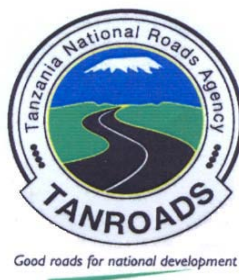


United Republic of Tanzania

Ministry of Works, Transport, and Communication



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Environmental and Social Impact Assessment Report for the Proposed Upgrading of Kasulu – Manyovu Road and its Bypass Roads (77.6km) to Bitumen Standard in Kasulu and Buhigwe Districts, Kigoma Region

Name of the Project:

Multinational: Tanzania/ Burundi: Nyakanazi –
Kasulu – Manyovu/ Rumonge – Rutunga –
Bujumbura Road: Consultancy Services for Review
of the Feasibility Studies and Detailed Designs

Project Location:

Kasulu and Buhigwe Districts in Kigoma Region

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DECLARATION

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LIST ABBREVIATIONS

AADT:	Annual Average Daily Count
AC:	Asphalt Concrete
ACD:	Allergic Contact Dermatitis
AI:	Area of Influence
AQRB:	Architects and Quantity Surveyors Registration Board
BOQ:	Bill Of Quantities
CBA:	Cost Benefit Analysis
CBOs:	Community Based Organizations
CoI:	Corridor of Impact
CRB:	Contractors Registration Board
DRC:	Democratic Republic of Congo
CRR:	Crushed Rock
DBM:	Dense Bituminous Macadam
DE:	District Engineer
DED:	District Executive Director
DEMO:	District Environmental Management Officer
DFO:	District Forestry Officer
DIZ:	Direct Impact Zone
DoE:	Director of Environment
DP:	Domestic Point
DWE:	District Water Engineer
EAC:	East Africa Community
EIRR:	Economic Internal Rate of Return
ESIA:	Environmental and Social Impact Assessment
EMA:	Environmental Management Act
ERB:	Engineers Registration Board
E & S:	Environmental and Social
ESMP:	Environmental and Social Management Plan

ESS	Environmental and Social Specialist
FYB:	First Year Benefit
FYRR:	First Year Rate of Return
GS:	Galvanised Steel
GHGs:	Green House Gases
H & S:	Health and Safety
HIV/AIDS:	Human Infected Virus/Acquired Immunity Deficiency Syndrome
ICD:	Irritant Contact Dermatitis
IEE:	Initial Environmental Examination
IRI:	International Roughness Index
IRR:	Internal Rate of Return
LEA:	Limited Environmental Analysis
LHS:	Left Hand Side
ASL:	Above Sea Level
MKURABITA	Mpango wa Kurasimisha Rasilimali na Biashara za wanyonge Tanzania
MSHA:	Mine Safety and Health Administration
MWTC:	Ministry of Works, Transport, and Communication
NACP:	National AIDS Control Programme
NEMC:	National Environment Management Council
NEP:	National Environment Policy
NGO:	Non-Governmental Organization
NICTBB:	National ICT Broadband Backbone
NIOSH:	National Institute for Occupational Safety and Health
NO ₂ :	Nitrogen Dioxide
NPRS:	National Poverty Reduction Strategy
NPV:	Net Present Value
OCC:	Opportunity Cost of Capital
OPC:	Ordinary Portland Cement
OSBP:	One Stop Border Post

PAPs:	Project Affected Parties
PEL:	Permissible Exposure Limit
PORALG:	President’s Office Regional Administration and Local Government
PLHAs:	People Living with HIV & AIDs
PTR:	Pneumatic Tired Roller
PVC:	Poly Vinyl Chloride (hard plastic)
RHS:	Right Hand Side
RoW:	Right of Way
RS-ES:	Road Sector Environment Section
SO ₂ :	Sulphur Dioxide
STIs:	Sexually Transmitted Infections
SSESMP:	Site Specific Environmental and Social Management Plan
SSHSMMP:	Site Specific Health and Safety Management Plan
TACAIDS:	Tanzania Commission for AIDS
TANAPA:	Tanzania National Park
TANESCO:	Tanzania Electricity Supply Company
TANROADS:	Tanzania National Roads Agency
TFS:	Tanzania Forest Services
TOC:	Take Over Certificate
TPBP:	Tanzania’s Property and Business Formalization Programme
TZS:	Tanzanian Shilling (Currency)
UNEP:	United Nations Environment Programme
UNESCO:	United Nations Education, Scientific and Cultural Organization
URTI:	Upper Respiratory Tract Infection
VOC:	Vehicle Operation Costs
VPO:	Vice President Office
WHO-GPA:	World Health Organization Global Programme on AIDS

EXECUTIVE SUMMARY

Environmental Impact Statement for the Proposed Upgrading of Kasulu – Manyovu Road and its Bypass Roads (77.6km) to Bitumen Standard in Kasulu and Buhigwe Districts, Kigoma Region

Project Name: Multinational: Tanzania/ Burundi: Nyakanazi – Kasulu – Manyovu/ Rumonge – Rutunga – Bujumbura Road: Consultancy Services for Review of the Feasibility Studies and Detailed Designs

Location: Kasulu and Buhigwe Districts, Kigoma Region

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PROJECT BACKGROUND AND JUSTIFICATION

The Government of the United Republic of Tanzania with the assistance from African Development Bank (AfDB) intends to upgrade/ construct Nyakanazi – Kasulu – Manyovu road section (291km) to bitumen Standard.

The project is being implemented by East Africa Community (EAC) through Tanzania Roads Agency. EAC has engaged EGIS International to review the design of the road which was done in 2010 to ensure their correctness and completeness.

The proposed road upgrading will be split into four as indicated in the following schedule:

Contract No	Section	Road Section	Length	Total Contract Length
01	a	Kasulu roundabout – Manyovu: The road section starts off at Kasulu T-junction; the point where Kibondo – Kasulu road links with Kasulu – Manyovu and Kasulu – Kigoma roads and ends at Munanila village (Manyovu) roundabout	47.9	77.6
	b	Kasulu Southern Link Road: Starts off at the	7.9	

Contract No	Section	Road Section	Length	Total Contract Length
		junction to Baraka Secondary school, along Kigoma – Kasulu road and ends at the end of Kasulu roundabout – Manyovu road section		
	c	Kasulu North Link Road: Starts off at the Kasulu T-junction; the point where Kibondