passes through many villages

Corridor Parameter	Description	Alternative I-1	Alternative I-2	Alternative I-3
	Preservation of culture	Minor impact on properties	Minor impact on cultural properties	Minor on cultural properties
	Protection of flora and fauna	Maximum	Minimum	Moderate
Land use	Impact on agricultural activities	Major	Minor	Minor
	Impact on existing commercial activities	No current commercial activities noted along the proposed alternatives, hence no effect		
	Consideration on future land use pattern	May change with the availability of a better transportation facility	May change with the availability of a better transportation facility	May change with the availability of a better transportation facility
Financial	Cost of construction	Minimum	Moderate	Maximum
	Logistic for construction operation	Being a new alignment, construction is easy with access from the existing alignment I-2.	Existing road to be maintained during construction.	Better due to easy access from existing road.
Special Issues		Land acquisition is difficult due to community land in some stretches.		Land acquisition is difficult due to community land in some stretches.

7.3 Recommended Alignment

Based on above comparison and preliminary studies, the alignment option I-1 is recommended by the Consultant. KeNHA has also approved the proposal of alignment option I-1 during presentation of Inception Report and supplied the feasibility study details in Soft Copy in form of LiDAR Survey Data with respect to the alignment Option I-1.

While comparing the details received from KeNHA, it has been noticed that there are two different alignments separated by 20m throughout except for the first 16 km, where the alignments are separated by varying width of 20m to 1000m.

Thereafter, the Consultant has reviewed the report of LAPSSET corridor & New Lamu Port Feasibility Study and Master Plan. Consultant has plotted the coordinates of Land Usage of Port area given in LAPSSET report and also superimposed the two alignments to have clear idea regarding the final highway alignment to be followed. The drawing of Land Usage of Port area along with two alignments is shown in **Figure 7.1**. The Consultant has contacted different organizations involved in LAPSSET project to clarify the alignment issue.

Based on the information received from different organization on the alignment and the coordinates of Port Master Plan given in LAPSSET report, following observations has been nailed out:

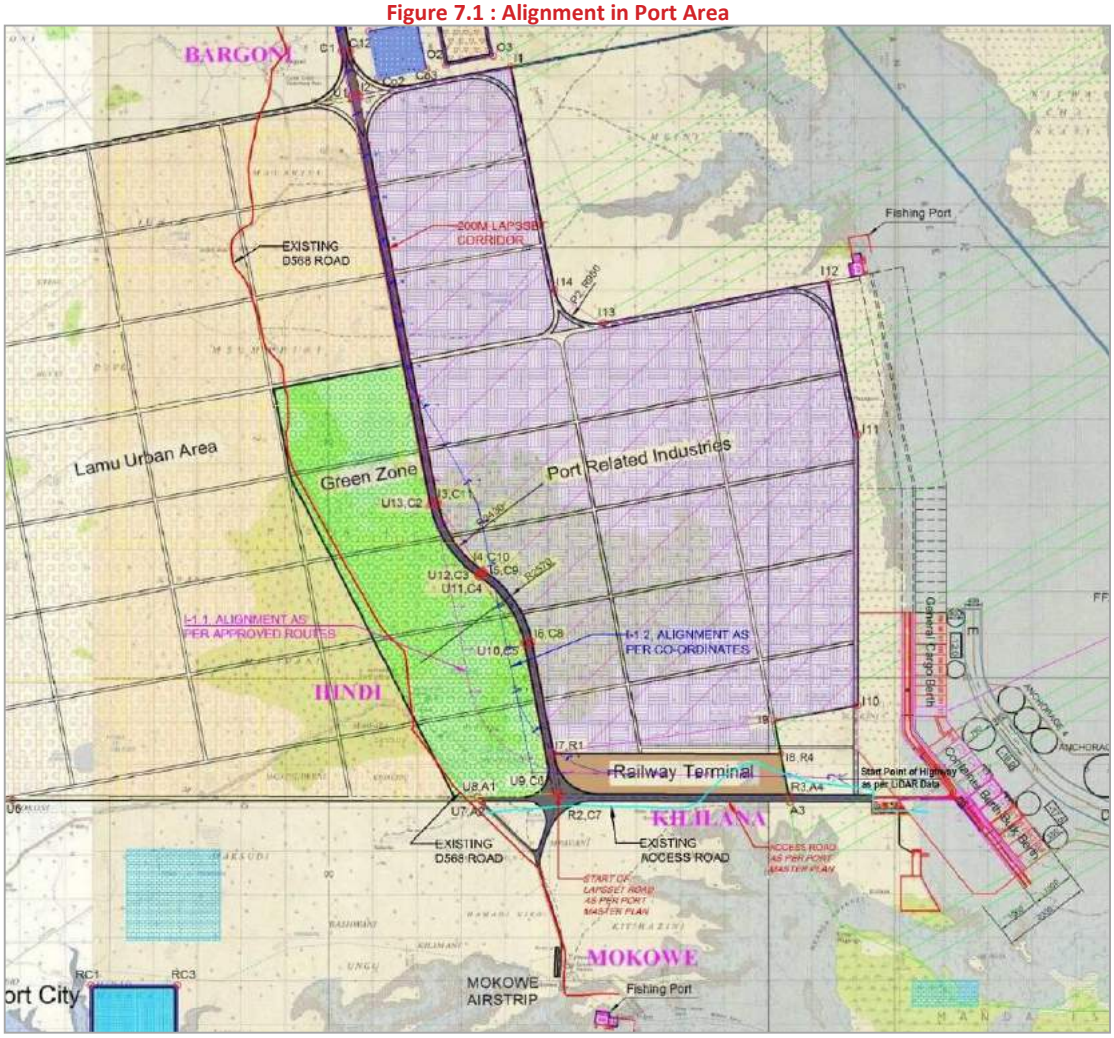
- As per Land Usage of Port area, the start point of the LAPSSET corridor should be at proposed junction of LAPPSET Corridor with Port access road at R2,C7. Rest of the road network shown in the Port Development map can be treated as access road and proposed to keep outside the jurisdiction of main corridor for LAPSSET Highway.

- From the study of details of co-ordinates for 200m corridor given in port area and the configuration of proposed LAPSSET corridor (given in Chapter - 3 Conceptual Plan of LAPSSET Corridor Development of Volume -1, Feasibility study of LAPSSET Corridor), it seems that the alignment option based on approved corridor is matching the corridor centre and the eccentric placement of centreline proposed for LAPSSET Highway.
- Further, the Consultant has also approached different organizations, such as LAPSSET Corridor Development Authority (LCDA), Kenya Port Authority (KPA) and Ministry of Transport, and obtained their view on the final alignment of LAPSSET corridor in the initial few kilometres.

Based on above, alignment I-1.1 (based on details of Approved Corridor) is recommended as the final alignment for taking up further studies except initial 20 km (approx.), where the alignment proposed in Land Usage Plan of Port area should be followed along with start point of LAPSSET Highway at proposed T-junction with Port Access road.

The Recommendation is also submitted to KeNHA through letter dated 15th July 2014.

Figure 7.1 : Alignment in Port Area



Based on studies, the alignment Option I-3 was recommended by the Consultant as the best alignment option. KeNHA approved the proposal of alignment Option I-3.

Chapter 8

Potential Environmental and social impacts

TABLE OF CONTENTS

8. POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

8.1 Introduction

This chapter brings out the potential positive and negative environmental and social impacts that would arise out of resettlement and implementation of the road project.

In general, the potential environment and social impacts arises during the construction phase of the project road include:

- Air pollution and dust evolution ;
- Noise & vibration;
- Ecological damage from the clearance of areas for maintenance camps, and storage of materials (fuel, lubricants and machinery);
- Material sourcing and supply for the construction and maintenance works; and
- Social disturbance caused, due to proposed alignment, Social disturbance caused due to the construction and maintenance activities.

Impacts can be positive or negative; direct or indirect. The magnitude of each impact is described in terms of being significant, minor or negligible, temporary or permanent, long-term or short-term, specific (localized) or widespread, reversible or irreversible. These are indicated in the assessment table as follows (**Table 8.1**).

Table 8.1: Impact assessment

Symbol	Type of Impact	Symbol	Type of Impact
++	major positive impact	+	minor positive impact
--	major negative impact	-	minor negative impact
0	negligible/ zero impact	NC	no change
sp	Specific & localized	w	widespread
r	Reversible	ir	irreversible
sht	short term	Lt	long term
t	temporary	p	permanent
Y	mitigation of negative impacts/ enhancement of positive ones **IS** possible	N	mitigation of negative impacts/enhancement of positive ones is **NOT** possible

8.2 Anticipated Environmental Impacts

Construction work will be confined to the road corridor with some minor realignment. Works will include construction of the road from gravel to bitumen standard, the installation of culverts, provision of side drains and mitre drains, upgrading of the bridges, and route deviations. Anticipated environmental and social economic impacts are tabulated below (**Table 8.2**). Construction work will confined to the road corridor

Table 8.2: Anticipated Environmental Impacts

Impacts on or due to	Construction Mitigation		Operation Mitigation		Remarks
Changes in hydrology/ drainage	-, r, t	Y	+		The new road will alter the hydrology of the area because due to the flat nature of the terrain, the road level will need to be raised in many areas. Hence, runoff will be channelled through culverts. This will be a temporary problem occurring during the construction works. A review of the design and positioning of culverts will be made to ensure that there is no future blockage by siltation and plant overgrowth that will impede water flow. As a result drainage will be improved.
Soil erosion	-, Lt, sp	Y	-	Y	Earthworks (during road construction, and creation of gravel pits) and deviations will have an impact on soil erosion, which may continue after construction. Incorporating appropriate soil conservation measures and proper drainage facilities during construction would mitigate impacts during operation. During operation, maintenance of structures would also prevent soil erosion.
Pollution: Air Dust Noise Oil Wastes Sediment Loads	--, t, r --, t, r -,- t, r --, Lt, r --, t, r --, t, r	Y Y Y Y Y Y	--, p, r 0 --, p, r --, L, r --, p, r --, p, r	Y N Y	During construction, there will be air, dust and noise pollution, but this will be temporary in nature. Oil wastes however will have a long-term impact. Spoil material will be generated. During operation, noise and oil waste pollution will affect settlements/households along the road. Pollution due to sediment loads will not be a problem during operation. Mitigation is possible through consideration on the part of the Contractor and motorists, or legal enforcement.
Solid waste	-, t, r, sht	Y	0		During the construction phase, three types of solid wastes will be generated: Debris from demolitions, spoils and domestic refuse. During operations the waste will be mainly paper and plastic. Apart from visual impacts, debris can affect water quality.
Land Acquisition	--, t, r	Y	0		The most of the alignment is passing through the green field hence land take is inevitable. This will lead to loss of land. The owners will have to be compensated as stated in sections of this report
Material sites	+	Y	+, Lt	Y	Material site owners will benefit from the sale of construction materials.

Impacts on or due to	Construction Mitigation		Operation Mitigation		Remarks
	-, p, r, sp		-, p, r, sp		Negative impacts may result from pits that are not reinstated/ landscaped or fenced. Impacts may include hazards to children and livestock, and water accumulating in the borrow pits providing a breeding ground for mosquitoes.
Water resources	--, t	Y	-	Y	A few streams (laghas) found along the road corridor. The hydrological regime will be affected during the construction work and water quality will be altered.
Vegetation/Flora	-, p, ir	Y	0		Clearing of vegetation will be necessary for the carriageway and extension of the road reserve. Natural vegetation is not regarded as having any special conservation significance. However, clearing activities could encourage soil erosion. Unnecessary clearing of vegetation should be avoided.
Fauna	-, p, ir	N	0		Animals and birds will be disturbed by the clearing activities and their homes/nesting sites may be destroyed. Noise and dust pollution will occur during construction activities, but this will revert to the present situation during operation. Any clearing should be done with the utmost consideration for the wildlife species.
Wetlands	-	Y	0		A few wetlands found along the road corridor. Siltation and oil pollution may affect the wetlands. Construction activities should be carefully monitored.
Settlements/ Induced settlements	-, t	Y	+, -, p	Y	During construction, there will be temporary disturbance due to noise and dust. During operation, people in the settlements along the roads should benefit from improved access. There could be an increase in settlements along the road. Development of settlements along the road should be properly planned.
Employment opportunities	++, t		0		The project will provide temporary employment for many of the local people for example as casual labourers during construction works and allow for the trade of food and basic supplies to workers.
Agricultural activities	NC		++, p, w		During construction, little or no change is expected with regard to agricultural activities. However during operation, the improved road should encourage agricultural activity between the two counties.
Workmen/Contractor camps	+, sht --, Lt, r	 Y	0 -	 Y	Some benefits are expected from increased business. However, the presence of the camp is likely to lead to an increase in water usage putting a strain on the local communities. Solid waste disposal and sanitation problems will be an issue.
Public health	-, t, r, w --, p, r, sp	Y Y	-, p, r, w		During construction and operation, increased dust, noise and air pollution levels could impact on public health. Immigrant workers on road projects are associated with the spread of sexually transmitted diseases. Awareness campaigns in shopping centres and the settlement areas would help to mitigate this problem.

Impacts on or due to	Construction Mitigation		Operation Mitigation		Remarks
Cultural, historical or traditional sites	0		0		There are sites of cultural, historic or traditional value that would be affected by the road upgrading works .i.e. the grave yards in Ijara
Road safety	-, t, sp, r	Y	-	Y	During construction, there will be some danger to pedestrians and cyclists along the existing road, but this can be mitigated with awareness campaigns and road signs.
			++	Y	The upgrading works will be designed to improve road safety during operation. Road safety can be enhanced, by awareness and educational campaigns. The erection of speed signs, warning and directional signs, and speed bumps will reduce accidents.
Visual intrusion	-, t/p	Y	--	Y	During construction visual intrusion will be affected due to road works and traffic. These conditions will create a greater impact during operation. Mitigation will be achieved through controlling traffic, sensitising motorists, and clearing of construction debris.

Source: SAI ESIA Report-Lamu Garissa Road Project

8.3 Negative Environmental and Social Impacts during Construction Phase

Several negative environmental and social impacts will result during the construction phase of this road.

8.3.1 Loss of Land and Livelihood

Land will be required for construction of the new road project. This will require acquisition of public, community and private lands, and will involve resettlement of quite a number of families. Land acquisition for some sections of the proposed alignment will affect the built environment, agricultural lands especially, forested areas and protected areas such as Arawale National Reserve and ranches among others.

Table 8.3 : The Area of Land Affected in the Two Respective Counties

Location of the Land	Total Area Affected	Status of the Land
Hindi Magogoni	**71. 27 acres**	Private land
Witemere (Bele Bele, Bobo, Roka)	**415 acres**	Public land
Kenya Defence Forces (Bargoni Camp)	**36 acres**	Public land
Aweer Community	**329 acres**	Community land
Land in County of Garissa	**5312 acres**	Community land

Most of the residential buildings and structures along the road corridor are constructed from locally available materials namely; wood, sticks and thatch. A few of the buildings to be affected have galvanized iron sheets' roofs.

A public boarding school, two big public water pans and six individually constructed water pans is to be affected in Ijara.

One fuel depot situated at Modika and supplying fuel to Garissa and the region is the only business concern to be affected by the proposed Road. **Table 8.4** & **8.5** represents the type and number of structures that will be affected.

Table 8.4 : Summary of Affected Structures in Lamu County

	Residential houses/huts	Livestock/ chicken cages	Bathroom and latrines	Planted Trees (saplings, timber species, fruit trees)
Hindi Magogoni	**7**			**825**
Bele Bele	**-**	**-**	**-**	**-**
Bobo	**3**	**-**	**-**	**43**
Roka	**24**	**-**	**-**	**2013**
Bargoni	**7**	**-**	**-**	**362**

(Source: SAI Valuer's Survey Report, 2014)

Table 8.5: Summary of Affected structures in Garissa County

	Residential houses/huts	Livestock/ chicken cages	Bathroom and latrines	Planted Trees (saplings, timber species, fruit trees)
Bodhei	**153**	**44**	**15**	**13**
Ijara	**110**	**40**	**10**	**1**
Masabubu	**8**			
Modika	**3**			

(Source: SAI Valuer's Survey Report, 2014)

Social infrastructure in Garissa County

Affected Private water Pans	
Water pans	6

Affected Community Social infrastructure in Garissa	
Ijara Primary school	1
Public water pans	2

The only other assets affected were;

Private Business Concern	
Fuel Depot at Modika	1
Water reservoirs at Modika	2

(Source: SAI Valuer's Survey Report, 2014)

8.3.2 Disruption and change of local livelihoods/outward migrations

The project is expected to lead to some disruption and change of livelihoods of local people during construction. The locals in urban centres such as Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa will have to interact with influx of labour force that will be engaged for construction. This may attract influx of Commercial Sex Workers, vendors, etc. This will lead to changes in behaviour and livelihoods (increases in crime rates, substance abuse, prostitution, etc.).

8.3.3 Interference With Cultural-Set Up of Communities

Increased immigration into the project area will lead to increase in population especially in towns and urban centres along the road leading to changes in behaviour and livelihoods (increases in crime rates, substance abuse, prostitution, etc.). This will result in strained relationships which sometimes degenerate into open conflicts between the residents and the construction workforce. With immigration into areas adjacent to the road, there will be additional demand on the existing social facilities.

8.3.4 Increased Crime Rates/ Culture Erosion

Social crime rate in the area is expected to rise with the beginning of the operations due to influx more people into the area looking for job opportunities, etc. There will be interaction with other cultures, especially increased number of people to be engaged on construction activities. The influx of workers into local communities where the road will pass may lead to cultural erosion in areas such as Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa.

8.3.5 Change in Wildlife Behaviour

Due to noises from construction machinery and plants, wildlife within the protected areas, may suffer disturbances leading general change in behaviour of wildlife. This impact is likely to occur in areas adjacent to Arawale and Dodori National Reserves and where wildlife occurs especially around Korakora as you approach Garissa town.

8.3.6 Modification of Drainage

As the general topography the road alignment will pass is more or less flat, localised changes in hydrology and drainage will be expected in same areas during construction, especially on some sloppy areas and near laghas/seasonal streams. This will lead to challenges on the drainage system including stagnant waters. This will be experienced at Tomo Dogo Swamp

(Km 12+370 to Km 12+650), Mkondo Bargoni river valley (Km 19+250 to Km 19+320), Duldul dry river valley (Km 34+400 to Km 34+550), Arosen dry river valley (Km 42+000 to Km 42+250), and Kulan dry river valley (Km 63+700 to Km 64+000).

8.3.7 Soil Erosion

The majority of the soils in the project area are sandy soils to clay sand that are prone to erosion. This is especially so if they are disturbed especially on sloppy areas and near laghas/seasonal streams. This will be experienced at Tomo Dogo Swamp (Km 12+300 to Km 12+800), Mkondo Bargoni dry river valley (Km 19+250 to Km 19+320), Duldul dry river valley (Km 34+400 to Km 34+550), Arosen dry river valley (Km 42+000 to Km 42+250), and Kulan dry river valley (Km 63+700 to Km 64+000).

8.3.8 Vegetation Clearance

The vegetation of most part of the road alignment is mostly wooded grasslands, shrubs and woodlands. Taking into account that the Right of Way (RoW) of the road is about 100m, this width will be cleared for road construction leading to some loss in vegetation. This will be experienced, for example, around Mokowe, Bargoni, Korakora and Garissa. However, no endangered plant species were noted in the area of road alignment that may be affected. But vegetation clearance could lead to accelerated soil erosion in bare areas.

8.3.9 Emissions into the Air

During road construction use of heavy machinery to clear and level the alignment and trucks to haul materials will be in use. These will emit exhaust gases thereby polluting the air. Transportation and transfer of dry granular materials (e.g. minerals and grain) in uncovered trucks may result in dust emissions, while the storage and transfer of fuels or volatile chemicals may result in fugitive emissions above baseline ambient levels. These will affect inhabitants of urban centres of Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa.

8.3.10 Waste Generation

Depending on the amount of materials used in road construction, these may generated wastes from packaging materials in camp sites and along the road. Other wastes will include solids from mechanical cleaning of trucks, waste paint, spent solvent and solvent sludge (from painting and cleaning), waste oil, hydraulic fluid, and other petroleum-based fluids; petroleum-contaminated solids (e.g. oil filters and saturated spill absorbent material); spent coolant; metal filings and scrap; spent batteries; and spent brake shoes at various service centres that will spring up along the road at various urban centres. There will be need for the Contractor to adhere closely to the ESMP.

8.3.11 Fuel Management

There will be need to use fuel and oils economically so as to reduce wastes during road construction. There will be need for the Contractor to adhere closely to the ESMP.

8.3.12 Oil Pollution/Spillage

At campsites and other areas where fuel may be stored or used, there will potential for soil and ground water resource contamination due to leaks and spills. To prevent or reduce these, there will be need for the Contractor to adhere closely to the ESMP.

8.3.13 Pollution on Vegetation

Not very well serviced trucks produce a lot of exhaust gases and smoke. Again, there will be a lot of dust generated on service roads and sites where road construction materials such as ballast is crashed. Once the dust and smoke settle on vegetation leaves, it interferes with the process of photosynthesis thus compromising the plant growth. Exhaust gases results to acid rain that impacts negatively on vegetation growth and house structures such as roofing iron sheets. Along the road we have sections with thick vegetation such as at Mokowe, Bargoni, Arawale, Korakora and Garissa which will be affected.

8.3.14 Noise Pollution

Sources for noise pollution will include noise generated by heavy trucks movement, braking, and ground vibrations. This may affect wildlife and communities along the road under construction affecting people and wildlife. There will be felt at urban centres of Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa for local communities and areas adjacent to Bargoni (with several pastoral communities, Arawale and Dodori National Reserves and around Korakora as you approach Garissa town where wildlife occurs.

8.3.15 Health and HIV/AIDS

During the construction phase of the road, there will be an influx of population from many areas outside the project area coming to look for work in the project. These none-indigenous people will interact with the locals along the road and in urban centres such as Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa. This will also attract Commercial Sex Workers, vendors, etc. leading to changes in behaviour and livelihoods (increases in crime rates, substance abuse, prostitution, etc.). This may also include increase in prostitution in labour camps. Cases of HIV/AIDS specially and other social diseases may also increase in addition to potential health from sanitation and hygiene challenges. There also could be potential increase in cases of other communicable diseases (STIs, TB, etc.).

8.4 Negative Environmental and Social Impacts during Operation Phase

8.4.1 Disruption and Change of Local Livelihoods/Outward Migrations

The project is expected to lead to some major disruption and change of local livelihoods of local people due to introduction of long-distance trucks. The locals in urban centres such as Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa will have to interact with influx of drivers, mechanics, turn-boys, truck owners, other related/ supportive business owners, Commercial Sex Workers, vendors, etc. This will lead to changes in behaviour and livelihoods (increases in crime rates, substance abuse, prostitution, etc.).

8.4.2 Interference With Cultural-Set Up of Communities

Increased immigration into the project area will lead to increase in population especially in towns and urban centres along the road (see **section 8.3.1** above) leading to changes in behaviour and livelihoods (increases in crime rates, substance abuse, prostitution, etc.). This will result in strained relationships which sometimes degenerate into open conflicts between the residents and the users of the road. With immigration into areas adjacent to the road, there will be additional demand on the existing social facilities.

8.4.3 Increased Crime Rates/ Culture Erosion

Social crime rate in the area is expected to rise with the beginning of the operations due to influx more people into the area looking for job opportunities, etc. There will be interaction with other cultures, especially increased number of tourists. The influx of workers into local communities where the road will pass may lead to cultural erosion (see **sections 8.3.1 and 8.3.2** above).

8.4.4 Change In Wildlife Behaviour

The proposed fencing of the road line within the protected areas, introduction of underpasses and overpasses, may change the movement and general behaviour of wildlife. This impact is likely to occur in areas adjacent to Arawale and Dodori National Reserves and where wildlife occurs especially around Korakora as you approach Garissa town.

8.4.5 Modification of Drainage

As the general topography the road alignment will pass is more or less flat, localised changes in hydrology and drainage will be expected in same areas. A new pavement in some sections (especially on some sloppy areas and near laghas/seasonal streams) along the road corridor will consequently lead to increased surface run-off hence leading to challenges on the drainage system including outfalls. Due to the flat nature of the terrain in most parts of the road from Lamu to Garissa, drainage will be a problem.

8.4.6 Emissions to Air

Trucks engines are known significant contributors to air pollution, especially if they are not regularly serviced. Diesel truck engines (especially those that use high sulphur diesel) are known to emit combustion products, including nitrogen oxides (NO_X) and particulate matter (PM_{10}), both of which contribute to public health problems, and carbon dioxide (CO_2), a greenhouse gas. Transportation and transfer of dry granular materials (e.g. minerals and grain) in uncovered trucks may result in dust emissions, while the storage and transfer of fuels or volatile chemicals may result in fugitive emissions above baseline ambient levels. These will affect inhabitants of urban centres of Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa.

8.4.7 Waste Management

Depending on the number of vehicles and passengers handled by the new road, solid, non-hazardous, food waste may generated from new and existing food establishments, in addition to packaging materials from retail facilities, and paper, newspaper, and a variety of disposable food containers at the many urban centres along the road (see **section 8.3.1** above). Other wastes will include solids from mechanical cleaning of trucks, waste paint, spent solvent and solvent sludge (from painting and cleaning), waste oil, hydraulic fluid, and other petroleum-based fluids; petroleum-contaminated solids (e.g. oil filters and saturated spill absorbent material); spent coolant; metal filings and scrap; spent batteries; and spent brake shoes at various service centres that will spring up along the road at various urban centres (see **section 8.3.1** above).

8.4.8 Fuel Management

Due to distances the trucks will cover, fuelling stations will be built in towns such as Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa along the road to supply petrol, diesel, etc. Typically, these fuelling stations will act as service bays

(see **section 8.3.7** above) for the increased numbers of trucks and will contain facilities including include underground storage tanks, piping, and filling equipment with the potential for soil and ground water resource contamination due to leaks and spills.

8.4.9 Oil Pollution / Spillage

Oil spillage during change of lubricants, cleaning and repair processes are very common. Oil spillage are also likely to occur by leaks of these petroleum products, coupled with the normal leaking and dripping of oil, grease and solvents from trucks. Oil spills are hazardous to the environment as they contaminate the soil and water. Typically, fuelling and service stations (see **section 8.3.7** above) will act as service bays The spilled oil should be trapped in grit chamber for settling of suspended matter. The collected oil should either be auctioned or incinerated, so as to avoid any underground water contamination.

8.4.10 Pollution on Vegetation

Not very well serviced trucks produce a lot of exhaust gases and smoke (see **section 8.3.6** above). Once the smoke settle on vegetation leaves, it interferes with the process of photosynthesis thus compromising the plant growth. Exhaust gases results to acid rain that impacts negatively on vegetation growth and house structures such as roofing iron sheets. Along the road we have sections with thick vegetation such as at Mokowe, Bargoni, Arawale, Korakora and Garissa which will be affected.

8.4.11 Wildlife and Livestock Accidents Due to Damaged Fence

With the introduction of fast moving traffic it is expected that the number of livestock and wildlife deaths will occur. This impact is likely to occur in areas adjacent to Bargoni (with several pastoral communities), Arawale and Dodori National Reserves and around Korakora as you approach Garissa town where wildlife occurs (see **section 8.3.4** above). Construction of overpasses and underpasses will prevent many accidents occurring. This will also reduce damage of trucks that may occur during accidents.

8.4.12 Separation of Communities and Inaccessibility to Other Social Amenities/ Services

Fencing of the road and railway corridor will lead to a possible separation of communities in the project areas. Some people will also find it difficult to access some shopping, markets areas, schools, churches and mosques, etc. if no proper planning for access routes/ facilities are developed. This will occur especially at towns such as Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa. The project should give provisions for foot bridges and flyovers in areas where the road cuts through communities to aid in access to amenities on either side of the road.

8.4.13 Blockage of Wildlife, Livestock and Human Corridors

Livestock and wildlife cross the area freely move from all directions in search of pasture and water. Since it is proposed that the new railway line corridor (which shares the same corridor with the road) will be fenced, the corridor will be blocked and the wildlife and livestock will not be able to move freely in search of pasture, water and breeding grounds. This impact is likely to occur in areas adjacent to Bargoni (with several pastoral communities), Arawale and Dodori National Reserves and around Korakora as you approach Garissa town where wildlife occurs (see **section 8.3.4** above). To prevent this, provision of underpasses and overpasses will be provided at strategic points to enable wildlife and livestock to cross the corridor without accidents. Some water points may have to be established for the wildlife to ensure that they are attracted to the underpasses which they will be used with over time.

8.4.14 Noise Pollution

Sources for noise pollution will include noise generated by heavy trucks movement, braking, hooting and ground vibrations. This may affect wildlife and communities in urban areas. These will affect inhabitants of urban centres of Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa for local communities and areas adjacent to Bargoni (with several pastoral communities, Arawale and Dodori National Reserves and around Korakora as you approach Garissa town where wildlife occurs) .

8.4.15 Health and HIV/AIDS

Operation of the road will be accompanied with influx of population from many areas. The locals in urban centres such as Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa will have to interact with influx of drivers, mechanics, turn-boys, truck owners, other related/ supportive business owners, Commercial Sex Workers, vendors, etc. This will lead to changes in behaviour and livelihoods (increases in crime rates, substance abuse, prostitution, etc.). This may also include increase in prostitution in the project area. Cases of HIV/AIDS specially and other social diseases may also increase in addition to potential health from sanitation and hygiene challenges. There also could be potential increase in cases of other communicable diseases (STIs, TB, etc.).

8.5 Negative Impacts during Decommissioning Phase

8.5.1 Noise and Vibration

The demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas. This will be because of the noise and vibration that will be experienced as a result of demolishing the proposed project.

8.5.2 Solid Waste Generation

Demolition of infrastructure will result in large quantities of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, etc. Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. In addition, even the generally non-toxic chemicals such as chloride, sodium, sulphate and ammonia, which may be released because of leaching of demolition waste, are known to lead to degradation of groundwater quality.

8.5.3 Dust generation

Large quantities of dust will be generated during demolition works. This will affect demolition workers as well as the neighbouring residents close to the project areas.

8.5.4 Reduced/Loss of Positive impacts to the Project

All positive impacts of project operation listed in this report will be lost unless alternative means of transport will be put in place.

8.6 Positive Environmental and Social Impacts during Operation Phase

There will many possible positive environmental and social impacts.

8.6.1 Economic and Social Development

Overall, the road will be an economic pillar for realization of the Kenya's Vision 2030 by enhancing efficient transportation and movement of people and goods. Speedy movement will spur economic development between the new Lamu Port, the hinterland of Kenya as well as the neighbouring countries of Ethiopia, Uganda and South Sudan.

8.6.2 Climate Change

It is commonly known that as traffic congestion increases, CO_2 emissions (and in parallel, fuel consumption) also increase. In general, CO_2 emissions and fuel consumption are very sensitive to the type of driving that occurs. Traveling at a steady-state speed results in much lower emissions and fuel consumption compared to a stop-and-go driving pattern. By developing this new road, this will decongest the exist Mombasa to Uganda Northern Corridor route and help reduce CO_2 emissions.

8.6.3 Social Benefits

(i) People crossings will be provided in sections where there are cattle grazing areas corridors, especially around urban centres of Mokowe, Bargoni, Bodhei, Ijara, Roka, Masabubu, Nanighi, Korakora and a section of Garissa.

(ii) Cattle will be provided in sections where there are cattle grazing areas, especially around Bargoni, Bodhei, Ijara, Roka, Masabubu, Nanighi, and Korakora.

(iii) Wildlife crossings will be provided in sections where there are wildlife corridors, especially those connecting Arawale National Reserve, Boni National Reserve, Dodori National Reserve, Tana River Primate Reserve and around Korakora.

(iv) Through social responsibility arrangements, the project will expected to intervene on social facilities including schools, health centres and water supplies along the road, especially in pastoral areas of Bargoni, Bodhei, Ijara and Korakora. This will be in addition to the provision of wellness centres at pre-determined locations, and urban centres.

8.6.4 Emergence and Growth of New Towns and Urban Development

Growth of businesses, market centres and other essential services will be witnessed at the new and old urban along the new road leading to growth of the local economy. Urban centres such as Mokowe, Bargoni, Bodhei, Ijara, Roka, Masabubu, Nanighi, Korakora and Garissa will benefit. Some markets, and shopping centres, for example Bura East and Masabubu, are most likely to shift based on the location of the road.

8.6.5 Growth of Businesses and Market Centres

Economic activities will increase around the corridor, as enhanced transportation by new road will attract industries, enterprises to serve the workforce and also sale to easily accessible cities of Mombasa and Nairobi. New businesses are also likely to emerge around the current market centres along the road corridor.

8.6.6 Reduction in Freight Haulage and Transportation Time

Freight haulage to Ethiopia and north eastern areas of Kenya will be diverted from the port of Mombasa to this new road. Efficient movement of goods and people will translate to effective

human resource management. Access to remote areas will be improved especially where the line is passing and where raw materials/ goods will be sourced from.

8.6.7 Reduced Transport Costs of Goods

Efficient and reliable transport system from the ports of Mombasa and Lamu to the hinterland of Kenya, Uganda, South Sudan and Ethiopia following the new road will translate to reduced transport costs for goods and services in the region. The transport costs of goods like petroleum products, building materials, cereals and food stuffs, minerals, livestock, etc. are expected to drop and this will greatly improve regional trade by making the country's goods and services competitive to other markets.

8.6.8 Improved Tourism Opportunities

It is anticipated that with the construction of the proposed road, which promises to be faster and reliable will become popular for all categories of tourists to Lamu, Arawale National Reserve, Tana River Primate Reserve, etc. This in itself is likely to increase the number of visitors annually these areas. This will arise from low costs of transport, comfort and reliability provided by a new all-weather road. More tourists will visit these areas.

8.6.9 Increase in Property Value

Residents who own property in towns and areas, especially at Hindi, Mokowe, Bargoni, Bodhei, Ijara, Roka, Masabubu, Nanighi, Korakora and Garissa along the road corridor will experience a tremendous increase in the value of their properties due to infrastructural development and emergence of new businesses that will require new space.

8.6.10 Regional Economic Growth

The road will improve the inter-country transportation status in East Africa, so as to form a modern road network covering several countries in Eastern Africa. The project implementation will promote the regional economic and trade development, support the national economic development in Kenya and facilitate the regional economy to better and faster development of South Sudan and Ethiopia. The efficiency of the road network will improve foreign trade, tourism, and agriculture in the region leading to an increase in the economic growth in the region.

8.6.11 Revitalization of the Agricultural Production In Rural Areas

A new all-weather road people will motivate people to engage in agricultural production thereby reviving the agricultural activities. This will benefit areas like Mpeketoni agricultural scheme, the many cattle ranches in Lamu and the pastoral economy in the area of Lamu and Garissa. This will stimulate growth of the livestock and fish industries (especially marine fisheries around Lamu and Kiunga near the Somalia border). Livestock and fish products will be more cheaply transported. Losses incurred through death when livestock are transported on foot or by road will be minimized.

8.7 Positive Impacts during Decommissioning Phase

8.7.1 Rehabilitation of the Environment

It is envisaged that road services will be provided throughout but upon decommissioning of the proposed project, rehabilitation of the project sites will be carried out to restore the sites to their original status or to a better state than they were originally. This will include

replacement of topsoil and re-vegetation, which will lead to improved visual quality of the areas.

8.7.2 Employment Opportunities

Temporary employment opportunities will be created for the demolition staff during the demolition phase of the proposed project.

8.7.3 Reduced Environmental Pollution

Decommissioning will obviously lead to reduced air, water, soil and general environmental pollution that may be experienced during operations.

8.7.4 Reduced Negative Environmental Impacts of Operation

Many negative impacts listed under the operations section will drastically reduce when the decommissioning will take place. These include oil spillage during change of lubricants, cleaning and repair processes, and wastes which include solids from mechanical cleaning of trucks, waste paint, spent solvent and solvent sludge (from painting and cleaning), waste oil, hydraulic fluid, and other petroleum-based fluids; petroleum-contaminated solids (e.g. oil filters and saturated spill absorbent material); spent coolant; metal filings and scrap; spent batteries; and spent brake shoes at various service centres.

Chapter 9

Mitigation / Enhancement Measures and Complementary Initiatives

TABLE OF CONTENTS

9. MITIGATION / ENHANCEMENT MEASURES AND COMPLEMENTARY INITIATIVES

9.1 Introduction

This chapter highlights the necessary mitigation measures that will be adopted to prevent or minimize significant negative environmental, social, health and safety impacts associated with the activities of the project during its construction, operation and decommissioning phases.

9.2 Mitigation Measures during the Construction Phase

9.2.1 Land Acquisition and Involuntary Resettlement/Displacement of persons

This will cause loss of ancestral land, community institutions and social networks will be weakened, and kin groups dispersed. Cultural identity, traditional authority and potential for assistance will be diminished. All these can be mitigated through a Resettlement Action Plan (RAP) where any loss of land and crops will be compensated. A separate Resettlement Action Plan (RAP) study has been commissioned for the proposed project. The RAP will be carried out in accordance with the legal framework of the Government of Kenya, and in line with the requirements of the African Development Bank's provisions for Land Acquisition and Involuntary Resettlement. Comprehensive compensation process and compensation before commencement of the project works will be ensured.

An implementation schedule covering all resettlement activities from preparation through implementation, including target dates will be created. The schedule will indicate how the resettlement activities are to be linked to the implementation of the overall project.

Kenya National Highways Authority (KeNHA), County Government of Lamu and Garissa, shall through Resettlement Committee (RC), oversee the implementation of the RAP.

The following four components will form part of Implementation of the RAP:

I. Notification to affected persons/ communities
II. Verification of properties of affected persons and estimation of their type and level of losses;
III. Civic education to prepare PAPs on utilization and proper use of compensation funds
IV. Relocation from affected land and resettlement of the PAPs.

9.3 Background Information-Land Tenure

Land tenure refers to the terms and conditions under which rights to land and land-based resources are acquired, retained, used, disposed or transmitted to others. Rules of tenure define how rights to land are allocated within societies. They define how access is granted to rights to use, control and transfer land, as well as associated responsibilities and restraints. In simple terms, land tenure systems determine who can use what resources, for how long and under what conditions

9.4 The Constitution and Its Classification of Land

The Constitution has classified land into (a) Public Land; (b) Private Land; and (c) Community Land.

a. **Public land** is defined pursuant to Article 62 of the Constitution and includes un-alienated land, land occupied by a State organ, land transferred to the State, land to which no heir can be identified, minerals, forests, all roads and thoroughfares, national parks, water catchment areas, sea, lakes, rivers, land between high water mark and low water mark, any land not classified as private land or community land.

b. **Community land** is defined pursuant to Article 63 of the Constitution as land held by communities identified on the basis of ethnicity, culture or similar community of interest and includes land lawfully registered in the name of group representatives, land lawfully transferred to a specific community and any land declared to be community land by an Act of Parliament.

- The essence of community land tenure is to provide recognition and protection for group land rights and to vest the ultimate ownership and control over community land with members of the community.
- Where community land is compulsorily acquired, it shall only be in the interest of defence, public safety, public order, public morality, public health or land use planning and subject to prompt payment in full of just compensation to the community.
- A Community Land Bill to regulate management of the Community land was due for debate in the Senate on or before 27th August, 2015 however Parliament adjourned the debate and enactment of the law to on or before 27th August, 2016.

c. **Private Land**- is land that is held by private persons or entities in either freehold or leasehold interests and is/was registered under Registered Land Act (cap 300), Government Land Act (Cap 280), Registration of Titles Act (cap 201) or Registration of Documents act (1908).

The four land registration statutes have been repealed but any grant or certificate of title registered under the repealed Registered Land Act (RLA) and Registration of Titles Act (RTA) are deemed to be a certificate of title or certificate of lease issued under the Land Registration Act (2012). The folio or the register of title kept under the repealed RLA or RTA is deemed to be the register under the Land Registration Act (2012).

9.5 Tenure of the Affected Land

1) The Lamu-Garissa Road will start at Hindi-Magogoni Settlement Scheme that borders the land that has been set aside for development of Lamu Port. From the start it traverses through Hindi-Magogoni Settlement Scheme. The land in Hindi-Magogoni Settlement scheme is classified as “private land” under Article 64 of the Constitution of Kenya. The persons owning the land hold it under freehold tenure and the land is registered at the Lands Office at Mukowe. The parcels of land are all from 4.0 hectares (10 acres) to 6 hectares (15 acres) in size and are largely undeveloped. It is estimated that about 60 percent of the 726 parcels originally comprising the Settlement have remained unoccupied to date since the Scheme’s inception in the mid-1980s. The land is currently generally bushy. There are, however, a few parcels of land that are developed and cropped with simsim, mango and cashew nut trees. Goats mainly dependent on browsing, are the main livestock kept in the area.
2) From Hindi-Magogoni Scheme, the proposed road will traverse through public land that was before promulgation of the new Kenyan Constitution earmarked for the Swahili Settlement Scheme. The land remains public land as per Article 62(1) (a) of the Constitution but has been encroached upon by persons who have curved the land into 2 to 4 hectare parcels. The encroachers have cleared some of the land and some have constructed wood-thatch structures on the land in order to lay a claim to the land in the

event the Government decides to make the land a settlement scheme for the landless. Only two of the encroachers were living on the land along the proposed road corridor and its neighbourhood as at the time of the ground survey in September-October, 2014. Few others would occasionally visit their claimed sites during day' time but were resident elsewhere.

3) The Aweer Community (derogatorily referred to as Waboni) occupy the land from approximately Km 20 to approximately Km 28 and then from Km 33 to approximately Km 49 along the proposed road. The land has been occupied by the Aweer Community for generations but has been labelled "public land" since 1908. This land is expected to revert to the Aweer Community once the Community Land Act, now before Parliament as a Bill, is enacted. The Aweer are traditionally hunter-gatherers and are found in Boni forest and are estimated to number less than 10,000 according to the 2009 Census. The community lives in villages spread within the Boni Forest. The village near the proposed road is Bargoni. The community, in recent times has been diversifying to shifting cultivation agriculture for subsistence, growing mainly cassava and maize and some have planted cashew nut and mango trees. Keeping livestock in this area is a problem because of the prevalence of tse-tse fly infestation.
4) The land between approximately Km 28 and Km 33 along the proposed road from Lamu is occupied by the Kenya Defence Forces
5) From approximately Km 49, the road enters the County of Garissa. The land is largely unoccupied up to Bodhei town that lies between approximately Km 62 to Km 65 along the road from Lamu. The Somali Community that is resident in the County of Garissa, like all the pastoral ethnic Somalis, are pastoralists who own cattle, camels and goats that forage for pasture far and wide within the County and in parts of the County of Lamu. From Bodhei, the road passes through Ijara town, to north of Masalani, Bura, Masabubu and ends at Modika that is a northern suburb of Garissa town.

   The land affected by the road in Garissa County is all Community land that, according to Article 63(1) of the Constitution of Kenya, vests in and is held by the community identified on the basis of ethnicity, culture or similar community of interest. The land is unregistered and is under the management of the County of Garissa who hold it in trust and on behalf of the Garissa Community.

Table 9.1 : Summary of Land Compensation Schedule

The Cost Item (Compensation for loss of)	Cost in Kenya Shillings
1. 71.27 acres of Private land and improvements (Hindi Magogoni)	108,657,885
2. 415 acres of Public land at Witemere	0
3. Encroachers' developments at Witemere	1,704,840,
4. 329 acres occupied by Aweer Community	16,450,000
5. Individuals' developments on Aweer's land	2,555,823
6. 5312 Acres of Arid And Semi-Arid Land In Garissa At Kshs 30,000 Per Acre	183,264,000
7. Garissa County's Total Developments' Proposed Compensation	66,773,929
8. 36 acres occupied by KDF	1,800,000

The Cost Item (Compensation for loss of)	Cost in Kenya Shillings
9. Cost of cleansing the burial site of late prince of the Abdallah clan if site is affected - the money to be administered by the senator of the county of Garissa and Ngini Omar Shurie	2,500,000
Sub-Total (A)	**382,001,637**
1. Provisional cost for M&E	60,000,000
2. Grievance Redress and Project Implementation committee meetings (transport, accommodation, stationery, flight charges etc.)	60,000,000
3. Capacity building programs for PIC, M&E and Grievance Redress Committee	4,000,000
4. Education for PAPs on financial literacy	10,000,000
Sub-Total (B)	**134,000,000**
1. Total Budget (C)= (A) + (B)	516,001,637
2. Contingencies as 15 % of the Total Budget =(D)	77,400,245.6
GRAND TOTAL (C) + (D)	**593,401,883**

(Source: SAI Valuer's Asset Survey)

9.5.1 Disturbances to Public Utilities

The developer will relocate all facilities affected in consultations with various parties affected with respect to water, pipelines, electricity, roads, etc.

9.5.2 Impact on Flora and Fauna

Clearance of part of the vegetation at the project site to pave way for road construction will take place in some sections requiring realignment or deviation. However, the proponent should ensure proper demarcation of the project area to be affected by the construction works so as to reduce spill over effects to neighbouring areas. In the same vein, there should be strict control of construction vehicles to ensure that they operate only within the area allocated with access routes and other works; deviation works should be confined close to the road or within reserves to avoid spread of vegetation destruction; avoid encroachment into rivers/streams, flood plains and banks; replace vegetation on the reserve upon completion of construction.

Since the proposed project traverses a protected and an active animal corridor, cost efficient and effective mitigation measures to ensure the protection of the biodiversity. Conduct continuous monitoring and enforcement of penalties to ensure that construction camps and borrow pits are located far from the forest area, and that water abstraction and disposal of construction waste is not undertaken within the forest area. In addition efforts must be taken to ensure that no fuelwood for the project or associated facilities such as camps are taken from the protected forest area.

This will be aimed at ensuring that any disturbance to flora and fauna is restricted to the actual project area and is kept to the minimum possible.

9.5.3 Soil Conservation

The project may require use of available spoil/borrow pits for structural fill for access roads and embankments before borrow pits are excavated. Borrow pits will be centrally located wherever possible so they can serve more than one site. Topsoil from the borrow pits will be removed and set aside. When borrowing from the pit ceases, the areas will be reinstated accordingly to the project engineers' approval. Agreements between the Contractor and owners of material and dumping sites should be brought to the attention of the Client representative/Project Engineers who shall ensure implementation of the Environmental Management Plan for these sites. All steep cuts will be benched accordingly. Special attention will be given to ensuring that watercourses are not blocked and material stockpiles will be designed so that runoff will not induce sedimentation of waterways. In areas of high swell shrink soils, solution would be removal of the soil. Alternative would be to raise the track with base built from the rock level of profile. Dug out quarries should be filled with soil and rehabilitated with grass and tree planting alternatively in some cases as in nomadic pastoralists areas, the open quarries can be left to serve as water harvesting points for watering of livestock and wildlife.

9.5.4 Air Quality

The Proponent shall put in place several measures that will mitigate air quality arising during the construction phase by adhering to the provisions of NEMA's Air Quality Regulations, 2008. The following mitigation measures should be adopted to minimise the Air Pollution

- Water sprinkling to reduce the dust at construction site and near settlements. Sprinkle water twice a day or more when visual inspection indicated excessive dust and during heavy traffic
- Use of dust masks to operators and those working in dusty areas.
- Use of goggles for operators
- Construction machines / equipment's shall be well maintained to ensure total fuel combustion.
- All the vehicles shall be frequently checked and serviced during the whole construction period so that the level of exhaust emissions is reduced
- Movement of vehicles should be kept to minimum necessary for completing the job
- Cover all trucks hauling materials particularly sand
- Limit the speed of the vehicles to 40 kph or by placing speed bumps especially in busy areas

9.5.5 Noise and Vibrations

The proponents shall put in place several measures that will mitigate noise pollution arising during the construction phase by adhering to the provisions of Noise Prevention and Control Rules 2005, Legal notice no. 24 regarding noise limits at the workplace as well as NEMA Noise and Excessive Vibration Pollution Control Regulations, 2009.

- Where the noise levels is beyond 85 dB (A), ear muffs or plugs shall be provided to all those working within the construction equipment area including the operators.
- Equipment shall be well maintained or fitted with noise silencers such as mufflers.
- Select a site for machinery not too close to residential premises
- During construction at site, the contractor should only work during the normal hours (especially activities involving noise) so that the residents living along the project road are not disturbed during sleeping and resting hours.
- Control the speed of road construction equipment in residential areas

9.5.6 Hydrology and Water Quality Degradation

The proponent should put in place several measures that will mitigate water pollution arising during the construction phase by adhering to the provisions of NEMA Water Quality Regulations, 2006 (Legal notice No. 121). Measures aimed at minimizing run-off and spillover effects to neighbouring land during rainy season or when wet activities are being conducted on the site.

These measures will include clearing the project site of excavated materials or protect excavated sections from storm water, avoid excavation through flood plains or into stream banks, creating proper channels for waste water and solid waste disposal, develop emergency measures and procedures for protection of soils and streams downstream, design adequate culverts to accommodate peak flows; stabilize cut-surfaces with gabions, concrete walls, vegetation etc.; identify locations with sub-surface water streams before cutting, direct all surface runoff into existing natural drains and stabilize the drains downstream, culverts and drains to accommodate peak runoff from the catchments, excavations should not encroach onto streams, flood plains, stream banks or springs

9.5.7 Occupational Health and Safety Issues

The proponent should ensure adherence to the occupational health and safety rules and regulations stipulated in Occupational Health and Safety Act (Cap 513). In this regard, the proponent should be committed to

- Provision of security, insurance of both personnel and equipment,
- Train and develop capacity especially for inexperienced labourers/workers or newly purchased equipment's,
- Compensate for losses and injuries,
- Provide appropriate personal protective equipment, as well as ensuring a safe and healthy environment for construction workers as outlined in the EMP.

Other critical practices to ensure and enhance safety are: evaluation of risks, inform community members along project route on project schedule and activities, workers should be trained on health and safety procedures, reflective signage should be installed for safety of road users, keep public away from material sites, area populated by wild animals should be marked and communicated to construction workers, collaborate with Kenya Wildlife Service (KWS) for safety aspects within conservation areas and their buffer zones, provide appropriate slip roads in towns and bus stops for enhanced road safety (especially within the settled parts), provide adequate stream crossing to enhance safety. Initiative should be taken to conduct public awareness and sensitization campaign on safety aspects related to the road project.

9.5.8 Increase in HIV/AIDs Infection Incidence

The Proponent through the Contractor shall provide voluntary counselling and testing for HIV/AIDS to incoming construction personnel. He will also strengthen advocacy through awareness training in HIV/AIDS and other STIs; encourage the use of preventive measures like condoms by availing condom dispensers to construction staff.

9.5.9 Increased Water Demand

The Contractor shall ensure that water is used efficiently by sensitizing construction staff to avoid irresponsible water use. The Contractor will install water-conserving automatic taps and toilets within the site camps. Moreover, any water leaks through damaged pipes and faulty taps will be fixed promptly by qualified staff. The Contractor will liaise with WRMA (Water

Resource Management Authority)in locating points where boreholes may be drilled for water and their use.

9.5.10 Pollution due to Solid and Liquid Waste Generation

- Dispose the spoil materials into the numerous borrow pits located along the project road before they are restored.
- Sort waste according to their type and quality. Decomposable waste can be buried on sanitary landfills and recyclable materials can be sent to the recycling stations such as used spare parts and written off or worn-out construction equipment and spare parts can be sent to foundries where metal scraps are melted to produce other materials such as reinforcing metal bars, hoes, machetes etc.
- Encourage and reward employees who show good practice of solid waste management.
- Ensure that all machinery working on site are not spilling lubricants,
- No refuelling or repairing the machinery within 75m of the water source
- Use drip pans when leakage is noted on any standing machinery.
- Ensure all waste water is treated to meet the discharge limits

9.6 Mitigation of Negative Impacts during Operation Phase

9.6.1 Interference of Physical Cultural Resources

The proponent will ensure preservation of the cultural resources as per the provisions of African Development Bank and World Bank on Physical Cultural Resources. These resources are archaeological, paleontological, historical, architectural, and religious (including graveyards and burial sites), aesthetic or other cultural significance. There is need to ensure that in communities where graves are likely to be affected by the project, these sites are to be avoided as much as possible through consultations with individual home owners before project implementation to enable develop appropriate mitigation measures.

9.6.2 Separation of Communities as well as Inaccessibility to Market Centres and other Social Amenities/ Services

Fencing of the corridor due to the railway line will also lead to a possible separation of communities in the project areas. The project can give provisions for foot bridges and flyovers in areas where the railway line cuts through communities to aid in access to amenities on either side of the road.

9.6.3 Interaction with other Cultures

This is due to influx of construction and rail workers. The local communities would slowly acquire practices from the new populations in the area. The community and proponent should therefore develop programmes to enhance cohesion between project employees and the local community.

9.6.4 Interference with Livelihoods

Livelihoods will be disrupted since there will destruction of loss of agricultural land, etc. This might lead to increase in crime and impoverishment. The RAP should aim at promoting the participation of displaced people in the resettlement planning and assist displaced persons in their efforts to improve or at least restore their incomes and standards of living after displacement.

9.6.5 Disruption of Socio-economic Activities

Some socio-economic activities may be disrupted especially in towns and market centres. The proponent should consider employment of locals and considerations in job allocations especially for activities requiring unskilled labour.

9.6.6 Accidents Involving Wildlife and Livestock

The Lamu-Garissa LAPSSET corridor has not been mapped for wildlife crossings by KWS except in the rest of the LAPSSET corridor after Garissa (see **Annexure 9.1**). So there will be need to consult with KWS in locating animal crossing in this project area. Exact locations will be specified at the detailed design stage with close consultation with KWS staff.

The proponent will construct underpasses and overpasses at strategic points for animal crossing. The public will also be educated to ensure the crossing provisions are used.

One of the ways that will allow free movement of wildlife is to leave the road corridors open to movements of wildlife by restricting wholesale fencing of the corridor. Where fencing occurs, certain areas in the fence will be open to form wildlife bridges ("wildlife crossings") that will allow free movement of wildlife within the area and in and out of the area across the LAPSSET corridor (see Fig 2-1). In addition, sign posts written “Beware of Wildlife Crossing” will be erected to warn drivers as they approach these wildlife crossings. The other way for reducing road-kills, is a combination of fencing and over-passes (see Photo below) and underpasses and tunnels (see Photo) to allow small animals (including small mammals, frogs, toads) cross the road safely. These mitigation measures and constructions of these structures should be supervised closely by KWS.

A typical overland crossing bridge (should have fencing that serves to funnel wildlife toward passage structures)

A typical underpass that allows animals to pass through under the road

There will be several well-spaced wildlife crossing bridges/underpasses at each of the major wildlife corridors. These major wildlife closing areas are as shown below in **Figure 9.1**.

Table 9.2 : Suggested locations of Animal Crossings

Sr. No.	Corridor			Fencing	No of Animal Crossings	Tentative Location of Animal Crossing
	Chainage From	Chainage To	Length (km)			
1	35+000	41+000	6.0	Both side	1	40+720
2	57+000	67+000	10	Both side	1	61+700
3	102+100	142+800	40.7	Both side	4	108+500, 112+400, 124+425, 134+955
4	210+000	215+000	5	Both side	1	213+000
5	235+000	245+000	10	Both side	1	241+500
Total			**71.7**		**8**	
			143.4	**Both side**		

Figure 9.1 : Major wildlife closing areas (⬌) that will need construction of over-passes or underpasses

9.6.7 Flooding and Surface Run off

Poorly designed drainage systems may trigger flooding which may in turn be a health problem to the communities along the road corridor. Well-designed drainage system and re-afforestation of affected catchment areas will minimize such impacts.

9.6.8 Ensuring Efficient Solid Waste Management

Waste handling facilities such as waste bins for holding waste generated will need to be provided along the road corridor, especially at market centres. In addition, with help of local

governments the proponent will ensure that such disposed of regularly and appropriately. An integrated solid waste management system is recommendable.

First, the proponent will give priority to Reduction at Source of the materials. Recycling, reuse and compositing of the waste will be the second alternative in priority. This will call for a source separation programme to be put in place. The third priority in the hierarchy of options is combustion of the waste that is not recyclable in order to produce energy. Finally, sanitary land filling will be the last option for the proponent to consider. The proponent will adhere to the Environmental Management and Coordination (Waste Management), Regulations 2006.

9.6.9 Permanent changes to Traffic Routes

There will be temporary and permanent changes to traffic circulation due to fencing of the corridor (due to the railway line). This impact can be minimized by provision of dedicated underpasses/overpasses at strategic locations throughout the corridor to ensure free movement of people and animals. Appropriate signage and information will be provided.

9.7 Complimentary Initiatives

Landscaping and Trees Planting program: The project shall support the efforts of Lamu and Garissa county governments through planting of trees and shrubs to beautify the road corridor, replace trees that may be cut down during construction, protect the road reserve; and planting trees that will contribute towards sequestering carbon emissions.

HIV/AIDS Awareness and Prevention: The project has included in its design implementation of a sensitization and awareness activities to cater for the prevention of the spread of HIV/AIDS, STI and avoidance of drug and substance abuse. There shall be the establishment of several wellness centres at truck parking locations that will be established along the road, especially at Bargoni, Bodhei, Ijara, Roka, Masabubu, Nanighi and Korakora. The design and operation shall benefit from the experience of National Aids Control Council (NACC) at the Wellness Centre at Kenya Ports Authority. In addition, NACC shall facilitate implementation of this component, identification of potential service providers and drawing up of Terms of Reference.

Gender Considerations at Construction Sites and RAP Implementation: On gender sensitization, efforts shall be put in place to ensure that both men and women take part in project preparation and implementation. Distribution of jobs during construction shall be guided by the national policy of at least 30% to be women employed. In addition, the contractors and employers shall be obliged to develop a code of conduct to ensure no abuse takes place at the working areas. Appropriate facilities including rest places and ablution facilities shall be provided for both women and men. The National Gender and Equality Commission (NGEC) shall work with KeNHA to ensure appropriate messages and procedures are followed by the service providers in this respect. Of importance is gender sensitization during implementation of the RAP to ensure rightful owners of properties are compensated and that for family assets, both wife and husband are availed with full information and payment procedures.

Training and Capacity Building for Local Unemployed Youth: Many rural areas in Kenya have an acute problem of youth unemployment resulting into unbecoming behaviours; the project should include, as part of the activities, a training programme to be implemented by the local technical and vocational training institutes. The programme shall be on a self-selection basis and shall be short term. The plan is to commence with the training programme ahead of commencement of construction works to give first hand opportunity to the trainees to get

jobs. In addition, the training programme shall include modules that will go beyond construction trades but those that would be sought by the labour market. In order to ensure gender equality, the participants shall have to be at least 30% women youth.

Gender Mainstreaming: Gender mainstreaming is intended to uplift the social and economic status of both men and women. The National Gender and Equality Commission (NGEC) which, among others, is charged with the responsibility of monitoring and reviewing Government's institutions performance on gender inclusion is developing sector specific indicators. NGEC will assist incoming up with indicators and guidelines as part of the Gender and Inclusion Monitoring Framework. In this process NGEC shall provide technical support in working with KeNHA and the identified service provider to develop the indicators and guidelines.

Roadside Amenities Including Parking Areas: The project shall consider provision of roadside amenities and truck parking at designated sites. However concrete sites and size of locations have not yet been identified and agreed upon with the appropriate authorities. The intention is for the project to compact and pave the sites and in collaboration with the local authorities who should prepare a site physical plan and operate the sites where facilities such as kiosks will be built. Priority for allocation of space shall be to youth and female traders, maintaining gender equity, who shall have been vacated from the project road. Amenities to be included at these sites shall include solid waste bins, potable water sources, rest places, restaurants, toilet facilities, shops/kiosks and HIV/AIDS, STIs, and drug abuse information booths, etc.

Road Safety Campaigns: The project shall carry out awareness and educational campaigns on road safety. The service provider shall ensure that all road users and operators are educated about the road use and behaviour on the road both during construction and operation. Of importance is adequate signage especially during construction which will have to be emphasized in the traffic management plan and use of diversions and alternative routes by motorists. Pedestrians will have to be educated about the importance of crossing roads at designated crossing points and use of foot bridges to avoid accidents. Particular sensitization programmes will be for schools along the road corridor and motor cyclists.

The total cost of the ESMP is estimated at KShs. 638.901 Million. Details of the cost items and the estimate are presented in the **Table 9.3** below indicating roles and responsibilities to implement these measures, in addition to the estimated costs.

Table 9.3: Complimentary Measures and their Cost Estimates

Impact	Proposed Mitigation Measures	Responsible Entity	Cost Estimate (Kshs)
Soil erosion	• Control earthworks • Install drainage structures properly • Install erosion control measures • Landscape embankments and re-vegetate gravel sites • Management of excavation activities • Damaged drainage systems should be rebuilt or rehabilitated by suitable methods. • Impact on erosion (on road, off road, embankments, riverbanks, etc.) • Efficiency of erosion control measures	Contractor	3,000,000
Changes in hydrology /impeded drainage	• Install drainage structures properly • Efficiency of drainage structures	Contractor	10,000,000

Impact	Proposed Mitigation Measures	Responsible Entity	Cost Estimate (Kshs)
Material sites	• Inform people living at/near the sites that the pits have been selected for exploitation. • Plan access to gravel sites • Control and restrict access to gravel sites (e.g. by fencing) • Control earthworks • Proper management of excavation activities • Rehabilitate (Landscape, water pans, terracing, and grass sites) old and new gravel pits.	Contractor	9,000,000
Garbage or Solid Wastes	• Garbage will be disposed-off periodically from labour camps • Sufficient measures will be taken in the construction camps i.e. provision of garbage bins and sanitation facilities. If septic tanks are installed, waste will be cleared periodically • The Contractor to develop waste management plans and provide appropriate facilities for their operations • Prepare signed agreements with landowners where spoil earth is to be disposed indicating conditions and responsibilities for restoration and management, • The spoil disposal sites should be approved by NEMA before dumping commence • Consider re-use of used/waste asphalt concrete for public access roads in the neighbouring urban areas	Contractor	5,000,000
Construction Camps (Public health and occupational safety)	• Sufficient measures will be taken in the construction camps i.e., provision of garbage bins and sanitation facilities. If septic tanks are installed, waste will be cleared periodically. • Special attention shall be paid to the sanitary condition of camps. • Garbage will be disposed of periodically. • Sensitization campaign on STDs & AIDS will be mandatory at the camps and in the community.	Contractor NGOs, NBOs	3,500,000
Road Safety	• Install warning signs and speed bumps on approach to the towns and settlements • Provide parking bays for heavy goods vehicles and public transport vehicles • Enforce speed limits • Enforcement of traffic Act	Contractor	2,00,000
HIV/AIDS	• Sensitization and awareness campaign in the communities along the project road • Preventives measures like use of condoms, voluntary testing • Training	NGOs Contractor	1,500,000

Impact	Proposed Mitigation Measures	Responsible Entity	Cost Estimate (Kshs)
Vegetation	• Control clearing – avoid unnecessary clearing of vegetation. • Replant areas where vegetation is unnecessarily removed. • Landscaping and planting all disturbed areas (pits, deviations, embankments, camp sites). • Planting and grassing should be done just before the rains.	Contractor	3,000,000
Air Quality	• Dust during construction near homes and settlements…watering at regular intervals during the day	Contractor	4,000,000
*Resettlement	• Resettlement of people and shifting of properties and utilities where applicable:	KeNHA	593,401,883
Decommissioning of Construction Installations	• Removal of construction camps • Rehabilitation of material sites • Materials batching yards • Construction equipment removals • Clean up-up at fuelling yards • Removal of the road pavement	Contractor Resident Engineer KeNHA	6,500,000
Total			**638,901,883**

* The estimates for the resettlement action plan (RAP) will cover land acquisition, restoration of livelihoods and other negative impacts arising within the community as a result of the road project. the cost is calculated based on the valuation of the impacted assets and structures, and break up of the same cost is presented in Chapter-14 of Volume VIII RAP Report.

9.8 Decommissioning Phase

Roads, under normal circumstances may not need to be decommissioned. They are mainly maintained and sometimes rehabilitated. During rehabilitation, a new ESIA can be instituted or an environmental and social management plan can be prepared depending on the degree of rehabilitation.

Chapter 10

Expected Residual Effects and Environmental Hazard Management

TABLE OF CONTENTS

10. EXPECTED RESIDUAL EFFECTS AND ENVIRONMENTAL HAZARD MANAGEMENT

10.1 Expected Residual Effects of the Project

Residual effects are those environmental effects predicted to remain after the application of mitigation outlined in this ESIA Report

10.1.1 Disruption and change of Local Livelihoods/Outward Migrations

The project is expected to lead to some major disruption and change of local livelihoods of local people due to introduction of long-distance trucks. The locals in urban centres such as Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa will have to interact with influx of drivers, mechanics, turn-boys, truck owners, other related/ supportive business owners, Commercial Sex Workers, vendors, etc. This will lead to changes in behaviour and livelihoods (increases in crime rates, substance abuse, prostitution, etc.).

10.1.2 Interference with Cultural-Set Up of Communities

Increased immigration into the project area will lead to increase in population especially in towns and urban centres along the road, leading to changes in behaviour and livelihoods (increases in crime rates, substance abuse, prostitution, etc.). This will result in strained relationships which sometimes degenerate into open conflicts between the residents and the users of the road. With immigration into areas adjacent to the road, there will be additional demand on the existing social facilities.

10.1.3 Increased Crime Rates/Culture Erosion

Social crime rate in the area is expected to rise with the beginning of the operations due to influx more people into the area looking for job opportunities, etc. There will be interaction with other cultures, especially increased number of tourists. The influx of workers into local communities where the road will pass may lead to cultural erosion.

10.1.4 Change in Wildlife Behaviour

The proposed fencing of the road line within the protected areas, introduction of underpasses and overpasses, may change the movement and general behaviour of wildlife. This impact is likely to occur in areas adjacent to Arawale and Dodori National Reserves and where wildlife occurs especially around Korakora as you approach Garissa town.

10.1.5 Modification of Drainage

As the general topography the road alignment will pass is more or less flat, localised changes in hydrology and drainage will be expected in same areas. A new pavement in some sections (especially on some sloppy areas and near laghas/seasonal streams) along the road corridor will consequently lead to increased surface run-off hence leading to challenges on the drainage system including outfalls. Due to the flat nature of the terrain in most parts of the road from Lamu to Garissa, drainage will be a problem.

10.1.6 Emissions to Air

Trucks engines are known significant contributors to air pollution, especially if they are not regularly serviced. Diesel truck engines (especially those that use high sulphur diesel) are known to emit combustion products, including nitrogen oxides (NO_X) and particulate matter (PM_{10}), both of which contribute to public health problems, and carbon dioxide (CO_2), a greenhouse gas. Transportation and transfer of dry granular materials (e.g. minerals and grain) in uncovered trucks may result in dust emissions, while the storage and transfer of fuels or volatile chemicals may result in fugitive emissions above baseline ambient levels. These will affect inhabitants of urban centres of Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa.

10.1.7 Waste Management

Depending on the number of vehicles and passengers handled by the new road, solid, non-hazardous, food waste may generated from new and existing food establishments, in addition to packaging materials from retail facilities, and paper, newspaper, and a variety of disposable food containers at the many urban centres along the road. Other wastes will include solids from mechanical cleaning of trucks, waste paint, spent solvent and solvent sludge (from painting and cleaning), waste oil, hydraulic fluid, and other petroleum-based fluids; petroleum-contaminated solids (e.g. oil filters and saturated spill absorbent material); spent coolant; metal filings and scrap; spent batteries; and spent brake shoes at various service centres that will spring up along the road at various urban centres.

10.1.8 Fuel Management

Due to distances the trucks will cover, fuelling stations will be built in towns such as Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa along the road to supply petrol, diesel, etc. Typically, these fuelling stations will act as service bays for the increased numbers of trucks and will contain facilities including include underground storage tanks, piping, and filling equipment with the potential for soil and ground water resource contamination due to leaks and spills.

10.1.9 Oil Pollution/Spillage

Oil spillage during change of lubricants, cleaning and repair processes are very common. Oil spillage are also likely to occur by leaks of these petroleum products, coupled with the normal leaking and dripping of oil, grease and solvents from trucks. Oil spills are hazardous to the environment as they contaminate the soil and water. Typically, fuelling and service stations will act as service bays. The spilled oil should be trapped in grit chamber for settling of suspended matter. The collected oil should either be auctioned or incinerated, so as to avoid any underground water contamination.

10.1.10 Pollution on Vegetation

Not very well serviced trucks produce a lot of exhaust gases and smoke. Once the smoke settle on vegetation leaves, it interferes with the process of photosynthesis thus compromising the plant growth. Exhaust gases results to acid rain that impacts negatively on vegetation growth and house structures such as roofing iron sheets. Along the road we have sections with thick vegetation such as at Mokowe, Bargoni, Arawale, Korakora and Garissa which will be affected.

10.1.11 Wildlife and Livestock Accidents due to Damaged Fence

With the introduction of fast moving traffic it is expected that the number of livestock and wildlife deaths will occur. This impact is likely to occur in areas adjacent to Bargoni (with several pastoral communities), Arawale and Dodori National Reserves and around Korakora as you approach Garissa town where wildlife occurs. Regular surveillance of the fence to detect damaged areas will be undertaken. Prompt repairs on damaged fence should be undertaken.

10.1.12 Separation of Communities and Inaccessibility to other Social Amenities/ Services

Fencing of the road and railway corridor will lead to a possible separation of communities in the project areas. Some people will also find it difficult to access some shopping, markets areas, schools, churches and mosques, etc. if no proper planning for access routes/ facilities are developed. This will occur especially at towns such as Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa. The project should give provisions for foot bridges and flyovers in areas where the road cuts through communities to aid in access to amenities on either side of the road.

10.1.13 Blockage of Wildlife, Livestock and Human Corridors

Livestock and wildlife cross the area freely move from all directions in search of pasture and water. Since it is proposed that the new railway line corridor (which shares the same corridor with the road) will be fenced, the corridor will be blocked and the wildlife and livestock will not be able to move freely in search of pasture, water and breeding grounds. This impact is likely to occur in areas adjacent to Bargoni (with several pastoral communities), Arawale and Dodori National Reserves and around Korakora as you approach Garissa town where wildlife occurs. To prevent this, provision of underpasses and overpasses will be provided at strategic points to enable wildlife and livestock to cross the corridor without accidents. Some water points may have to be established for the wildlife to ensure that they are attracted to the underpasses which they will be used with over time.

10.1.14 Noise Pollution

Sources for noise pollution will include noise generated by heavy trucks movement, braking, hooting and ground vibrations. This may affect wildlife and communities in urban areas. These will affect inhabitants of urban centres of Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa for local communities and areas adjacent to Bargoni (with several pastoral communities, Arawale and Dodori National Reserves and around Korakora as you approach Garissa town where wildlife occurs).

10.1.15 Health and HIV/AIDS

Operation of the road will be accompanied with influx of population from many areas. The locals in urban centres such as Mokowe, Hindi, Bargoni, Bodhei, Ijara, Roka, Bura East, Masabubu, Nanighi, Korakora and Garissa will have to interact with influx of drivers, mechanics, turn-boys, truck owners, other related/ supportive business owners, Commercial Sex Workers, vendors, etc. This will lead to changes in behaviour and livelihoods (increases in crime rates, substance abuse, prostitution, etc.). This may also include increase in prostitution in the project area. Cases of HIV/AIDS specially and other social diseases may also increase in addition to potential health from sanitation and hygiene challenges. There also could be potential increase in cases of other communicable diseases (STIs, TB, etc.).

10.2 Contingency Plan to Mitigate Residual Effects

The risks can be mitigated to a large extent through: (i) Strengthening staff skills and training in environmental management; (ii) Monitoring environmental actions and responsibilities and making provision for remedial actions; (iii) Planning for remedial measures in case initial planned actions are not successful; (iv) Limiting time of exposure to dust particles, chemicals and noise; (v) Establishing safety and inspection procedures in materials handling, operating heavy equipment and constructing trenches; and (vi) Safe handling of toxic materials, explosives and other hazardous substances. The Contractor shall submit a Traffic Management Plan and an Emergency Response Plan containing Method Statements covering the procedures for the main activities which could generate emergency situations through accidents or neglect of responsibilities. These situations include, but are not limited to: (i) Accidents at the work place; (ii) Accidental fires; (iii) Accidental leaks and spillages; (iv) Vehicle and plant accidents and (v) traffic snarl up and (vi) security of plant and equipment.

A summary table (**Table 10.1**) shows the mitigations measures suggested to mitigate against residual negative effects and the entities responsible for the mitigation.

Table 10-1: Summary of Contingency Plan to Mitigate Residual Effects

Sr. No.	Impact	Mitigation Action	Responsibility	Means of Communication
1	10.2.1 Disruption and change of local livelihoods/outward migrations	✓ Follow-up on the implementation of RAP report to ensure that locals benefit ✓ Follow-up on provision of community improvement services under social responsibility including health, education, water supply, sanitation, access roads, etc.	✓ KeNHA ✓ National government ✓ County Government	✓ Posters ✓ Public meetings (barazas)
2	10.2.2 Interference with cultural-set up of communities	✓ Support local cultural groups and values ✓ Ensure the established Community Liaison Committees that will help in dispute resolutions function well ✓ Discourage negative vices such as substance uses, prostitution, etc.	✓ KeNHA ✓ National government ✓ County Government ✓ Churches	✓ Posters ✓ Public meetings (barazas)
3	10.2.3 Increased crime rates/culture erosion	✓ Encourage social integration between different communities ✓ Ensure the established Community Liaison Committees that will help in dispute resolutions function well ✓ Enhance community policing	✓ National Police Service ✓ County Government ✓ Churches ✓ Local CBOs	✓ Posters ✓ Public meetings (barazas)

Sr. No.	Impact	Mitigation Action	Responsibility	Means of Communication
		✓ Support local cultural groups and values		
4	10.2.4 Change in wildlife behaviour	✓ Periodic monitoring of wildlife (numbers and behavior) along the road corridor	✓ KWS ✓ County Government	✓ Posters ✓ Public meetings (barazas)
5	10.2.5 Modification of drainage	✓ Drainage channels to be kept clear at all times to prevent overloading with polluting materials. ✓ Drainage outfalls are to be acquired and kept free of encroachments	✓ KeNHA ✓ County Government	✓ Posters ✓ Public meetings (barazas)
6	10.2.6 Waste Management	✓ Provide public waste receptacles at strategic locations along the route (bus stops, foot bridge landings and crossing areas) ✓ Introduce clean-up responsibilities and charges for the road users (e.g. spills from accident vehicle owners) to reduce road related environmental pollutants and visual nuisance ✓ Drainage channels to be kept clear at all times to prevent overloading with polluting materials. ✓ Drainage outfalls are to be acquired and kept free of encroachments ✓ Maintain truck parking yards on drainage, water supply, waste collection and lighting/security	✓ KeNHA ✓ County Government ✓ Vehicle owners associations	✓ Posters ✓ Public meetings (barazas)
7	10.2.7 Oil pollution/spillage	✓ The spilled oil should be trapped in grit chamber for settling of suspended matter. ✓ The collected oil should either be auctioned or incinerated, so as to avoid any underground water contamination. ✓ Introduce clean-up responsibilities and charges for the road users (e.g. spills from	✓ KeNHA ✓ County Government ✓ NEMA ✓ Vehicle owners associations	✓ Posters ✓ Public meetings (barazas)

Sr. No.	Impact	Mitigation Action	Responsibility	Means of Communication
		accident vehicle owners) to reduce road related environmental pollutants and visual nuisance		
8	10.2.8 Pollution on Vegetation and General Environment	✓ KeNHA to consider developing and enforce vehicular emission regulations in consultations with NEMA ✓ Provide public waste receptacles at strategic locations along the route (bus stops, foot bridge landings and crossing areas) ✓ Introduce clean-up responsibilities and charges for the road users (e.g. spills from accident vehicle owners) to reduce road related environmental pollutants and visual nuisance	✓ KeNHA ✓ County Government ✓ NEMA	✓ Posters
9	10.2.9 Wildlife and Livestock Accidents due to Damaged Corridor Fencing	✓ Regular surveillance of the fence to detect damaged areas will be undertaken. ✓ Prompt repairs on damaged fence should be undertaken.	✓ KeNHA ✓ County Government ✓ KWS	✓ Posters ✓ Public meetings (barazas)
10	10.2.10 Separation of Communities as well as inaccessibility to Market Centers and other Social amenities/services	✓ Maintain proper care and cleanliness of foot bridges and flyovers in areas where the road cuts through communities to aid in access to amenities on either side of the road.	✓ KeNHA ✓ County Government	
11	Blockage of wildlife, livestock and human corridors	✓ Provide underpasses and overpasses at strategic points to enable wildlife and livestock to cross the corridor without accidents. ✓ Establish water points for the wildlife to ensure that they are attracted to the underpasses which they will be used with over time.	✓ KeNHA ✓ County Government ✓ KWS	✓ Posters ✓ Public meetings (barazas) to warn public

Sr. No.	Impact	Mitigation Action	Responsibility	Means of Communication
12	10.2.11 Noise pollution	✓ Introduce vegetation cover (trees and shrubs) along the road reserve as noise buffer to the immediate premises close to the road ✓ Influence land use practices and building characteristics along the road for low noise conflicts (orientation, design considerations, distance from the road) ✓ Influence County Governments policy on land use planning along the corridor with among others annuals noise monitoring to influence land use practices ✓ Sensitize motorists/road users	✓ NEMA ✓ Vehicle owners associations ✓ KeNHA ✓ County Government	✓ Posters ✓ Public meetings (barazas) to warn public
13	10.2.12 Health and HIV/AIDS	✓ Enhance initiatives for information and awareness as part of the road displays ✓ Organize and implement HIV/AIDS Awareness programmes along the road corridor in liaison with relevant authorities (make it a long term initiative) ✓ Maintain on corporate social responsibility (CSR) basis the wellness centres (including the VCT Services and ARVs) located within the truck parking yards and improved public health centres for long term benefits to the communities.	✓ Ministries in charge of health ✓ KeNHA ✓ County Government ✓ NGOs	✓ Posters ✓ Public meetings (barazas) to warn public
14	10.2.13 Road accidents	✓ Establish road safety strategies for the road complete with sensitization programmes for the road users including motorists, pedestrian, etc.	✓ Kenya Police Service (Traffic Department) ✓ KeNHA ✓ County Government ✓ NGOs	✓ Signages ✓ Posters ✓ Public meetings (barazas) to warn public

Sr. No.	Impact	Mitigation Action	Responsibility	Means of Communication
		✓ Provide parking bays for heavy goods vehicles and public transport vehicles ✓ Liaise with the Traffic Police on ways to ensure compliance with road regulations ✓ Ensure maintenance of signage, crossings, speed breaks and other facilities at all times (in view of the current challenge of vandalism of road safety installations in the country) ✓ Maintain non-motorised transport (NMT) facilities (overpasses, underpasses and crossing rumps at all times) ✓ Involve community leaders and administration in ensuring usage and sustainable utilization of NMT provisions for public safety		

Chapter 11

Environmental Monitoring Plan

TABLE OF CONTENTS

11. ENVIRONMENTAL MONITORING PLAN

11.1 General Statement

Environmental Monitoring is a long-term process, which should begin at the start of construction and continue throughout the life of the road project. Its purpose is to establish benchmarks so that the nature and magnitude of anticipated environmental and social impacts can be continually assessed. Monitoring involves the continuous or periodic review of construction and maintenance activities to determine the effectiveness of recommended mitigation measures. Consequently, trends in environmental degradation or improvement can be established, and previously unforeseen impacts can be identified or pre-empted.

Environmental audits are supposed to be carried out one year after completion of the project. These audits assess the relevance, efficiency and impact of any mitigation measures that have been employed.

Environmental monitoring is an essential component of project implementation. Environmental Monitoring Plan provides mechanism of monitoring environmental impacts of a project during its execution in order to reduce their negative effects and to introduce standards of good practice to be adopted for all project works. It facilitates and ensures the follow-up of the implementation of the proposed mitigation measures proposed in the EMP. The parameters of the proposed road project identified for monitoring include

- Vegetation,
- Water Quality,
- Air Quality,
- Soil Erosion
- Solid Waste Management,
- Environmental Risks/Hazards
- Occupational Health And Safety Risks
- Wildlife/Livestock/Human Accidents,
- AIDS/HIV Incidences,
- Resettlement and Livelihood.

Table 11.1 below summarizes the important aspects to be considered for environmental monitoring during the life of the project and its decommissioning. Estimated costs of these activities are included in the ESMP.

Table 11.1: Proposed Environmental Monitoring Plan

Sr. No.	Issue	Monitoring Parameters	Means of Verification	Time Frame (Phase)	Responsibility
1	Air quality	✓ Construction related dust levels within the project ✓ Exhaust fumes levels from construction machineries ✓ Exhaust fumes levels from vehicles	✓ Low visible particulate matter in the air through the road corridor and material sites ✓ Frequencies of watering of deviations and roads under construction ✓ Low visible particulate matter in the air through the road corridor during Operations Phase	✓ Construction ✓ Operation	✓ RE ✓ Contractor ✓ NEMA
2	Changes in hydrology/ Drainage; and Use of water resources	✓ Water quality levels ✓ Complaints from public ✓ Social conflicts ✓ Overgrazing around water points	✓ Compliance with the works specifications ✓ Regular consultations with local leaders	✓ Construction	✓ RE ✓ Contractor ✓ NEMA County governments
4	Vegetation cover degradation & Soil erosion	✓ Changes in Vegetation cover ✓ Sediment and debris build up in road ditches and culverts ✓ Complaints from the public	✓ Records of cleared acreages ✓ Plans for landscaping and beatification for the project corridor upon project completion ✓ Plans for landscaping and planting grasses on road reserves	✓ Construction ✓ Operation	✓ RE ✓ NEMA ✓ Contractor County governments
5	Noise pollution and vibrations	✓ Noise levels in construction and material sites ✓ Noise nuisance close to sensitive institutions, such as schools, health centres, villages and towns ✓ Noise impacts of workers	✓ Number of complaints ✓ Records of working hours (strictly during the day for areas near settlements) ✓ Approval of spoil disposal sites by NEMA (appropriate environmental assessments submitted) ✓ Disposal of spoil in accordance with regulations and conditions on signed agreements, ✓ Noise levels in accordance with NEMA Regulations ✓ Provision of Personal Protective Equipment (PPEs)	✓ Construction ✓ Operation	✓ RE ✓ NEMA ✓ Contractor ✓ County governments

Sr. No.	Issue	Monitoring Parameters	Means of Verification	Time Frame (Phase)	Responsibility
6	Garbage or Solid and Liquid Wastes	✓ Number of complaints from the public ✓ Wildlife deaths or occurrence of diseases linked to poor wastes disposal ✓ Morbidity statistics related to sanitation in contractor's camps	✓ Locations and means of wastes disposal sites ✓ Frequency of waste collection and disposal ✓ Presence of waste management policy with the Contractor ✓ Number annual of Environmental Audits	✓ Construction	✓ RE ✓ NEMA ✓ Contractor ✓ County governments
7	Land use changes	✓ Public complaints ✓ Disappearance of public utility areas ✓ Disappearance of vital biodiversity	✓ Land use plans and zoning plans	✓ Construction ✓ Operation	✓ NEMA ✓ RE ✓ Contractor ✓ KeNHA ✓ County governments
8	Health (Public health and occupational safety) and Safety	✓ Complaints on health safety aspects related to the road construction activities ✓ Trends in HIV/AIDS cases along the corridor ✓ Reports of awareness creation ✓ Medical records of injuries, etc. ✓ Medical covers taken for workers	✓ Compliance records as set forth by the Resident Engineer (RE) ✓ Records of communications with vulnerable members of the public ✓ Presence of an occupational health and safety policy ✓ Compliance records with other relevant government policies and regulations ✓ Number of condoms dispensed ✓ Annual audits ✓ Operational of VCT Centres	✓ Construction ✓ Operation	✓ RE ✓ NEMA ✓ Ministry of Health ✓ Contractor
9	Road safety	✓ Data on traffic accidents ✓ Public complaints ✓ Police records and reports ✓ Reports of awareness creation ✓ Presence of safe crossings	✓ Presence of traffic management plans ✓ Records of cautions made to the public	✓ Construction ✓ Operation	✓ RE ✓ Traffic Police ✓ Contractor ✓ County governments

Sr. No.	Issue	Monitoring Parameters	Means of Verification	Time Frame (Phase)	Responsibility
10	Socio-economic	✓ Public complaints from affected communities and families	✓ A comprehensive RAP ✓ Compensation records	✓ Construction ✓ Operation	✓ RE ✓ Contractor ✓ KeNHA ✓ County governments
11	Construction Water sources	✓ Flow volumes of abstracted streams, rivers or pans ✓ Changes in aquifer levels ✓ Public complaints	✓ Annual environmental audits ✓ Compliance with permitted abstraction rates	✓ Construction	✓ RE ✓ Contractor ✓ NEMA ✓ WRMA ✓ County governments
12	Disruptions and Inconveniences	✓ Public complaints	✓ Records of cautions and information made to the public	✓ Construction	✓ Contractor ✓ RE ✓ County governments
13	Wildfires	✓ Burnt up areas close to the road	✓ Number fire incidences	✓ Construction ✓ Operation	✓ RE ✓ Contractor
14	Wildlife	✓ Data on vulnerable wildlife populations ✓ Cases of poaching ✓ Changes in wildlife migration corridors	✓ Data on wildlife populations ✓ Numbers animal kills ✓ Number of cases of poaching ✓ Presence of waste management protocols ✓ Reports on awareness sessions conducted by the Contractor to his personnel	✓ Construction ✓ Operation	✓ KWS ✓ RE ✓ Contractor ✓ County governments
15	Aesthetics and landscape	✓ Number of public complaints (of exposed surfaces, quarry/borrow pits and material stockpiling areas)	✓ Compliance with the Works Specifications	✓ Construction	✓ RE ✓ Contractor ✓ KeNHA ✓ County governments

Sr. No.	Issue	Monitoring Parameters	Means of Verification	Time Frame (Phase)	Responsibility
16	Archaeological and cultural sites	✓ Actual sites found and marked ✓ Public complaints	✓ Records of identified sites ✓ Records that they are safe and secure	✓ Construction	✓ RE ✓ Contractor ✓ Kenya National Museums ✓ County governments
17	Gender issues	✓ Number of women employed by the Contractor ✓ Complaints on gender bias ✓ Reported cases of rape involving Contractor's personnel	✓ Maintaining and presence of complaints register	✓ Construction	✓ RE ✓ Contractor ✓ County governments
18	Establishment, operation and decommissioning of construction camps	✓ Public complaints ✓ Environmental quality within the camps	✓ Annual environmental audits ✓ Schedules of waste collection and disposal	✓ Construction ✓ Decommissioning	✓ RE ✓ Contractor ✓ KeNHA ✓ County governments

Chapter 12

Public Consultation and Community Participation

TABLE OF CONTENTS

12. PUBLIC CONSULTATION AND COMMUNITY PARTICIPATION

12.1 Introduction

To conform to GoK and AfDB Bank's involuntary resettlement policies and guidelines, stakeholder's consultation and participation was undertaken in preparation for this RAP. The community consultation and participation provided the opportunity to raise the PAPs and stakeholders awareness on the proposed road project and its facets.

Participation of Project Affected Persons (PAPs) is an important component in the efforts of identifying impacts and designing of the Resettlement and Rehabilitation Plans. The public consultation for the project was carried out with the PAPs, key Stakeholders, NGOs and public representatives in the project area especially in identifying the impact categories, magnitude of compensation package and livelihood restoration options. Care was taken to allow for greater participation of the marginalized and vulnerable groups among the PAPs

12.2 Key Stakeholder's Identification & Consultation

One of the major purposes of stakeholder's identification and analysis is to provide an opportunity to involve and ensure participation of all groups of the society in the planning and implementation of a project depending on the stakeholders' willingness and participation. The stakeholders for this highway project, their roles and responsibilities concerns and strategies in RAP are illustrated in the **Table 12.1** below;

Table 12.1 : Key Stakeholders

Institution	Role and Responsibility	Stake in the Project	Concerns	Strategies and Planning
KeNHA	Implementing agency	High	Timely project implementation	-Preparation of RAP -Supervision and monitoring of RAP implementation
County governments	Harmonious implementation of the project	High	Managing and influencing peaceful compensation with individual PAPs	-Engagement with consulting teams, national teams and KeNHA
Local Communities	Ensuring conducive environment throughout the project period	High	Compensation and employment during project implementation	-Formation of grievance settlement committees -Awareness creation -Regular consultation
Project affected persons	Land acquisition/ Compensation	High	Compensation as per RAPSs recommendations and consensus reached during	-Payment of compensation in consultation with the PAPs -full involvement

Institution	Role and Responsibility	Stake in the Project	Concerns	Strategies and Planning
			RAP process	and inclusion at all stages
Contractors	Construction works	High	Conducive / peaceful and secure environment	-Linkage with the community -Coordination with County administration
NGO's and Civil society	Public service	Medium	Socio-economic impact on the people and HRBA approach	-Consultation, inclusion and information sharing
National Land Commission	Public service	High	Land acquisition for the LAPSSET corridor if negotiations fail	Involvement of other stakeholders
Kenya Defence Forces	Public service	High	Land acquisition vis-à-vis security of state and the project	High level consultation

(Source: SAI Consulting- RAP Consultations, 2014)

12.2.1 Consultation With County Commissioners

Before start of the field work, the Consultant had meetings with the respective County Commissioners at Lamu and at Garissa. The meetings with the County Commissioner centered on issues regarding:

a) The design concepts of the proposed project and need for land and asset acquisition;
b) The project and its impacts including the PAPs and how they will be compensated;
c) Confirmations and need for participation during the scheduled PAPs consultative meetings

12.2.2 Consultation with Sub-County Commissioners

After meeting the County administration at Lamu and Garissa, the second consultative tier was the respective sub – County commissioners and their Chiefs. The meetings took place at diverse dates between the Months of September 2014 to April 2015 and were held with the aim of informing this second tier of Administrators of the Government intention to develop the road and to seek their co-operation as the Consultants Bridge to the potential PAPs. Awareness creation meetings were held with the administration in order to organize entry into the specific communities.

12.2.3 Consultation with Village / Ward Administration

For the field surveys, the Consultants assembled a committee comprising the Assistant Chief, Two male village elders from the respective villages an elder Woman to accompany the Land Valuer, Assistant Land Valuer and the Socio-Economist in the field. This committee and the Consultants would, while in the field oversee measurements and counting of the various

assets to be affected and conducted through in-depth discussions with each of the PAPs while in the field inspecting the land affected.

12.3 Public Consultation

12.3.1 Awareness Creation Meetings at Sub-County Level

Meetings with potential PAPs were conceived, organized and held in the sub counties. The initial meetings with the PAPs were intended to inform the potential PAPs of the project, that it was to affect their properties and that they were to be compensated for all that was to be affected. Towards this, the Consultants would seek the potential PAPs cooperation while inspecting the land to be affected. Photographs shows some of the community levels meetings.

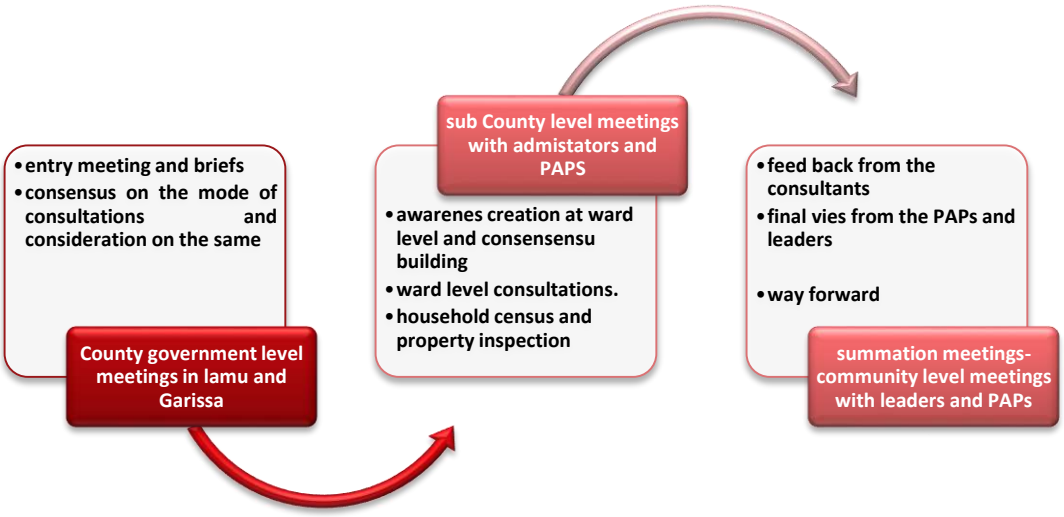
Elders during Meetings in Fafi Sub County in Garissa

Ongoing awareness creation Meetings at KM 0.00 Hindi sub county in Lamu

12.3.2 Ward Level/ Community Level Meetings

The individual household census survey was undertaken with assistance of the ward level committee while still in the field where each PAP's household was involved in the consultation and their concerns on the effects of the project on their assets were addressed. The summary of the consultation process adopted for the proposed project is described in **Figure 12.1**.

Figure 12.1: Summary of the Consultation Process



12.3.3 Consultation Meetings Held and Locations

The consultants in collaboration with the respective leaders organized and facilitated PAPs consultation as shown in **Figure 12.2** below. During the consultations forum, local leaders, faith based organizations and PAPs participated in the discussions. Overall, 481 persons attended the meetings as shown in **Table 12.2** below. During the meetings the RAP study was discussed in details further elaboration on the dynamics was accorded the PAPs and leaders

Figure 12.2 : Consultation Meetings Held and Locations

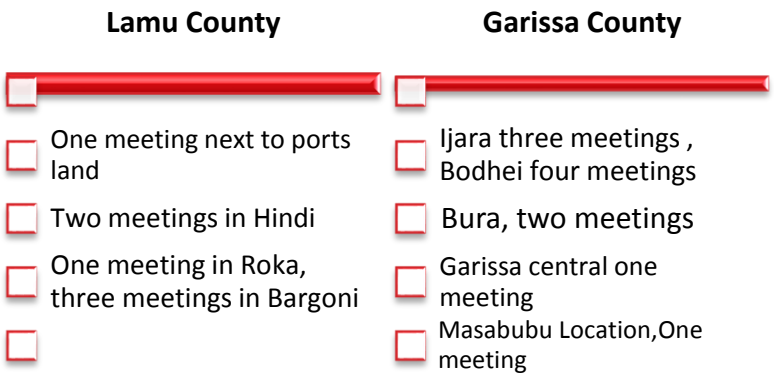


Table 12.2 : Summary of Meetings Attendance

Location	Dates	No. of Persons	Representation	Remarks
Lamu County				
1. **Roka**	23rd September, 2014	114	Chiefs, Ass. Chief, Local leaders, PAPs, FBOs, Sub-County and ward Administrators	The meetings were held in the villages with the support of local administration. In some villages like Bargoni, several meetings were held in order to develop consensus on modes of compensation especially on issues of land.
2. **Bele bele**	23rd September, 2014	8	Chiefs, Ass. Chief, Local leaders ,PAPs, FBOs Sub-County and ward Administrators	
3. **Bobo**	23rd September, 2014	25	Chiefs, Ass. Chief, Local leaders, PAPs FBOs, Sub-County and ward Administrators	
4. **Bargoni**	8th November, 2014	51	Chiefs, Ass. Chief, Local leaders, PAPs, FBOs Sub-County and ward Administrators Chiefs, Ass. Chief, Local leaders ,PAPs, Sub-County and ward Administrators	
5. **Hindi**	7th November, 2014	56	Chiefs, Ass. Chief, Local leaders, PAPs, FBOs Sub-County and ward Administrators	

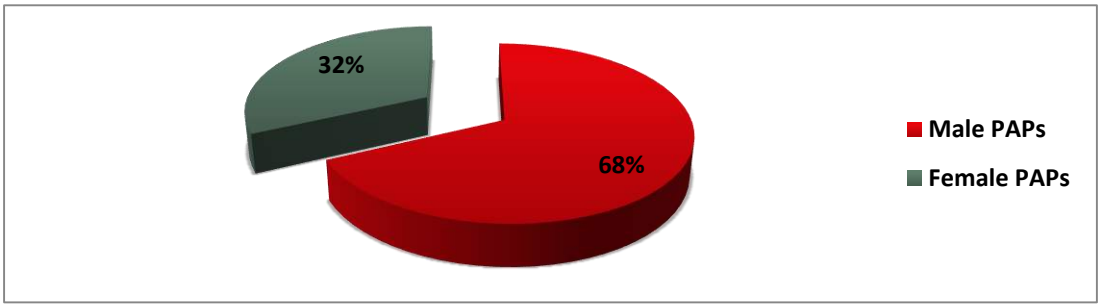
Location	Dates	No. of Persons	Representation	Remarks
Lamu County				
Garissa County				
6. **Ijara**	9th November, 2014	99	Chiefs, Ass. Chief, Local leaders, PAPs, FBOs Sub-County and ward Administrators and community	In Garissa County, Ijara town attendants were from two separate sub locations.
7. **Masabubu**	22nd April,2015	8	Chiefs, Ass. Chief, Local leaders, PAPs, Sub-County and ward Administrators	
8. **Mondika**	23rd April,2015	5	Chiefs, Ass. Chief, Local leaders, PAPs, FBOs Sub-County and ward Administrators	
9. **Bura**	5th September, 2014	44	Chiefs, Ass. Chief, Local leaders, PAPs, FBOs Sub-County and ward Administrators	
10. **Bodhei**	7th November, 2014	71	Chiefs, Ass. Chief, Local leaders, PAPs, FBOs Sub-County and ward Administrators	
11. **Km 0**	20th September, 2014	Over 100 persons	This was a public barazas addressed by the ACC (Mutua, the Principal Chief and the Valuer.	The list of attendants not captured.
Total Attendance		**481**		

Lists of participants of all the meetings is presented in **Annexure 12.1&12.2** of this report.

12.3.4 Project Affected Persons Attendance of Consultative Forums

A total of eighteen (18) Consultative meetings were held with the PAPs between 5th September 2014 to 23rd April 2015. Consultative meetings were attended by a total of 481 PAPs, males representing 68% of the affected 32% of the PAP participants were females, see **Figure 12.3** below.

Figure 12.3 : Gender Representation Among PAPs



12.3.5 Results of Consultative Meetings Conducted in All the Sub-counties

The consultations were designed to elicit stakeholders' views and perceptions on the impacts of the project, create awareness on the project on what the outcomes of the projects can translate to, for the benefits of the communities**.** In all the meetings the potential PAPs and other stakeholders were advised on how the land and the developed assets (houses and trees) were to be measured valued and inventoried, the legal aspects of their eminent displacement, their entitlement to monetary compensation or resettlement with its attendant resettlement assistance, proposed project's implementation structures and their available grievance redress mechanisms.

In all the meetings, the PAPs and other stakeholders contributed freely on their perceptions of the project, they expressed positive and negative aspects of the project and sought the consultants' comments on their many varied concerns regarding the road's impact from construction to its future as an operational infrastructure.

Consultations were gender inclusive, vulnerable groups were also included. See photographs.

Consultation Meeting in Hindi Sub County

During the consultative meetings, the communities aired their views and concerns which are summarized in **Table 12.3** below;

Table 12.3 : Views and Concerns

	Issue of Concern	Remarks
1.	People should be educated on the utilization of the cash derived from compensation for proper allocation of the resources and ensuring maximization of impact at household level.	The aim is to provide the education on the utilization of compensated funds so as to improve the livelihoods and standards of living, and hence realizing eventual poverty reduction
2.	There will be the environmental degradation due to road project where some trees and pasture will be destroyed. Special attention should be paid to replace them.	The environment should be restored as per requirement of EIA Guidelines and Regulations.
3.	There will probably be spread of HIV/AIDS and other sexually transmitted infections due to influx of the people in the region as new opportunities emerge:	The health authorities /contractor should implement HIV/AIDS prevention program. Also, religious leaders have a role in building the moral behaviour amongst the communities. The contractor should conduct relevant awareness seminars and campaigns on HIV/AIDS during construction phase. The recommended approach being awareness creation by testimony

	Issue of Concern	Remarks
4.	Compensation should be done in time not more than six months after valuation of people's properties. The PAPS preferred cash compensation instead of in-kind compensation	To avoid the fluctuation of the price for the properties evaluated, the compensation will be implemented as soon as possible.
5.	County governments in collaboration with national government should engage to assist the PAPs resettling and conflicts management.	The counties have enough reserved lands for those who will be affected. Administration will be included in all grievances resolution committees
6.	During road construction there will dust generated by construction which might affect the health of the people.	The contractor will responsible for sprinkling of water during the construction process as per requirement of ESMP.
7.	Employment (Labourers): The contractor should give the priority of employment to the people hailing from the localities along the project sites during the construction	Employment opportunities should only be provided to those people aged l8 years and above. All guests going to the counties for jobs should be clearly identified. This will reduce the number of crime incidences .also Gender parity needs to be observed through a gender sensitive recruitment policy
8.	It is feared that the tarmac road will claim people's lives through accidents. It was recommended to use speed bumps in the places where there are many pedestrians such as at schools, markets and near mosques/churches.	Road safety education and road signs should be instituted. The construction and operation should be as per requirement of ESMP
9.	Proper consultations and legal methods should be used in acquiring borrow pits and /or stone quarries. Proper reinstatement should be made once the gravel is depleted or developed into water reservoirs where possible.	The recommendation that will be observed is that the Contractor will not allowed to exploit any new borrow pit or quarry site before it has been compensated for. At the end of project the contractor will be required to reinstate such materials source.
10.	The road will guarantee easy accessibility and therefore more physical development and investment opportunities.	This is the main objective of the project
11.	The local people should be involved in the selection of the camp sites. The idea is to use the structures for public services e.g. schools or village offices at the end of the project construction phase.	The campsites should be located in location where at the end of the project construction they will carter for public use like school or dispensary (this is to be agreed in advance with contractor/Employer in advance)
12.	The project will pioneer developments of towns along the route. These towns should be assisted by the government in planning (e.g. land use and plot surveying) in order to curb/cut back/limit/control unplanned growth of settlements.	Guidance on planning by the County governments will be necessary
13.	The residents/ citizen along the route were happy with the project and want the road to commence as soon as possible.	The project should be implemented without unnecessary delays.
14.	The Aweer community's land interests have been side-lined and they have the perception that their interests and rights will not be taken into account.	They have confirmation that procedural safeguards will be scrupulously complied with regard to their 'full and prompt compensation'.

Source: Lamu &Garissa PAPs Field Study, 2014

12.4 Specific Views from the Sub County

12.4.1 Bodhei Location

Every sub County was consulted through local forums at sub County level. The specific views of the people regarding the positive as well as negative effects of the proposed project road is tabulated in the foregoing sections;

Views from Bodhei village/ settlement Bodhei Location- Ijara Sub County

Table 12.4 (a): Positive Effects of the Project-Bodhei Location

Positive Effects
• Easy transportation • Cheaply acquired goods will be accessible • Development of the towns along the highway • Attraction of more people to the area, hence population increase • Good Infrastructure, schools , health facilities as accompanying development • Good communication opening up the area • Networking and interaction among communities

(Source: SAI Consulting- RAP Consultations, 2014)

Table 12.4 (b): Negative Effects and Mitigation Measures-Bodhei Location

Negative Effects	Mitigation Measures
• Diseases like HIV/AIDs Cholera, rift valley fever will spread due to intermingling of people and livestock	• Promote family values through the existing Islamic faith and counseling. Work closely with the livestock and ministry of health
• Conflicts over land will emerge	• Respect of people's land and proper compensation
• Accidents due to the improved road will increase	• Install road signs as appropriate according to road use
• Insecurity might increase due to improved standards and closeness to Somalia	• Coordination between government and community in terms of monitoring security levels
• Sacred grounds like graveyards might be tampered with	• Liaison with Kadhis on the relocation or management of affected grave sites

(Source: SAI Consulting- RAP Consultations, 2014)

12.4.2 Ijara Sub County

Table 12.5(a): Positive Effects of the Project -Ijara Sub County

Positive Effects
• Improved communication • Easy, cheap transportation • Trading will improve • General development of the area will be accelerated • Good interaction of the people • Job creation due to emerging opportunities • Easy access to Health, education services from existing facilities due to ease of transport • Improved agricultural production due to improved markets connection

(Source: SAI Consulting- RAP Consultations, 2014)

Table 12.5 (b) : Negative Effects and Mitigation Measures-Ijara Sub County

Negative Effects	Mitigation Measures
• Accident risk for human and livestock while crossing the road	• Provision of underpass or overpass along the road
• Property destruction	• Compensate owners for property according to the existing policies
• Passage to grazing lands might be obstructed by the new infrastructure	• Provide appropriate passage for animals
• Health- spread of diseases like due interaction and transit population.	• Dispensaries along the corridor and first aid services
• Dumping of waste along the road	• Provide Garbage collection stations/ services along the route and at all stopovers
• Inadequate Compensation for resources used/ affected	• Compensate owners for property according to the existing policies
• Disturbance of wild life habitat	• Minimize interference of the animal habitats
• Competition from well-placed livestock traders	• Consultations with trading groups and empowerment of local traders through provision of commensurate infrastructure like livestock markets

(Source: SAI Consulting- RAP Consultations, 2014)

12.4.3 Fafi Sub County

Table 12.6(a) : Positive Effects of the Project -Fafi Sub County

Positive Effects
• Employment generation • Business improvement, locally and regionally • Improved Communication • Access to better markets for local goods • Improved security • Cheap Fuel due to reduced distances • Direct benefits from farm produce due to expansion of markets • Population increase hence development • Improved national cohesion due to interaction • Improved tourism in the region due to the opening up of the area • Improved service delivery

(Source: SAI Consulting- RAP Consultations, 2014)

Table 12.6 (b) : Negative Effects and Mitigation Measures - Fafi Sub County

Negative Effects	Mitigation Measures
• Increased population leading to strained social amenities	• Develop required infrastructure alongside the road project • Respect of culture / heritage
• Conflicts of interests due to competition	• Consider local tendering of services • Youth employment
• Lack of access to the road	• Provide service roads
• In- migration by job seekers	• Consider locals for employment
• Destruction of wild life habitats	• Train youth for environment surveillance
• Damaging structures manyattas/ dams	• Avoid existing infrastructure and where affected, compensate or develop similar infrastructure

Negative Effects	Mitigation Measures
• Environmental degradation, interference with pasture land	• Regeneration of pasture land beyond the road area
• Health risks due to interaction	• Create awareness on communicable diseases and prevention measures
• Accidents due to speed and unfamiliarity with the new infrastructure	• Create Under paths or over paths and provide roads signs alongside public awareness
• Insecurity due to in-migration	• Security along the project route should be improved by both national and County governments

(Source: SAI Consulting- RAP Consultations, 2014)

12.4.4 Hindi Sub County

Table 12.7(a) : Positive Effects of the Project -Hindi Sub County

Positive Effects
• Communication improvement • Population will increase • Improvement of education • Improved internal roads • Cheap goods, Better services due to competition • Improved health facilities • Market value for land will improve • Business will improve • Standards of living will improve • Employment opportunities

(Source: SAI Consulting- RAP Consultations, 2014)

Table 12.7 (b) : Negative Effects and Mitigation Measures - Hindi Sub County

Negative Effects	Mitigation Measures
• Regional conflicts intensification	• Establishment of green zones
• Pollution due to emissions from heavy traffic	• Health- monitoring on effects on the people
• Destruction of property i.e. houses, wells, trees • Inconvenience for the resettled families	• Cash compensation for the affected families(Hindi Settlement) • Negotiate/ consent on value of property relocation(house, land, trees)
• Accidents	• Provide road signs .i.e. zebra crossing, bumps, flyovers education/ awareness creation
• Noise for those near the road	• Institute noise reduction measures during road construction
• Insecurity/robbery	• Highways patrols by police and lodges inspection
• Environmental destruction- dust	• ESMP should be implemented and monitored
• Spread of diseases like HIV/AIDs	• Equip health facilities and create awareness on health issues that might emerge
• Social facilities will be inadequate due to population increase • Intercultural –interaction	• Expand and equip existing social facilities

(Source: SAI Consulting- RAP Consultations, 2014)

12.4.5 Bargoni Sub-location

Table 12.8 (a) : Positive Effects of the Project -Bargoni Sub County

Positive Effects
• Employment Creation • Easy Transportation • Security Improvement • Trade Improvement • General Development

(Source: SAI Consulting- RAP Consultations, 2014)

Table 12.8 (b) : Negative Effects and Mitigation Measures - Bargoni

Negative Effects	Mitigation Measures
• Accidents along the road	• Provide Zebra crossing as appropriate
• Competition for jobs	• Reserve job quotas for the local people • Employment of women
• Insecurity due to closeness to war zone	• Administrative units, • Police stations
• Diseases. i.e. HIV spread	• Provide Medical centres and create awareness
• Divorce rates increase due to infidelity fuelled by ease of travel	• Family life education will be necessary
• Conflicts at house hold levels	• Physically challenged given support for transportation
• Drug abuse due to ease of access	• Educate the community and create awareness on the dangers of drug abuse
• Reduced water sources due to competing usage	• Develop water infrastructure for the purpose of construction works

(Source: SAI Consulting- RAP Consultations, 2014)

12.4.6 Masabubu & Mondika Locations

Table 12.9(a): Positive Effects of the Project -Masabubu & Mondika Sub County

Positive Effects
• Access to other location will be improvement • improvement of the human settlements • Security improvement in Garissa County • improved access to social facilities

(Source: SAI Consulting- RAP Consultations, 2014)

Table 12.9 (b) : Negative Effects and Mitigation Measures - Masabubu & Mondika

Negative effects	Mitigation Measures
• Accidents along the road	• Provide Zebra crossing as appropriate
• Reduction of the size of the shopping Centre	• Planning of new shopping Centre
• Dusty environment	• Dust mitigation measures to be implemented during construction phase
• Competition in business	• Allocation of business sites by County government
• Traders from Garissa town migrating to the area	• Allocation of business sites by County government
• Conflicts over plots at house hold levels	• Planning and regularizing the ownership of the plots by the County government

(Source: SAI Consulting- RAP Consultations, 2014)

12.5 Specific concerns of PAPs associated with the project

During the field survey, the community members were asked about their views regarding the project. In general people have very positive thinking and good hopes about the project. However, some specifics that were pointed out by the PAPs and that are in congruence with major policies are that;

- **Public Participation and Community participation -** This requires the implementation of the RAP to be carried out with the active participation of PAPs and the local stakeholders and consultation to continue at every stage of implementation of RAP process to assess the effectiveness of implementation.
- **Government Policy on Community Consultation & Participation-**Under guiding values and principles of the Land Act, every public officer must ensure democracy, inclusiveness and participation of the people in matters related to Land. Also, people should participate in determining critical land matters like land acquisition for infrastructure development.

The concerns voiced by the PAPs through public participation were captured in the preparation of the RAP by:

a) A review of the resettlement package on alternative land, initially considered appropriate alternative to payment of monetary compensation

This process captured:

a) The views expressed by the PAPs were factored in preparing the resettlement action plan;

b) A review of the resettlement alternatives presented and the choices made by PAPs regarding options available to them, including choices related to forms of compensation and resettlement assistance to sustaining existing patterns of group organization and to retaining access to cultural property (e.g. grave yards)

c) Institutionalized arrangements by which affected persons can communicate their concerns to project authorities throughout planning and implementation, and measures to ensure that vulnerable groups like indigenous people, ethnic minorities and women are adequately represented.

12.6 Future Consultations and RAP Disclosure

Following the preparation of the RAP, disclosure of the RAP report should be undertaken in the counties and also with the PAPs. This will enhance PAPs and public awareness on the resettlement and compensation processes.

Further consultation and communication with the PAPs should also be undertaken during the RAP implementation process. The proponent should also prepare communication materials on the resettlement and compensation processes, PAPs rights during compensation and resettlement, established grievance redress mechanism, PAPs relocation and resettlement. These should all be communicated to the PAPs to enhance smooth implementation of the RAP.

The involvement of the local community will continue during the implementation of this RAP through public forums, participating in interviews held in the project area and by filling pre-defined questionnaires, discussing pressing issues with the project team consisting of land

valuer, land surveyor, socio-expert and environmental experts. The PAPs will also continue to participate during the project through:

i. Resettlement Committee and PAPCs
ii. Grievance mechanisms for the RAP implementation
iii. RAP monitoring and evaluation events including social surveys and meeting discussions
iv. Progress review by internal and external auditors
v. Awareness creation and training with other community members

Several stakeholders and community public meetings should be held in the project area and the proponent present to the community details of the RAP status as well as monitoring findings including possible impacts and recommendations.

12.7 Factors for Successful RAP Implementation

For the successful implementation of the RAP the following should be considered:

- Working closely with the stakeholders to identify the most vulnerable, least visible, and voiceless for whom special consultation efforts can be made
- Identifying contentious issues and forces behind them so as to find mechanisms for creating harmony
- Program or schedule of disclosure at various stages of the project and identifying methods to be used, agenda, budget, and plan for consultation activities.
- Informing the County government, ward leaders, local community organizations of the plan for the project for community awareness creation
- Setting eligibility cut off and informing local administration machinery to discourage construction or approval of construction of new buildings or capital improvements of the areas affected by the project
- Resettlement program regular updates

The AfDB Bank policy on involuntary resettlement stipulates that resettlement information be accessible and understandable. Therefore all communication will be translated into Kiswahili or broadcasted in the media accessible to both illiterate and literate (local radio stations, television, public notice boards, leaflets, newspapers, fliers, posters in both local and Kiswahili languages).

Chapter 13

Environmental and Social Management Plan (ESMP)

TABLE OF CONTENTS

13. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

13.1 Introduction

The project specific Environment Management plan has been formulated with an aim to avoid, reduce, mitigate, or compensate for adverse environmental impacts/risks. This includes (i) mitigation of potentially adverse impacts (ii) monitoring of impacts and mitigation measures during project implementation and operation (iii) integration of ESMP with Project planning, design, construction and operation.

13.2 Scope of the Management Plan

The scope of this environmental and social management plan (ESMP) is to give guidelines to all parties involved during construction, maintenance and utilization of the road in fulfillment of environmental and social requirements. The management plan has a long-term objective to ensure that:

(i) Environmental management conditions and requirements are implemented during the construction and post-construction period;
(ii) The social interests of the stakeholders are considered throughout the construction and post commissioning phases of the roads;
(iii) Maximum economic benefits to the project road corridors and the whole country; and
(iv) Precautions against damages to environment, biological diversity and sensitive habitats (where present).

13.3 Responsibilities

The responsibility for the incorporation of mitigation measures for the construction works lies with the Design Engineer.

The Supervising Engineer must ensure that the Contractor implements all specified mitigation measures.

In order for the Contractor to carry out environmental management activities during construction, the Contractor should draw up an environmental management plan of his own to show how he will address the mitigation measures during the construction period. The Supervising Engineer is responsible for assessing the Contractor's environmental management plan.

The KeNHA, Design and Construction Department will have to oversee the Supervising Engineer to confirm that mitigation is being implemented in the correct manner. KeNHA has set up an Environmental and Social Interests Unit under Planning and Environment Department whose responsibility is to ensure that monitoring does take place, and in addition oversee environmental compliance and mitigation in all road related activities.

13.4 Environmental Monitoring Plan

Environmental monitoring allows measures to be implemented in order to prevent or avert negative impacts. Simple monitoring systems should be set up during construction by the Supervising Engineer and Contractor and during operation so that potentially environmentally problematic areas can be detected well in advance and the appropriate remedial action taken. This could simply be a checklist of items that need to be inspected as a matter of routine, or

periodically, depending on the nature of the aspect. The types of parameters that can be monitored may include mitigation measures or design features, or actual impacts. In some cases, such as drainage structures and soil conservation interventions monitoring is fairly straightforward and can be done as part of routine or periodic maintenance. However, other parameters, particularly those related to socio-economic and ecological issues can only be effectively assessed over a more prolonged period of say 3 to 5 years.

13.5 Stages in ESMP

The ESMP refers to all implemental tasks at different stages of project, namely,

13.5.1 Construction Phase Environmental & Social Management Plan

The necessary objectives, activities, mitigation measures, and allocation of costs and responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts and maximization of positive impacts associated with the construction phase of the proposed project are outlined in Table 13-1 below.

13.5.2 Operational Phase Environmental & Social Management Plan

The necessary objectives, activities, mitigation measures, and allocation of costs and responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts and maximization of positive impacts associated with the operational phase of the road project are outlined in Table 13-1 below.

13.5.3 Decommissioning Phase Environmental & Social Management Plan

In addition to the mitigation measures provided in previous chapters, it is necessary to outline some basic mitigation measures that will be required to be undertaken once all operational activities of the project have ceased. However, it is envisaged that the road services will be always provided. The necessary objectives, mitigation measures, allocation of responsibilities, and costs pertaining to prevention and minimization of all potential impacts associated with the decommissioning and closure phase of the project are outlined in **Table 13.1** below.

Table 13.1 below summarizes the environmental management plan for the project road. It describes parameters that can be monitored, and suggests how monitoring should be done, how frequently, and who should be responsible for monitoring and action. The costs for the various mitigation measures are likewise presented in this section. It will be noted that many of the costs (for example those for drainage structures) will be included in the BoQ for the design. Other issues such as sensitization of the workforce or the public, and management issues can be done at negligible cost. Also include are measures that can be incorporated into the tender documents and Bill of Quantities.

Table 13.1 : The Proposed Environmental and Social Management Plan

a) ESMP - Construction Phase

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
1	Air quality	✓ Ensure deviations and dry materials are kept damp at all times ✓ Materials extraction under damp conditions ✓ Establish information flow process to the communities on dusty conditions ✓ Material delivery trucks to comply with established emission standards ✓ Control speed of construction vehicles ✓ Prohibit idling of vehicles ✓ Sensitize workforce ✓ To avoid toxic fumes, residences should be at least 500 m from windward side of asphalt mixing sites ✓ Water should be sprayed during the construction phase on excavated areas, deviations routes, and temporary access roads leading to borrow pits, and asphalt mixing sites ✓ In filling sub-grade water spraying is needed to moisten the material and to assist in compaction. After compaction, water spraying should be regular to prevent dust ✓ Regular maintenance of plant and equipment ✓ Impose speed limits for all vehicles, especially at the trading centres and busy junctions ✓ Sensitize motorists/road users ✓ Undertake sampling for air quality at in pre-identified locations every 6 months	✓ Contractor(s) ✓ Resident Engineer	4,000,000
2	Changes in hydrology/ Drainage; and Use of water resources	✓ Install proper drainage structures ✓ Ensure efficiency of drainage structures ✓ Consult local residents in siting of boreholes ✓ Proper and management of water usage ✓ Plan for harvesting and storage of water during rains by construction of water pans for use later ✓ Plan works schedule according to water availability ✓ Abstraction from rivers and streams are not to be done during low flow ✓ Ensure valid permits on construction water abstraction ✓ Groundwater abstraction be on permits conditions (locations to be identified ✓ Ensure the public at target water sources gets priority	✓ Design Engineer ✓ Resident Engineer ✓ Contractor	10,000,000

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
3	Soil erosion	✓ Control earthworks ✓ Install proper drainage structures ✓ Install soil erosion control measures ✓ Landscape embankments and re-vegetate gravel sites ✓ Plant shrubs and trees along the road and on approach to towns (e.g. *Acacia* trees that occur locally in the area) ✓ Proper management of excavation activities ✓ Damaged drainage systems should be rebuilt or rehabilitated by suitable methods	✓ Resident Engineer ✓ Contractor	3,000,000
4	Material sites	✓ Inform people living at/near the sites that the pits have been selected for exploitation. ✓ Plan access to gravel sites ✓ Control and restrict access to gravel sites (e.g. by fencing) ✓ Control earthworks ✓ Proper management of excavation activities ✓ Rehabilitate (Landscape, water pans, terracing, and grass sites) old and new gravel pits.	✓ Contractor	9,000,000
5	Vegetation cover degradation	✓ Controlled clearing – avoid unnecessary clearing of vegetation ✓ Replant areas where vegetation is unnecessarily removed ✓ Landscaping and planting all disturbed areas (pits, deviations, embankments, camp sites) ✓ Plant shrubs and trees along road and on approach to towns (e.g. *Acacia* trees that occur locally in the area) ✓ Re-vegetation to be done just before the rains Care for planted trees/other plants	✓ Contractor ✓ Resident Engineer	3,000,000
5	Noise pollution	✓ Sensitize workforce ✓ Supervise construction traffic ✓ Sensitize drivers of construction vehicles ✓ Maintain plant and equipment ✓ Workers in the vicinity of high level noises to wear safety & protective gear ✓ Impose speed limits for all vehicles, especially at the towns and settlements	✓ Contractor ✓ Resident Engineer ✓ Traffic Police	To be covered under planning and administration costs of the Contractor

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
6	Garbage or Solid Wastes	✓ Garbage will be disposed-off periodically from labour camps ✓ Sufficient measures will be taken in the construction camps i.e. provision of garbage bins and sanitation facilities. If septic tanks are installed, waste will be cleared periodically ✓ The Contractor to develop waste management plans and provide appropriate facilities for their operations ✓ Prepare signed agreements with landowners where spoil earth is to be disposed indicating conditions and responsibilities for restoration and management, ✓ The spoil disposal sites should be approved by NEMA before dumping commence ✓ Consider re-use of used/waste asphalt concrete for public access roads in the neighbouring urban areas	✓ Contractor ✓ Resident Engineer	5,000,000
7	Land use changes	✓ Monitor emerging land use trends along the road during construction in liaison with planning department of the county governments of Lamu and Garissa ✓ Land use planning and zoning to commence during the construction phase and enforced immediately ✓ KeNHA to encourage the local authorities on the provisions of social amenities along the corridor in light of changing social and economic development	✓ KeNHA ✓ County Governments (Lamu and Garissa) ✓ Planning Department	This is an administrative aspect and no direct costs are anticipated on this item
8	Health (Public health and occupational safety) and Safety HIV/AIDS	✓ Special attention shall be paid to the sanitary conditions of camps ✓ Sensitization campaign on STDs &HIV/AIDS will be mandatory at the camps and in the community ✓ Preventives measures like use of condoms, voluntary testing for HIV/AIDS ✓ Provide safety programmes for material sites and working areas including emergency response mechanisms ✓ Awareness, prevention and training on HIV/AIDS and other social diseases such as TB ✓ Provide wellness centres at: • The construction camp sites • Adoption of pre-identified health centres within the road corridor ✓ Provide group medical insurance and Personal Protective Equipment (PPEs) for the construction workers ✓ Provide police security to the Contractor	✓ Resident Engineer ✓ Contractor ✓ Police	3,500,000 1,500,000

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
9	Road safety	✓ Install warning signs and speed bumps on approach to towns and settlements ✓ Appropriate information and warning signs shall be provided along all the deviation roads for enhanced safety ✓ Enforce vehicular speed limits ✓ Monitor road accidents ✓ Enforcement of Traffic Act	✓ Resident Engineer ✓ Contractor ✓ Traffic Police	2, 00,000
10	Socio-economic/Resettlement Action Plan ✓ The estimates for the resettlement action plan (RAP) will cover land acquisition, restoration of livelihoods and other negative impacts arising within the community as a result of the road project. the cost is calculated based on the valuation of the impacted assets and structures, and break up of the same cost is presented in Chapter-14 of Volume VIII RAP Report.	✓ Enhance collaboration with communities on construction activities affecting them through established Community Liaison Committees ✓ Provide deviations and accesses to affected premises during construction throughout the corridor ✓ The Contractor to establish and manage environmental and social initiatives to oversee mitigation measures developed under this report ✓ Ensure effective signage and information to road users, especially on deviations and construction sections with obstacles ✓ Provide safe crossings and walkways during the construction works backed up with appropriate signage ✓ Provision for community improvement services under social responsibility including health, education, water supply, sanitation, access roads, etc. ✓ The Contractor to prepare and consult on an employment plan and implement in accordance to Kenyan labour law ✓ At least 60% of employment (casuals) to involve the local population, especially the youth and women ✓ Follow-up on the implementation of RAP	✓ Contractor ✓ Resident Engineer ✓ KeNHA – CSR (corporate social responsibility) ✓ Contractor – CSR (corporate social responsibility) ✓ Property Owners, Traders and residents	593,401,883
11	Water pollution	✓ Solid waste at construction camps, and equipment maintenance workshops should not be dumped in or near any water bodies (rivers, streams, etc.) along the project road or area of influence	✓ Resident Engineer ✓ Contractor	To be covered under planning and

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
		✓ Proper handling, storage and disposal of oil and oil wastes ✓ Proper disposal of wastewater / sewage at Contractor's/ workmen's camps ✓ Maintenance and repair of construction vehicles/plants should be carried out at dedicated areas at the Contractor's camp		administration costs of the Contractor
12	Oil pollution	✓ Proper handling, storage and disposal of oil and oil wastes ✓ Maintain plant and equipment ✓ Maintenance and repair of construction vehicles/plants should be carried out at dedicated areas at the Contractor's camp	✓ Resident Engineer ✓ Contractor	To be covered under planning and administrative costs of the Contractor
13	Wildfires	✓ Install warning signs along the road not light fires near bushes as this could result in wild fires	✓ Resident Engineer ✓ Contractor	To be covered under planning and administrative costs of the Contractor

b) ESMP Post-Construction Phase

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
1	General environmental pollution	In order to comply with established environmental standards including waste management regulations: ✓ Provide public waste receptacles at strategic locations along the route (bus stops, foot bridge landings and crossing areas) ✓ Introduce clean-up responsibilities and charges for the road users (e.g. spills from accident vehicle owners) to reduce road related environmental pollutants and visual nuisance ✓ Drainage channels to be kept clear at all times to prevent overloading with polluting materials. ✓ Drainage outfalls are to be acquired and kept free of encroachments ✓ KeNHA to consider developing and enforce vehicular emission regulations in consultations with NEMA	✓ KeNHA ✓ County Governments ✓ Traffic Police	No direct costs are anticipated (this is part of the road administration).
2	Road safety ✓Increased road accidents ✓General security aspects	✓ Establish road safety strategies for the road complete with sensitization programmes for the road users including motorists, pedestrian, etc. ✓ Provide parking bays for heavy goods vehicles and public transport vehicles	✓ KeNHA ✓ Traffic Police Department	No direct costs are anticipated (this is

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
	✓Road safety issues ✓Vandalism of safety installations	✓ Liaise with the Traffic Police on ways to ensure compliance with road regulations ✓ Ensure maintenance of signage, crossings, speed breaks and other facilities at all times (in view of the current challenge of vandalism of road safety installations in the country) ✓ Maintain non-motorised transport (NMT) facilities (overpasses, underpasses and crossing rumps at all times) ✓ Involve community leaders and administration in ensuring usage and sustainable utilization of NMT provisions for public safety	✓ County Governments	part of the road administration).
3	Health ✓ Cases of HIV/AIDS and other social diseases, ✓ Dust associated infections ✓ Noise and vibrations	✓ Enhance initiatives for information and awareness as part of the road displays ✓ Organize and implement HIV/AIDS Awareness programmes along the road corridor in liaison with relevant authorities (make it a long term initiative) ✓ Maintain on corporate social responsibility (CSR) basis the wellness centres (including the VCT Services and ARVs) located within the truck parking yards and improved public health centres for long term benefits to the communities. ✓ Introduce vegetation cover (trees and shrubs) along the road reserve as noise buffer to the immediate premises close to the road ✓ Influence land use practices and building characteristics along the road for low noise conflicts (orientation, design considerations, distance from the road) ✓ Influence County Governments policy on land use planning along the corridor with among others annuals noise monitoring to influence land use practices ✓ Sensitize motorists/road users	✓ KeNHA ✓ NEMA ✓ Land Use Planning divisions within County Governments	Part of the road administration
4	Social Aspects ✓ Increased population ✓ Higher traffic volumes ✓ Road safety issues	✓ Collaboration with Land Use Planning departments of the County Governments to influence collaborated land use zoning ✓ Maintain in collaboration with the County Governments social facilities within the corridor including bus bays, sanitation, waste bins, roadside drains, etc. ✓ Consider collaborated emergency response facilities within proximity of the road. The wellness centres proposed earlier are appropriate for this purpose ✓ Encourage landowners close to maintain road reserve sections in front of their premises, including beautification, drainage maintenance and vegetation clearance. This will enhance ownership and responsible use of the road	✓ KeNHA ✓ County Governments ✓ Local community small scale traders	Part of the road administration

Sr. No.	Type of Impact	Management Actions and Target Areas	Responsibility	Estimated Costs (KES)
5	Economic Aspects ✓ Land use changes due to efficient transport ✓ Mixed economic activities (general trading, industrial, institutional, etc.) ✓ Involve local youth on road maintenance to enhance income and ownership	✓ Collaborations for sustainable social and economic development ✓ Maintain truck parking yards on drainage, water supply, waste collection and lighting/security ✓ Enhance income generation opportunities for the County Governments and the local communities	✓ KeNHA ✓ County Governments ✓ Local community small scale traders	Part of the road administration
6	Road Maintenance: ✓ Blockage of drainage and hindrance to free storm water flow ✓ Accumulating roadside litter collection ✓ Effects on road safety from inadequate facilities and signage maintenance ✓ Encroachment into the road reserve ✓ Illegal roadside land development practices	✓ Establish modalities for the involvement of the residents in the maintenance of the road ✓ Install and maintain appropriate road signs ✓ Collaborate on the control of roadside billboards that are a safety risks ✓ Maintain trash bins at strategic locations along the roads including bus stops, foot bridge landings, under pass exits	✓ KeNHA ✓ County Governments	Costs within the road maintenance budgetary allocations

c) ESMP Decommissioning Phase

Sr. No.	Type of Impact	Management Action and Target Areas	Responsibility	Estimated Costs (KES)
1	Decommissioning of Construction Installations ✓ Removal of construction camps ✓ Rehabilitation of material sites ✓ Materials batching yards ✓ Construction equipment removals ✓ Clean up-up at fuelling yards ✓ Removal of the road pavement	✓ Carry out decommissioning audits for the camp sites and seek approval of the decommissioning plans from NEMA ✓ Prepare and submit for approval by NEMA the rehabilitation and restoration plans for all materials sites used for the project (quarry sites, borrow pits and spoil dumping areas) ✓ Rehabilitate all material sites and materials preparation yards in accordance with the approved rehabilitation plans	✓ Contractor ✓ Resident Engineer ✓ KeNHA	About 6,500,000 on decommissioning audits studies and development of decommissioning plans
2	Decommissioning of road: ✓ (Any decommissioning of the road section or its components should be preceded by preparation of removal plan)	✓ Undertake a decommissioning audits of part, sections or entire road and establish appropriate measures for prevention of environmental pollution and public safety risks ✓ Apply established decommissioning plan for the removal of part of all sections of the road	✓ KeNHA ✓ Contractor ✓ NEMA for surveillance	No direct cost estimates at this stage

Chapter 14

Institutional Capacities and Strengthening Plan

TABLE OF CONTENTS

14. INSTITUTIONAL CAPACITIES AND STRENGTHENING PLAN

14.1 General Overview

Precautions to ensure that damages to the environment are minimized calls for a concerted effort from the Project Management, Contractor and all Stakeholders. The Resident Engineer is expected to discuss and convey the contents of the Environmental and Social Management Plan, recommended mitigation/interventions outlined under the impacts, instructions from National Environment Management Authority (NEMA) as well as the wishes of the affected stakeholders to the Contractor and construction workers for integration in the construction process. The local NEMA Offices will also be involved in order to take advantage of the valuable information on the environmental trends in the area.

Some stakeholders might find the road construction period an inconvenience to their daily activities and safety, but the long term benefits from the road project are many. In this regard, they will need to be involved in the project monitoring framework through good relations between the Contractor and the stakeholders and through timely information on the construction schedules, duration of construction works, potential interference with their daily activities and other issues that may arise. This will also help in resolving problems related to construction and prevention of possible social conflicts associated with the project. Communication channels should always be open to ensure proper and timely responses to any complaints that may arise from the road project.

Specific responsibilities will be apportioned as follows:

14.2 LAPSSET Corridor Development Authority

The Lamu Port Southern Sudan Transport Development Authority that will manage the project on behalf of the Kenyan government.

14.2.1 Mandate of LAPSSET Corridor Development Authority

In March 2013, the LAPSSET Corridor Development Authority (LCDA) was established through the Presidential Order Kenya Gazette Supplement No. 51, Legal Notice No. 58, the LAPSSET Corridor Development Authority Order 2013 to plan, coordinate and manage the implementation of the Lamu Port-South Sudan-Ethiopia Transport Corridor Project. The functions of the Authority are as follows:

1) Plan, coordinate and sequence LAPSSET Corridor projects in collaboration with implementing ministries and agencies;
2) Coordinate implementation of LAPSSET Corridor projects across implementing ministries and agencies;
3) Provide leadership, direction and guidance in operations and implementation of the LAPSSET Corridor;
4) Ensure implementation of all decisions and resolutions of the government;
5) Mobilise funds to project components using a variety of resources including budgetary resources from government, donor loans, infrastructure bonds and private finance;
6) In collaboration with National and County government department, build the capacity of LAPSSET Corridor towns to manage urban growth resulting from LAPSSET Corridor investments;
7) Promote the competitiveness and use of the LAPSSET Corridor for the transport of goods and people; and

8) Provide a forum for all stakeholders of the LAPSSET Corridor.

The LAPSSET Corridor Development Authority is the policy, implementation, operational coordination and technical oversight organ for the LAPSSET Corridor Project. The LAPSSET Corridor Development Authority has the inter-ministerial coordination committees composed of relevant ministries.

14.3 KeNHA Responsibility

KeNHA is one of the established road authorities in Kenya. The Authority has a role of management, development, rehabilitation and the maintenance of the National roads. Enactment of the Kenya Roads Act, 2007 shows Kenya National Highways Authority as one of the road agencies and gives its main responsibilities on the highway roads. Part II section 4 of the Act states the functions of the authority which includes:

(i) Constructing, upgrading, rehabilitating and maintaining roads under its control,
(ii) Controlling the national roads and road reserves and access to the road side development,
(iii) Implementation of the road policies in relation to the national roads,
(iv) Ensuring adherence to the roles and guidelines on the axle load control prescribed under the traffic act (Cap. 403) and under any regulations under these act ensuring roads quality as prescribed by the minister,
(v) Monitoring and evaluating the use of national roads, and
(vi) Liaising and coordinating with other road authorities in planning and operation with respect to roads.

KeNHA as the entity in charge of all national roads network in Kenya has a long experience on such road projects and has a well-staffed environmental unit to oversee a complex ESMP. The Environmental and Social Interests Unit (Environmental and Social Division) at KeNHA will facilitate compliance of road projects with environmental regulations. The office will advise on the projects on compliance and is also a direct liaison with NEMA. Any projects concerns will be channelled through this office directly or through the supervisor. NEMA (or any other concerned environmental stakeholder) is expected to address the project related issues through the same office. The office, therefore, is expected to be well informed of all project related issues at all times. KeNHA and the Environment Division specifically will be represented on the ground by the Supervision for the day to day operations and engagements. However, the office will be expected to have a direct representation during monthly progress/site meetings and other consultative forums.

14.4 NEMA Functions

The government established the National Environmental Management Authority (NEMA) as the supreme regulatory and advisory body on environmental management in Kenya under EMCA 1999. NEMA is charged with the responsibility of coordinating and supervising the various environmental management activities being undertaken by other statutory organs. NEMA also ensures that environmental management is integrated into development policies, programmes, plans and projects.

14.5 Project Implementation Responsibilities

KeNHA has a project implementation structure that has clear provisions for environmental and social streamlining and integration. An ideal structural works has the following components:

14.5.1 Contractor

The Contractor is required to establish an environmental office to continuously advise on environmental components of the project implementation. Elements in the environmental and social management plan are expected to be integrated into the project with appropriate consultations with KeNHA through the supervising environmental expert. The environmental officer of the Contractor is also expected to fully understand the engineering and management aspects of the project for effective coordination of relevant issues. In addition, the Contractor is also expected to bring on board a Sociologist or a liaison officer to provide a communication link with the communities and other stakeholders. However, the Project Manager and the Operations Manager will require to be informed on the environmental and social status for ease of facilitation.

14.5.2 Project Supervisor

The Supervisor is engaged by KeNHA (as the project client) to ensure effective implementation of the environmental management plan. It is expected that the Supervisor will engage the services of an environmental expert who should in return understand the details of the environmental recommendations and especially the proposed action plans, timeframes and expected targets of the management plan. The Supervisor will be the liaison person between the Contractor and KeNHA on the implementation of environmental concerns as well as issues of social nature associated with the project. The Supervisor (through the Resident Engineer) will also ensure social expert inputs and support in addressing emerging concerns from the communities and the stakeholders including:

(i) Complaints on environmental pollution, safety, noise, water uses, etc.,
(ii) Land acquisition issues,
(iii) Employment and recruitment process,
(iv) Cultural interactions, and
(v) Security aspects.

14.5.3 Community Liaison Committees

Affected communities living along the road corridor should be asked to form Project Liaison Committees to collaborate with the Project Management (through the liaison office) on issues of concern to the people. The Committees to be established under the County Commissioners' office (through the Assistant County Commissioners and the Areas Chiefs) in both counties will provide the administrative support for the Committees. Members of the Committees should be drawn from a cross action of the community such as to include local leaders (village elders), landowners, institutions, business people, vulnerable groups, youth, etc. The Committee will comprise of a Chair and a Secretary and will be open a file with the Resident Engineer and the Contractor. Main focus of the Committee will be on issues touching on:

(i) Land acquisition issues,
(ii) Employment and recruitment process,
(iii) Health and safety,
(iv) Pressure on resources and amenities,

(v) Environmental quality including noise and air quality, and
(vi) Access passages and drainage channels blockages.

These Committees will need to be established and trained in community matters and development issues.

14.6 Resettlement Committee

KeNHA as the project proponent will set-up the Resettlement Committee jointly with the County Governments of Lamu and Garissa to oversee the implementation of the RAP. This will entail verifying the details of the PAPs and facilitating the payment of compensation or assistance benefits. The Committee will mobilize the PAPs and keep them informed of the various stages of the project implementation. The Committee will also create awareness among the communities living along the road corridor.

The proposed members of the resettlement committee are listed in **Table 14.1** below.

Table 14.1: Members of Resettlement Committee

Sr. No.	Organization	Appointing Office/ Authority	Number of Appointees
1	Kenya National Highways Authority	Director General	1
2	County Governments of Lamu and Garissa	County Chief officer, land and/or infrastructure	1
		County Director Social Services	1
		Director County planning	1
3	Administration	County Commissioner	1
4	National land commission	Chairman County Land Management board	1
5	Community Based Organization	Chief Officer of one Identified Organization	1
6	Representatives of PAPs	Representatives elected by PAPs by location including vulnerable groups	2
Total			**10**

14.7 Grievance Redress committee

In order to deal with the grievances that may arise during the implementation of RAP, there is need to incorporate a grievance redress process within the RC. The grievance redress process will be carried out by a sub-committee within RC which will hear the complaints and provide solutions, and reduce unnecessary formal litigation by resolving disputes through mediation.

The membership of the GRC will be comprised of:

- A representative of the PAPs;
- NGO at different levels.
- Local leaders

14.8 Capacity Building and Training

It is recommended that capacity building on Environmental Management and Monitoring be integrated as part of this project. The capacity building programmes for the project should include:

- Programmes to train the project engineers and proponent in the process of the EIA, to enable them participate fully in the implementation of the EMP; and
- Programmes to enhance transport management.

There is also need for the management to be trained on the following aspects to enable them run the road project appropriately;

- Organizational practices;
- Project management;
- Public awareness and community education especially on HIV/AIDs and other related social impacts;
- Financial management
- Operation and maintenance of road infrastructure.

Chapter 15

Conclusions

TABLE OF CONTENTS

15. CONCLUSIONS

The Government of Kenya (GoK), through the Kenya National Highways Authority (KeNHA) has proposed a completely new road to link the proposed Lamu Port and Garissa. The proposed road is a component of the Lamu Port-Southern Sudan-Ethiopia Transport (LAPSSET) Corridor, flagship project under the Kenya Vision 2030 programme which is the key government development initiative aimed at transforming Kenya into an industrialized nation by the year 2030.

To accelerate economic development and to increase trade and accessibility between neighbouring countries of South Sudan and Ethiopia, the Kenyan government proposed a dream project called **Lamu Port Southern Sudan Ethiopia Transport (LAPSSET) Corridor** project, which is a part of **"Kenya's Vision 2030".** This flagship project will stimulate economic activities in the northern and eastern part of Kenya.

Main aim of the LAPSSET Corridor is to integrate the transportation system and land use pattern in order to optimally utilize the potential of the three countries being served by the Corridor and to assess the way the transportation corridor can effectively be used to encourage growth in the three countries. The appropriate strategy would be to develop linkages between the transportation corridor to expand tourism potential; the regional development potential, other business potentials; and the urban networks as structured nodes of growth through concentrated services and infrastructure.

While appreciating the benefits and positive impact associated with the project, there are negative impacts that need to be addressed and mitigated during the construction and post-construction phases. For this reason, a comprehensive environmental and social impact assessment (ESIA) study will be necessary. Equally important will be a comprehensive resettlement action plan (RAP) considering the extent of potential displacements and disruptions along the corridor during the construction.

The ultimate goal of this ESIA study was to identify impacts resulting from the proposed project that were determined on the basis of the baseline conditions to be established during the field work and information obtained from the documents reviewed. The environmental and social impact assessment study process was designed to provide a view of the environmental and social status and establishment of the diversity on physical environment, social and ecological status in the area.

This study has found that there will be both positive and negative impacts on the environment from the project. Many are short term and can be mitigated. Among the notable impacts anticipated from the construction of the proposed road will be:

15.1 Negative Impacts on the Environment

Change In Hydrology: as a result of excavations and limited rerouting of surface runoff at different locations causing changes to micro-hydrological regimes and siltation and oil pollution may affect wetlands. Where culverts, drains and retention ditches are required, sediment loads in the rivers and streams will increase as a result of construction debris and excavation works.

Soil Erosion: is likely to occur due to: construction activities will loosen soils, particularly on the slopes that could then be washed down into the lower areas; topsoil (spoil) removed from the road construction requires offsite-dumping sites; earthworks during construction

and along steep sections will result in soil erosion, which is unavoidable; Improper drainage of runoff from the road to lower catchments; surface runoff from the upper parts of the finished road reserve could increase the hydraulic loading on the lower lands and clearing of vegetation for the upgrading works, and excavating of material from gravel pits.

Dust and Noise: Gravel material sites have identified and have been evaluated with a view of using them for the construction of the sub base and base layers either in their neat or chemically improved condition. Dust and noise during excavation and quarrying will therefore occur. However, much of the area is sparsely populated and the number of homesteads that may be affected is very small.

Exhaust and Engine Emissions: From vehicles cause air pollution, which can have an impact on public health, as well as soils, crops and water supplies.

Waste Oils and Debris: During construction and operation, wastes oils may become an issue if oil is carelessly stored, handled, or drained from construction vehicles and equipment. Oil wastes however will have a long-term impact. Debris from the construction of culverts and deviations will increase temporarily and during operation, noise and oil waste pollution will affect settlements/households along the road.

Bitumen Residuals and Machine Repair Parts Construction materials holding and preparation sites with waste oils; bitumen residuals, and machine repair parts may infiltrate into water sources, land and air.

Animals and birds will be disturbed by the clearing activities and their homes/nesting sites may be interfered with. Noise and dust pollution will occur during construction activities. The project road is to be designed for a speed of 120 km/h. It is likely that the safety of animals and people may be compromised. This may therefore cause accidents.

Clearing of vegetation will be necessary for the carriageway, extension of the road reserve, and deviations if any.

15.2 Negative Social Impacts and their Mitigation Measures

To mitigate the above listed negative impacts it is suggested that the following measures be put in place.

General Development*:* Roads are very rough and dilapidated which should be repaired and establish good airstrips in the area. Employment in the Project should be based in quota system to avoid community marginalization. To enhance the development community awareness should be stepped up.

Land Tenure and Land Use: People should be fairly compensated for the land to be occupied by the road project. Destruction of properties along the corridor should be minimized by realigning the route to areas that are not densely populated. Further there should be proper planning to avoid up-hazard development in the counties.

Increase in insecurity: National and County Governments to step up on security matter and involve the community in policing as well as institutionalizing community policing, the concept and aspects of "***Nyumba Kumi***".

Transmitting of Communicable Diseases: The responsible government authority to draw action plans on how to create awareness among the community and impart knowledge in behavioural change.

Cultural Heritage: There is no cultural asset that is affected apart from some grave at Ijara – maybe reformulate. However, during road construction, any local cultural heritage and artefacts that may be found should collected and stored at the Kenya National Museum for future generation.

Traffic Accidents: Identify all areas of black spot and put and mark the road as warning to the drivers, passengers and pedestrians.

Settlements and Housing*:* To improve on non-collection of garbage and refuse there should be plans to construct toilets and collection of solid waste along the corridor as accompanying infrastructure. In addition settlement schemes should be properly planned.

15.3 Recommendation

This Project is feasible with a perspective of social economic evaluation, financial evaluation and environmental assessment, which has stable economic benefit and strong anti-risk capacity. Therefore, the project is necessary, and should be implemented as soon as possible. Given the magnitude and complexity of the project, a comprehensive Environmental Management Plan (EMP) has been developed of which the proponent will implement to ensure minimal damage to the environment. Key issues that are conditional to full realization of the goals of the project is to ensure a professional Resettlement Action Plan is prepared and implemented fully and alternative urban and rural livelihood strategies are initiated for affected people along the route. We therefore, recommend for the project for NEMA approval because of its enormous contribution to achievements of Vision 2030 goals.

APPENDIX 1: LIST OF PROFESSIONALS/ORGANIZATIONS WHO CONTRIBUTED TO THE PREPARATION OF THE ESIA REPORT

1) Jenesio I. Kinyamario - Lead EIA Expert (NEMA Reg. No. 134), Environmentalist and Ecologist
2) Erastus Kanga - Biodiversity & Wildlife Expert, Kenya Wildlife Service
3) Jacob Kithinji - Environmental Chemist, University of Nairobi
4) Charity Gathuthi - Social/Gender Specialist
5) Partha Aich - Highway Engineer
6) A. M. Kihara - Materials Engineer
7) D. Gichuki - Senior Surveyor
8) R.K. Verma - Drainage/Structural Engineer
9) Francis Mureitthi - Hydrologist
10) S. Mishra- Hydrologist
11) D. Chatterji - Transport Economist
12) L. W. Muchiri - Senior Land Economist/Valuer

APPENDIX 2: REFERENCES

1. AfDB. 2009. Checklist for Gender Mainstreaming in the Infrastructure Sector.
2. AfBD. 2013. African Development Bank's Integrated Safeguards System
3. DRSRS. 2006. Policy Statement and Operational Safeguards. District land cover atlas: Aggregated land-cover maps and statistics for Kenya. Technical Report No. 160. Department of Resource Surveys and Remote Sensing. Ministry of Environment and Natural Resources, Nairobi.
4. FAO. 2000. Land-cover classification system (LCCS): Classification concepts and user manual. Food and Agriculture Organization of the United Nations, Rome.
5. GoK. 2010. 2009 Kenya Population and Housing Census. Volume 1A: population Distribution by Administrative Units. Kenya National Bureau of Statistics. Government of Kenya.
6. GoK, 2011. Environmental impact assessment report for construction of the first three berths at the New Lamu Port and associated infrastructure. Ministry of Transport, Government of Kenya.
7. Herlocker DJ. 1992. Vegetation types. In: Shaabani SB, M Walsh, DJ Herlocker and D Walther (Eds.) Range Management Handbook of Kenya, Volume II,2: Samburu District. Ministry of Agriculture, Livestock Development and Marketing. Government of Kenya.
8. Herlocker DJ, SB Shaabani and S Wilkes. 1993. Range Management Handbook of Kenya Volume II,5: Isiolo District. Ministry of Agriculture, Livestock Development and Marketing. Government of Kenya.
9. Jaetzold R, H. Schmidt, B Hornetz and C Shisanya. 2006. Farm management handbook of Kenya, Volume II 2nd Edition. Ministry of Agriculture, Nairobi.
10. Ministry of Health. 2014. Kenya HIV County Profiles. National Aids and STI Control Programme.
11. ODI. 2009. Pastoralism and climate change: Enabling adaptive capacity. Overseas Development Institute. United Kingdom.
12. Sombroek WG, HMH Braun and BJA van der Pouw. 1982. Exploratory soil map and agro-climatic zone map of Kenya. Exploratory soil survey report no. E1. Kenya Soil Survey, Nairobi.
13. Swift J. 1998. Major issues in pastoral development with special emphasis on selected African countries. Food and Agriculture Organization of the United Nations, Rome.
14. World Bank. 1991. Environmental Assessment sourcebook volume I: Policies, procedures and cross-sectoral issues, World Bank, Washington.

Annexure 5.1: Plants list from the coast (Lamu) to the interland (Garissa)

ZONE 1-NEAR PORT (BUSHLAND/GRASSLAND ZONE)

Scientific name	Family name
Acacia tortilis	Leguminosae
Albizia anthelmintica	Leguminosae
Allophyllus pervillei	Sapindaceae
Antidesma membranaceum	Euphorbiaceae
Catunaregam nilotica	Rubiaceae
Comberetum paoides	Combretaceae
Combretum illairi	Combretaceae
Dalbergia melanoxylon	Leguminosae
Fernandoa magnifica	Bignoniaceae
Garcinia livingstongnei	Guttiferae
Grewia bicolor	Tiliaceae
Grewia densa	Tiliaceae
Harrisonia abyssinica	Simaroubaceae
Hyphaene compressa	Palmae
Lannea schwenfurthii	Anacardiaceae
Lecanidiscus flaximifolius	Sapindaceae
Ozoroa obovata	Anarcadiaceae
Panicum maximum	Graminae
Phoenix	Palmae
Rhoicissus tride	Vitaceae
Setaria incrassata	Graminae
Setaria pumila	Graminae
Strychnos madagascariensis	Loganiaceae
Strychnos panganensis	Loganiaceae
Tephrosia villosa	Leguminosae
Terminalia spinosa	Combretaceae
Themeda triandra	Graminae

Zone 2 (ACACIA/THESPECIA ZONE)

Acacia nilotica	Leguminosae
Acacia seyal	Leguminosae
Acacia tortilis	Leguminosae
Acacia zanzibarica	Leguminosae
Afzelia quanzensis	Leguminosae
Antidesma membranaceum	Euphorbiaceae
Bridelia micrantha	Euphorbiaceae
Combretum illarii	Combretaceae
Dalbergia melaxylon	Leguminosae
Dichrostachys cinerea	Leguminosae
Garcinia livingstonei	Guttiferae
Lannea triphylla	Anacardiaceae
Ozoroa obovata	Anacardiaceae
Premna chryclada	Verbanaceae
Rhus natalensis	Anacardiaceae
Tamarindus indica	Leguminosae
Terminalia spinosa	Combretaceae
Thespecia danis	Malvaceae

Trichilia emetica	Meliaceae
Vitex ferrunginea	Verbanaceae
Ziziphus mucronata	Rhamnaceae

ZONE 3 (Acacia Zone)

Acacia nilotica	Leguminosae
Acacia seyal	Leguminosae
Acacia tortilis	Leguminosae
Acacia zanzibarica	Leguminosae
Albizia anthelmintica	Leguminosae
Catunaregam nilotica	Rubiaceae
Ceiba pentandra	Bombacaceae
Combretum hereroense	Combretaceae
Combretum illairii	Combretaceae
Dichrostachys cinerea	Combretaceae
Dobera glabra	Salvadoraceae
Harrisonia abysinicca	Simaroubaceae
Hyphaene compressa	Palmae
Salvadora persica	Salvadoraceae
Strychnos spinosa	Loganiaceae
Tabernamontana pachysiphon	Apocynaceae
Terminalia spinosa	Combretaceae
Thespecia danis	Malvaceae

ZONE 4 (DRY DOBERA/DIOSPYROS ZONE)

Acacia nilotica	Leguminosae
Acacia seyal	Leguminosae
Catuneragam nilotica	Rubiaceae
Cissus rotundifolia	Vitaceae
Combretum hereroense	Combretaceae
Diospyros abysinicca	Ebenaceae
Dobera glabra	Salvadoraceae
Lannea triphylla	Anacardiaceae
Manilkara mochisia	Sapotaceae
Manilkara sulcata	Sapotaceae
Manilkara zanzibarensis	Sapotaceae
Salvadora persica	Salvadoraceae
Sideroxylon inerme	Sapotaceae
Terminalia spinosa	Combretaceae
Thespecia danis	Malvaceae

ZONE 5 (ACACIA/COMMIPHORA DRY ZONE)

Acacia reficiens	Leguminosae
Acacia reficiens	Leguminosae
Acacia seyal	Leguminosae
Acacia zanzibarica	Leguminosae
Combretum hereroense	Combretaceae
Commiphora africana	Burseraceae
Commiphora habesiana	Burseraceae
Commiphora rostrata	Burseraceae
Dobera glabra	Salvadoraceae
Salvadora perisca	Salvadoraceae

Sanseveria robusta	Dracaenaceae
Terminalia spinosa	Combretaceae
Ximenia americana	Olacaeae

ZONE 6 INJARA (DRY BUSHLAND DWARF ACACIA/OPUTIA ZONE)

Acacia nubica	Leguminosae
Acacia reficiens	Leguminosae
Acacia seyal	Leguminosae
Acacia tortilis	Leguminosae
Combretum illairii	Combretaceae
Commiphora rostrata	Bureseraceae
Croton menyhartii	Euphorbiaceae
Dobera glabra	Salvadoraceae
Duosperma eremophium	Acanthaceae
Grewia tembenesis	Tiliaceae
Grewia tenax	Tiliaceae
Maerua subcordata	Capparidaceae
Opuntia vulgaris	Cactaceae
Prosopis juliflora	Leguminosae
Salvadora persica	Salvadoraceae
Sanseveria intermedia	Dracaenaceae

Zone 7 (ACACIA ZONE)

Acacia nubica	Leguminosae
Acacia reficiens	Leguminosae
Acacia seyal	Leguminosae
Boscia coriaceae	Cappariodaceae
Cadaba fruticosa	Cappariodaceae
Cadaba glandulosa	Capparidaceae
Combretum illairii	Combretaceae
Salsola kali	Chenopodiaceae
Sansevilea robusta	Dracaenaceae

Annexure 5.2: Threatened plant species known to occur in the project area

Terminalia spinosa	Endemic
Dalbergia melanoxylon	Vulnerable
Diospyros abysinicca	Vulnerable

Annexure 5.3: Endangered animal species known to occur in the project area

Hirola	Endemic & Endangered
African Elephant	Endangered
Giraffe	Endangered
Grevy's zebra	Endangered
Cheetah	Endangered
Buffalo	Endangered
African Wild Dog	Endangered
Aardwolf	Endangered
Lion	Endangered

Annexure 5.4: Sample photographs of wildlife and livestock found in the project area

(a) Wildlife

(b) Livestock

Annexure 9.1: KWS Wildlife Corridors Information on the LAPSSET Project

KENYA WILDLIFE SERVICE

ISO 9001:2008 Certified

Ref: KWS/5035

18th August, 2015

Pro. Jenesio I. Kinyamario
School of Biological Sciences
University of Nairobi
P. O. Box 30197 - 00100
NAIROBI.

Dear Prof. Kinyamario

RE: INFORMATION ON WILDLIFE CORRIDORS - LAPPSET PROJECT.

Reference is made to your letter dated 5th June, 2015 on the subject. Attached is a brief report that provides an overview of the wildlife crossing corridors and associated bridge designs.

Yours Sincerely

DR. ERUSTUS KANGA
FOR: Ag. DIRECTOR GENERAL

P.O Box 40241-00100, Nairobi, Kenya. Tel: +254-20-6000800, 6002345. ISDN: +254-020-3992000/1000
Wireless: +254-020-2379407/8/9. Mobile: +254-735 663 421, +254-726 610 508. Fax: +254-020-6003792
Email: kws@kws.go.ke Website:www.kws.go.ke

LAPPSET WILDLIFE INFORMATION FOR PROF. J.I. KINYAMARIO

Wildlife Corridors

Migration is defined as a periodic movement of wildlife from one spatial unit to another with a return trip. Wildlife migrate, disperse and/or move in response to intrinsic *(breeding*) and external (*environmental*) factors which include droughts, floods, fires, erosion, resource inadequacy (food and water), competition (food, water, mate), predation, parasitism (diseases), and avoidance of inbreeding. The ultimate function of dispersal is the enhancement of reproductive success and enhances resilience. These are regular movements to and from breeding areas mostly in search of food and water because of the variability of rainfall and hence variable responses of vegetation in location and quantity from year to year suggested that migrations in large herbivore populations is in response to seasonal changes in resource availability and quality, that is, as a means of enhancing access to high quality food and reducing the risk of predation. Because of patchiness within their home ranges, wildlife moves on daily basis (local resident movements) and change habitat seasonally (migrations, dispersal). There are three patterns or categories of movements, namely, migratory, resident and dispersal systems, where dispersal refers to wet season dispersal and dry season concentration of animals in a range. Today, because of anthropogenic activities such as infrastructure development, the habitats of most wildlife have been lost, degraded or fragmented such that some have been separated. Wildlife migratory routes or corridors are thus absolutely essential.

Wildlife corridors are usually designed with "umbrella species" in consideration. There are three key species namely: the elephant (*Loxodonta africana* Blumenbach), plains zebra (*Equus burchelli* Gray) and giraffe (*Giraffa camelopardalis* Linnaeus), which have widespread popular appeal and need a lot of land for dispersal. These species together with pastoral livestock have a large influence on the ecological dynamics of ecosystems in Kenya, especially in the areas where the LAPPSET will be passing through.

LAPPSET Alignment

According to the LAPPSET alignment, when the road leave Lamu Port it will pass through important wildlife areas (Fig. 1 below) clustered as follows:

1. Arawale National Reserve that is important for conservation of Hirola antelope.
2. Meru Conservation Area (MCA) that comprise of Meru National Park, Kora National Park, Rahole National Reserve, Bisinadi National Reserve and North Kitui National Reserve.
3. Laikipia Ecosystem that comprise of Laikipia National Reserve, Shaba National Reserve, Samburu National Reserve, Nyambene National Reserve and numerous wildlife ranches and conservancies.
4. Northern Conservation Area comprising of Marshabit National Reserve, Losai National Reserve and Reserve and numerous wildlife ranches and conservancies.

Corridor Design

Considering the high population of free ranging wildlife along the proposed LAPPSET, there will be need to undertake detailed field assessment to ascertain the best location of wildlife crossing point. However, there are five basic crossings (Fig. 2) that will be considered and they include the following:

i. Under Pass
ii. Over Pass
iii. Bridges
iv. Culvert
v. Tunnel

Figure 1 : Alignment of the LAPPSET and Wildlife Protected Area with associated Wildlife Distributions

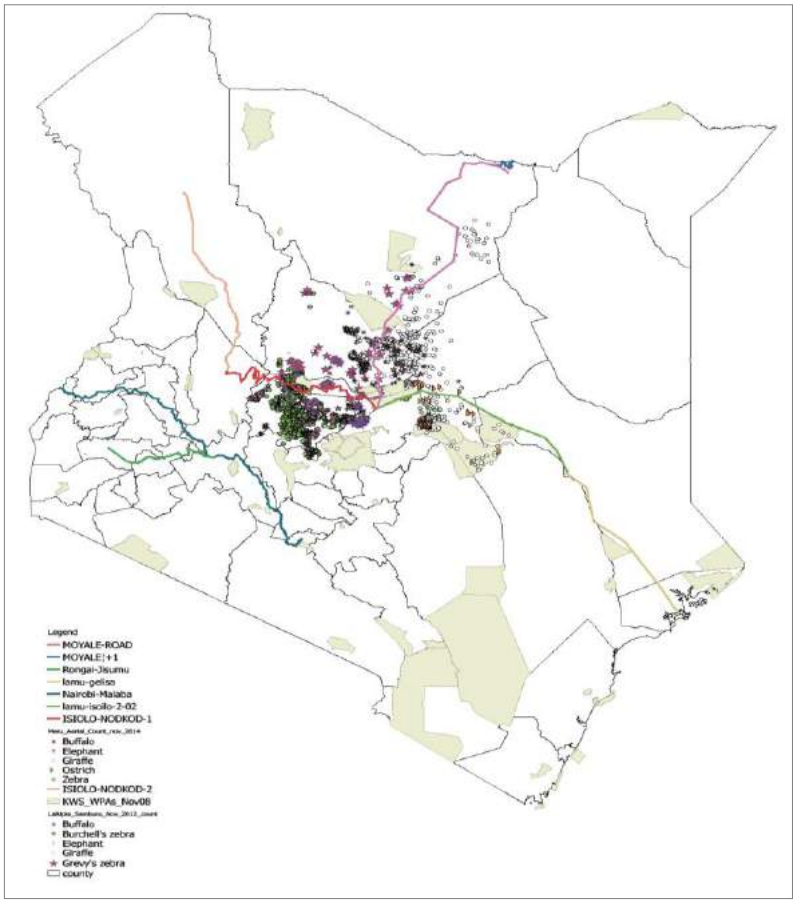


Figure 2 (a) : A typical Wildlife Corridor Underpass on an Highway

Figure 2 (b) : A typical Wildlife Green Overpass on a Highway

Annexure 12.1 : Samples of Some project affected Persons in Bodhei Village, Garissa County

Annexure 12.2: List of Persons attending Consultative meetings

Table 2A : Attendants at Roka September 23rd, 2014

Sr. No.	Name	ID no.
1.	Tamleha Mohammed Ali	0159842
2.	Khalid Yusuf Hajj	0650149
3.	Fatuma Salim Kola	20294008
4.	Johnson Gakuya	3379332
5.	Salim Sef	060225
6.	Abdi Fatah Mohamed	29510182
7.	John Muregi Gatitu	068200
8.	Ali Salim Guyo	2238674
9.	Johana Muchina Muthokia	107090
10.	Swaleh Ali Salim	26059283
11.	Charles Kivite Nduse	13536626
12.	Jerald Mwoka Kivuli	3050354
13.	Stephen Mwangi	11625616
14.	Esther Waithira Mungai	10643080
15.	Mohamed Atwai Shekue	25050219
16.	Ali Mohamed Amed	4842600
17.	Moris Chichenga Lingwe	25051950
18.	Gaeyan Fidah	5398211
19.	Jonathan Ringe Ringo	6458847
20.	Hussein Omar Golo	12728416
21.	Paul Ndungu Gatitu	0440416
22.	Bibiana Njoki Kimoro	25533179
23.	Peter Migwi Ngoroge	8524670
24.	Julius Maore Kangere	21888969
25.	Sidi Kaindi Karisa	28505324
26.	Francis Mburu Ngugi	6116181
27.	Rehema Bakari Mohamed	31173407
28.	Khambu Mwatsuma	
29.	Polly Gaturi Benson	10192516
30.	Mngumi Chondo Mngumi	4436289
31.	Abdiger Omar Ali	11550572
32.	David Bundi M. Ikunyua	11325794
33.	Peter Njoroge Mukaru	7275539
34.	Abubakar Mohamed Daip	27417722
35.	Abubakar Gulu Lubo	9353241
36.	Francis Muturi Gitau	3019270
37.	Peter Ngugi Mucheru	20308545
38.	Samuel Ndungu Kimani	
39.	John Macharia Nganga	4851277
40.	Fatuma Ware	23577558

Sr. No.	Name	ID no.
41.	Dishon Mwamburi Mwaisege	5462140
42.	Sadia Hasi Sigona	0055609
43.	Duncan Mbugua Warukage	11614400
44.	John Waweru Mbugua	8236086
45.	Freejita Gatavi Kinoro	28338767
46.	David Otieno Owino	21412100
47.	Philip Wambugu Mbuthia	25532675
48.	Peter Maluki Mututa	23682840
49.	Peninah Mutanu Kasuku	23653768
50.	Grace Kanyaa Muinde	26436701
51.	Swaleh Jarso Waticho	24314621
52.	Veronicah Nyambura Mbuthia	25533099
53.	Abdillahi Jarso Waticho	28927278
54.	Eunice Njambi Kamau	13320538
55.	Henry Mutungi Maveke	5718415
56.	Philip Njoroge Mugekenyi	0457239
57.	Swafia Ahmed Ali	10390474
58.	Mary Immaculate W. Njaga	8797894
59.	Dennis Roy Beauttah	24911421
60.	Francis N. Siemba	12455089
61.	Somoe Omar Kombo	26195053
62.	Ahamed Wilie	115922
63.	Gideon Kiarie Gachuire	0293090
64.	Daniel Kangethe Muiruri	20003439
65.	Joseph Kaniga Karanda	26111723
66.	Kaugu Kuria	7139397
67.	Kiara Karunyu	92522240
68.	Jene Wanjiku Kaungu	8716866
69.	Grace Waniku	10033833
70.	Mtafa Chemaga Lula	0158257
71.	Hamza Yusuf Charo	3018837
72.	Gideon Kiarie Gachuiri	
73.	Umi Said Athman	
74.	Eliud Gitau Mwaura	13018858
75.	Penina M Kasuku	
76.	Ann Njoki Kinoro	2553179
77.	Nzingo Daniel Makuta	27529350
78.	Eunice Njambi Kamau	13320538
79.	Francis Karera Kimani	0354027
80.	Gambo	
81.	Stella Juba	9475011
82.	Philip Wambugu	

Sr. No.	Name	ID no.
83.	Veronica Nyambura Mbuthia	25533099
84.	Susan Nyambura Mbiti	9932938
85.	Mislet Muhonja	11851749
86.	Mngumi Chondo Mngumi	14436289
87.	Abdul Kheri M. Omar	11550592
88.	Joseph Masumbuko Kasi	8297075
89.	Abslome Mwangi Kinyanjui	8613140
90.	John Macharia Nganga	4851277
91.	Rufus Kimani	
92.	Joseph Kimathi Antony	21920492
93.	Ali Salim Nguyo	2238674
94.	Ngulu Lubo Somba	0164198
95.	Henry Mutungi Matheke	5718415
96.	Bakari Ngulu Lubo	
97.	Esther Waithera	10643080
98.	Abubakar Said	
99.	Nuru Ngulu Lubo	
100.	Freejita Gatavi Kinoro	23338767
101.	Alasow Hassan	11573405
102.	Silas Kimathi Mungathia	21615035
103.	Florah Karimi M'thiritu	28946915
104.	Athman Bwana Mzee Athman	11625009
105.	Bakari	
106.	David Otieno Owino	21412100
107.	Halima Rago Irale	21659374
108.	Swaleh Jarso Waticho	24314621
109.	Francis Mburu Ngugi	6116181
110.	Josephat Kazungu Ziro Mwatela	3559720
111.	Titus Junje Kandere	
112.	Nasra Hassan Sheikh Ali	23067171
113.	Sheikh Ali Hussein	26461819
114.	Hassan Sheikh Ali Osman	

Table 2B: Attendants of Bura Sub- County Consultation Meeting held on 5th September,2015

Sr. No.	Name	ID no.	Telephone	Location	Position
1	Abdi Hussein Bore	9562740	0720593061	Bura	Ass.chief
2	Aden Y Sugor	0035767	0729020079	Bura	
3	Zeinab Mohammed Dagana	20897639	0719147721	Nanighi	
4	Rukia Sheikh Abdullahi	0033723	0717385025	Mansabobo	
5	Halima bare Kaeiwan	2101354	0708242757	Bura	
6	Isnino Hassan	23769258		Mansabobo	
7	Fabah Gure	1263124	0724561386	Bura	
8	Dagane Hamed Isse	8480369	0724502018	Nanighi	
9	Khalif Omar Abdi	3519954	0712636536	Bura	
10	Abdi Ibrahim	26839363	0729788420	Bura	
11	Abdi Abdullahi	0538297	0719625456	Kamuthe	Chief
12	Abdullah Mohamud Dubet	8481692	0718768504	Bura	
13	Mahat Borrow	12913042	0729069905	Nanighi	Chief
14	Gelle Bulego Mohammed		0700104104	Bura	
15	Abdi Dili Mohammed	0034067	0729712782	Bura	Village elder
16	Mustapha Khalib Mohamed	23467894	0725824537	Bura	Youth
17	Muhyadin Ahmed Ali	20867427	0726859934	Kamuthe	
18	Suleiman Ajtin Dagae	11887763	0719295583	Kamuthe	School SM
19	Bunsid Ali Rashid	7549563	0725596692	Kamuthe	
20	Mohammed Yussuf Mohan	9490334	0728227280	Bura	
21	Koriogord Dagane	2101643		Bura	
22	Abdi Adow Ali	6387554	0713314545	Bura	
23	YerowMohammed Mohammed	2100907	0701405955	Bura	
24	Salah Abdi Yarow	2100778	0717907177	Nanighi	
25	Abass Shidow Siyat	2101502	0706513509	Bura	
26	Sehel Ahmed Siat	0538246	0717904537	Nanighi	
27	Ibrahim Ali Mohammed	6386774	0715219034	Bura	Imam
28	Idriss Yunis Baow	0262405	0726803589	Bura	Village elder
29	Ahmed Shimbir Hussein	2101533	0729940654	Nanighi	Elder
30	Yussuf Mohamud Ahmed	22685972	0713750323	Kamuthe	Elder
31	Ismail Ali Gure	13119566	0714455168	Kamuthe	Elder
32	Jele Ahmed	6383714	0713114971	Mansabobo	Village elder
33	Sugon Elimesie	6387824	0700041228	Mansabobo	Village elder
34	Ibrahim Shire Warsame	9490515	0728442465	Mansabobo	Village elder
35	Osman Ahmed Aden	20875547		Mansabobo	Youth
36	Mohamed Ali Abdullahi	2101684		Mansabobo	Village elder
37	Rukia Abdiwahab	32449501	0719720071	Mansabobo	Youth
38	Gamar Hassan Mre	2102838		Mansabobo	MWK
39	Muhumed Mohamed Ibar	22837346	0724728697	Bura	Youth Rep.
40	Mohamed Abdi Owle	10360613	0724441574	Nanighi	Youth Rep
41	Yussuf Ali Omar	1738913	0716611229	Guyo	Elder
42	Mohammed Hassan	15116361	0727179153	Guyo	Elder
43	J W Wafula	21512470	0720813304	OOp	Ass.County. comm
44	M.A .Bille	0312696	0724024644	Bura	Chief Bura

Table 2 C: Attendants at Hindi Consultative Meeting held on 7th November, 2014

Sr. No.	Name	ID no.	Telephone	Plot No.	Position
1	Yanya Mohamed Ali	0650985	071801563	590	
2	Ibrahim Mutugi	11140079	0715235209	1065	
3	Peter Migwi	8524670	0728527377	Roka	
4	David Munene	6117919	0700533387	549	
5	Charles G. Waiganjo	16005239	0712576156	291	
6	Joseph Kimathi Anthony	219204492	0727436388	Roka	
7	Patrick Kyengo	7366793	0720956103	1067	
8	Rahabu Wambui Kyengo	20762761			
9	Ali Mohamed Ahmed	4842600			
10	Kariithi Metho Nyoike	10167555		527	
11	Antony Kariuki Simba	28131267		587	
12	Monica Wambui Kinuthia	1870301	0722513089	583	
13	Joseph Mburu Gituto	7178893	0707917010	581	
14	Veronicah Mutanu Mburu	25099303	0700245582		
15	Joseph Muciimi Njagi	13562685	070077901	598	
16	Zipporah Wambui Ali	10391756			
17	John Muregi Gatitu	0682097	0721572171		
18	Gideon Kiarie Gachuire	0293090	0726545484		
19	Peter G. Kirubi	8482759	0722474083	2261	
20	Paul Ndungu Gatitu	0440416	0710399220		
21	Joyce Wanjiku Munene	29157353	0702428712	579	
22	Joyce Wanjiku Munene	26983578	0714296612	1065	
23	Tima Mudhaar Omar	0163461	0715223491	589	
24	Peter Njoroge Mbuthia	10169821	0710661895		
25	Leah Njambi Njoroge	26184326	0729235804		
26	Leah Jambi Njoroge	13536568	0720727754	578	
27	Magdaline Njeri Ukabi	10390618	0714171630	007	
28	Joyce Wamuhu Njoroge	10390301	0715019339	1098	
29	Joseph Njoroge Wagoro	10391843	-		
30.	James Muchiri Gichungi	3438849			
31.	A.M. Miji				
32.	Public Utility Land				
33.	Patricia Muthoni Mungai & Jesica M Mungai				
34.	Mohammed Hussein Haji				
35.	Patrick Kibe Mungai				
36.	Hassan O. Ahmed				
37.	Geoffrey Njihia Gathinga	0366282			
38.	Charles Mburu Kamau				
39.	Said Mohamed Farah				
40.	Rose Muthoni Karuoya	813388			
41.	Stanley Kiarie				
42.	Josephat Wainaina Meme				

Sr. No.	Name	ID no.	Telephone	Plot No.	Position
43.	Titus Mwangi Wakahia				
44.	Luke Mutiso Muisyo & Caroline Nyambura Mwai	20101648 11698913			
45.	Luke Mutiso Muisyo & Caroline Nyambura Mwai	20101648 11698913			
46.	Patrick Njenga Muiruri	8614440			
47.	Mwangi Karimi Mwangi	13580295			
48.	Shee M Athmani(Cauti0n)				
49.	Public Utility Land				
50.	Boniface Kamanga Muhia	817398			
51.	Peter Njeru Simba Antony Njeru Simba	23112296 28131267			
52.	Nash Njoroge	PP 1127642			
53.	Monica Wambui Knuthia T/A				
54.	Young Tranders-Tigoni Ltd				
55.	Yunis Maalim Mahat				
56.	Gitao Chege George	6421025			

Table 2D: Bodhei Consultative Meeting_ 7th November, 2014. Attendance List

Sr. No.	Name	ID No.	Telephone	Plot No.	Position
1.	Osman Aden	20241245	0721635233		Peace elder
2.	Bashir Hussein	11884479	0712724771		Community
3.	Mohid Noor	22138423	0716245825		Youth
4.	Muhamud Aden	35189743	0717418062		Elder
5.	Mohid Lugey	7491353	0717254982		Elder
6.	Halima Amry	2684984	0727769259		Elder
7.	Guthoy Farah	3519734	0708771225		Busmeti
8.	Sahara Mohammed	25096162	0705534693		Bodhei
9.	Mirat Aden	1133438	0728008923		
10.	Abdi Mohid	20999021	0702484166		
11.	Abdi Hussein	20246893			
12.	Mohamud Abdi	20267881	0712039058		
13.	Mohamud Abaye	2564255			
14.	Zainab Harey				
15.	Barnia Dahir	4491617	0700427790		
16.	Ali Lopah Guve	2564876	0711652489		
17.	Abdi Mohamud Guve	0588627			
18.	Siat Omar Burale	123566			
19.	Ahatho Shide Nur	11693703			
20.	Gahbey Hassan Muhumed	11693793			
21.	Bashir Hussein Noor	11884473			
22.	Sarah Mohamud	26852471			
23.	Hussein Abdi Olow	20870936			
24.	Hirsi Kulmiye Farah	no id given			
25.	Mirat Aden Bosho	1133438			
26.	Ladhan Ali Muhumed	539803			
27.	Halima Burale Hussein	11883620			
28.	Geina Abdi Bilal	26852592			
29.	Abdullahi Mohamed Ali	11693970			
30.	Ambia Farah Gure	21107053			
31.	Mohamud Aden Bare	3519743			
32.	Fatuma Mohamed Moyo	no ID given			
33.	Ahmed Farah Gure	8054323			
34.	saadi Abdi Abdullahi	20867859			
35.	Dhahabu Abdi Abdullahi	26852599			
36.	Aden Farah Gure	21399804			
37.	Sinjia Horor Abdi	1132169			
38.	Leila Miradh Aden	29781424			
39.	Isnino Ali Tohow	20236985			
40.	Median Abdi Ali	1262141			
41.	Ubah Salat Muhumed	o541377			
42.	Fatuma Bilal Dahir	8054096			
43.	Halima Mohamed Olow	20873158			
44.	Ali Farar Gure	9491025			
45.	Abdi Aden Hassan	26857903			
46.	Taba Abdi Abdullahi	9564369			

Sr. No.	Name	ID No.	Telephone	Plot No.	Position
47.	Adhow Kumiye Muhumed	1133237			
48.	Kamar Buya Muhumed	o541308			
49.	Hamud Muhumed Ali	9490899			
50.	Sahara Hussein Shurie	9490751			
51.	Hawa Mohamud Olow	29781522			
52.	Gudho Farar Gure	3519734			
53.	Dubey Mohamud Khalif				
54.	Mohamud Olow Ali	o541664			
55.	Marian Hassan Muhumed	1132729			
56.	Jete Owlo Muhamed	48313			
57.	Sahara Yussuf Shide	20870371			
58.	Habiba Jele Owlo	25096769			
59.	Adhei Muhumed Dimbil	26849897			
60.	Ali Mohamed Aden	21268067			
61.	Siat Muhumed Abdi	21279074			
62.	Yasin Dahir Ineyrah	6384451			
63.	Abdi Salat				
64.	Furahu Abdi Duya	1132201			
65.	Muhamud Jele Mursal	1132950			
66.	Osman Omar Salat	20241245			
67.	Fatuma Mohamed Abdi	29270416			
68.	Abdi Mohamud Gure	8054208			
69.	Dereh Gona Bare	1132025			
70.	Hassan Farah Gure				
71.	Dulo Idle Duale				

Belebele village Attendance List held on 23rd September,2014

Sr. No.	Name	ID no.	Plot No.	Position
1	Joseph Mwangi Njenga	25128868		
2	Ali Guliye	30032724		
3	Hellen Muthoni Waiyaki	13743363		
4	Mohamed Abdi Allour	23740789		
5	Abdiaziz Hirsi Alnoor	23470789		
6	Abdi Nasir Yusuf Abdi	1325693		
7	Robertson Otwane Omodia	22711460		
8	Grace Mutio Isaiah	25990673		

Bobo Village Attendance List held on 23rd September,2014

Sr. No.	Name	ID no.	Telephone	Plot No.	Position
1.	Dishon Mwamburi Mwaisege	5462140			
2.	Mohammed Sheikh Abdi	2115017			
3.	Haji Omar				
4.	Dennis Onyango	13499598			
5.	John Muregi Gatitu	0682097			
6.	Johnson Gakuya Nyamu	3379332			
7.	Esther Wanjiku Mwangi	3530763			
8.	Halima Sheban				
9.	Rebecca Njoki Kihiu	26965328			
10.	Omari Ali Bakari	23827957			
11.	Hussein Mohamed Hussein	21507927			
12.	Bakari Ali Bakari	24671248			
13.	Esha Athman Banrova	31170745			
14.	Asad Yusuf Charo	30188060			
15.	Mohammed Atwai Shekuwe	25050219			
16.	Feswal Shebe				
17.	Ramadhan Karani	4581830			
18.	Athman Bwana Msaji				
19.	Francis Siemba Nakhatunda	12455089			
20.	Huzema				
21.	Mary Nyaga				
22.	Sophia				
23.	John Kihara				
24.	Hussein Abdi Nur				
25.	Abshir Bwana Msaji	16101219			

Table 2E : Ijara Sub County Consultative Meeting_ 9th November, 2014.

Sr. No.	Name	ID no.	Telephone	Location	Position
1.	Mohamed Hussein Noor	13119714	0725266537	Bodhei	Chief
2.	Mohamed Omar Aden	22737081	0729245137	Ijara	Chief
3.	Yusuf Omar Shuna	11693508	0710219193	Ijara	Ass. Chief
4.	Abdi Sahal Goh	0541594	0722392592	Ruqha	Chief
5.	Farah Sirat Abdi	1133914	0716914325	Ijara	Chairman
6.	Issack Digale Hussein	1132609	0729436444	Ijara	District Chairman
7.	Kayib Santur Sagar	0539925	0701542330	Ijara	Community leader
8.	Abdi Rahman Adow Korio	13701402	0716820914	Ruqha	
9.	Harun Jelle Bare	28934531	0716736212	Ijara	
10.	Abdullah Omar	13701401	0725827152	Ruqha	
11.	Mohamud Ali Omar	1263703	0728800383	Ijara	Chairman
12.	Farah Dahir Mubaal	11376270	0703151181	Ijara	Watchman
13.	Mohamed Mahat Aden	1132749	0722113300	Ijara	
14.	Siyat Noor Almi	0541641	0719475764	Ruqha	
15.	Aden Sahal Abdullahi	11693873	0715558073	Ijara	Watchman
16.	Amir Abikar Abdille	24461960	0721585641	Bura Golol	Chairman Social service
17.	Ali Mirat Dahir	3519537	0711325150	Ijara	Treasurer
18.	Shamsa Jelle Abdullahhi	24461064	0715440218	Ruqha	Member
19.	Maryann Ibrahim Duble	433910	0718773951	Ijara	Member
20.	Habon Farah Ali	24315399	0729930013	Ijara	Member
21.	Hubi Osman Abdi	22536751	0715538850	Ruqha	Member
22.	Hubi Abah Aboullahi	29111748	0713352478	Ruqha	Member
23.	Halima Ahmed Korio	1262924	0708783335	Ruqha	Member
24.	Ali Shurie Muhamed	3519711	0703342804	Ijara	Member
25.	Aden Dahir Dagane	0541694		Bura Golol	Religious leaders
26.	Muhiyadin Omar	2354276	0714912201	Bura Golol	Herder
27.	Ahmed Abdi Yussuf	24308995	0729069968	Ruqha	
28.	Yussuf Kediye Salat	11322047	0704930521	Bura Golol	Member
29.	Bashir Shurie Sancy	1132935	0718774066	Bura Golol	Imam
30.	Mohamed Dahir Dagane	8054151	0729351270	Bura Golol	Chief
31.	Murshid Omar Aden	13117102	0721870331	Gerille/ Ruqha	Chief
32.	Bashir Dahir Dagane				
33.	Ali Bare Hussein	11693927			
34.	Hawa Amin Ali	539653			
35.	Maryan Isse Hassan	1133308			
36.	Abshiro Ali Mursal	20236549			
37.	Fardosa Nur Kalil	26020542			
38.	Moge Gurow Sagar	540763			
39.	Madina Hussein Ibrahim	1133208			
40.	Mohamed Abdullahi Dahir	11693804			

Sr. No.	Name	ID no.	Telephone	Location	Position
41.	Binto Kalil Arte	20870450			
42.	Amina Mohamed Dahir	25865701			
43.	Ahmed Ibrahin Shurie	11693972			
44.	Ubah Hussein Muhamud				
45.	Muhmed				
46.	Abdi Ali Site	21646136			
47.	Hawo Amin Ali	539653			
48.	Fatuma Abdillahi Ali	3519587			
49.	Fatuma Amin Ali*	22430487			
50.	Halima Horow Dagane*	29239534			
51.	Abdi Ali Site*	21646136			
52.	Fatuma Ahmed Gure	7549619			
53.	Farah Dahir Mursal	539792			
54.	Farah Omar Muhumed	20262462			
55.	Ismail Abdi Kassim	3519719			
56.	Mohamed Mohamud	13701953			
57.	Abdi Anshur Kassim	3519794			
58.	Deiman Billow Bilal	29904569			
59.	Mohamud Ali Omar	1263703			
60.	Fanzia Madhar Siyah	23508688			
61.	Khadija Sirat Abdi	1132286			
62.	Mainono Hajir Ibrahim	1133083			
63.	Fatuma Yussuf Kethi	20230618			
64.	abdi muhumed Ali	538756			
65.	Ibrahim Burale Muhumed	1133615			
66.	Adan Guri Mohamed				
67.	Ibrahim Bulale Muhumed	1133615			
68.	Shurie Barrud Hassan	o540338			
69.	Ebra Shidu Shurie	o541313			
70.	Fatuma Dekon Abdulle				
71.	Fatuma Ahmed	22466672			
72.	Farhiya Abdullahi Bulle	30914346			
73.	Mohamed Gore Orah	9490913			
74.	Halima Harun Bullo	11883579			
75.	Ibrahim Ahmed Goni	25919726			
76.	Gunten Abdi Muhamed	6384756			
77.	Ahmed Goni Muhamud				
78.	Harun Isaak Khalif	1133489			
79.	Ahmed Gure Madobe	538781			
80.	Iqra Ahmed Gure				
81.	Sahara Muse Hassan	22534149			
82.	Abdullahi Mohamed Salat	22534671			
83.	Mruwa Mahamed Salat	7549991			
84.	Idima Bulle Hussein	o539322			

Sr. No.	Name	ID no.	Telephone	Location	Position
85.	Abdullah Iman Abdi	3519810			
86.	Dahabo Abdi Gundow	o541290			
87.	Duhoy Mohamed Salat				
88.	Khadija Abdi Elmore	26657706			
89.	Halima Abdi Elmore	24314444			
90.	Abdirahman Musekeinan	29200105			
91.	Amina Bille Duble	30915660			
92.	Fowsia Kabow Rage	31978629			
93.	Abdullah Iman Abdi				
94.	Bedel Said Khalif	o540124			
95.	Abdullahi Barkale Said	9490988			
96.	Ibrahim Ahmed Goni	25919726			
97.	Abdi Mohamed Alow	3513864			
98.	Sahra Burale Abdi	27649106			
99.	Bille Abdullahi	13117538			

Table 2F: Bargoni Sub County Consultative Meeting_ 8th November, 2014

Sr. No.	Name	ID no.	Location	Position
1.	Salim. A.Salim	8524271	Hindi/ Bargoni	Ass.chief
2.	Hamisi B.Kololo	0650855	Hindi/ Bargoni	Headman
3.	Yusuf Hassan	8455189	Hindi/ Bargoni	Dev.Comm
4.	Saidi Salent	26053731	Hindi/ Bargoni	Member
5.	Omour Bashungi	0158230	Hindi/ Bargoni	Head man
6.	Mohamed Hillow	0504280	Hindi/ Bargoni	Head man
7.	Nadho Gerame	26020594	Hindi/ Bargoni	Member
8.	Redi Ali	237357325	Hindi/ Bargoni	Member
9.	Omar Bausi		Hindi/ Bargoni	Member
10.	Abuli Guracho	0164224	Hindi/ Bargoni	Elder
11.	John Kinyanjui	3621338	Hindi/ Bargoni	Elder
12.	Asha Masuudi	21310297	Hindi/ Bargoni	Elder
13.	Faluma Abdi Hussein		Hindi/ Bargoni	Member
14.	Mohamed Madobe	9353427	Bargoni	Member
15.	Tafari Kombo		Bargoni	Member
16.	Mohamed Abdallahi	26201655	Bargoni	Member
17.	Ijuu Mohammed Ijuu	20800258		
18.	Abala Ali Azan	25444649		
19.	Abadiba Funana Abadula	2236842		
20.	Asumani Msud Pembe	2239077		
21.	Ali Kedi	0164197		
22.	Fatuma Mohamed Hillow			
23.	Abdila Gubo	5354729		
24.	Salim Abuli Salim	8524271		
25.	Mwanaesha Madhe			
26.	Shungi Abala			
27.	Mwanaesha Gure	5354745		
28.	Ali Mahafudh			
29.	Kenga Wanje			
30.	Bakari Chula			
31.	Mariam Jilo Sango	10391060		
32.	Saidi Boke			
33.	Mahadhi Elema Abalola	2239289		
34.	Afusa Bandova	0650909		
35.	Ali Kedi			
36.	Fatuma Abuli Kirio			
37.	Omari Chula	0650864		
38.	Adhan Mallim Hussein	0504380		
39.	Joseph Ng'ang'a Thungu	27558719		
40.	Ann Wanjiru Gatene	9810496		
41.	Peter Ngugi Mucheru	20308545		
42.	Guri Ali Wamazee	30917518		

Sr. No.	Name	ID no.	Location	Position
43.	Joseph Mukuria Gathoni	13536539		
44.	Ali Wazee Hassan	0158489		
45.	Fatuma Abuli	2239292		
46.	Mariyamu Jilo Sango	10391060		
47.	Mohammed Abuli Kiriyo	2239497		
48.	Fatuma Dagane Kirio	14537504		
49.	Said Boke Diza	11625794		
50.	Jane Nduta Mwangi	22297768		
51.	Ali Bin Kedi	0164197		

Masabubu Village Attendance List held on 22nd April,2015

Sr. No.	Name	ID no.	Telephone	Plot No.	Position
1.	Shukiria Burale Aden	30594899			
2.	Halima Mohamed Ismail				
3.	Isman Idow Roble	21272425			
4.	Mohamud Abdullahi Idhow	25713388			
5.	Ambia Ali Kolomiya	8481179			
6.	Qaibo Adan Ali	27090349			
7.	Abshiro Abdullahi Idow	2320082624			
8.	Halwadho Korio Adan	9565030			

Modika Village Attendance List held on 23rd April,2015

Sr. No.	Name	ID no.	Telephone	Plot No.	Position
1.	Diis Digale Gure				
2.	Abdia Mohamed				
3.	Auraka Abdile Noor				
4.	Aden Abdi Maalim				
5.	Yussuf Abdi Daud	26709434			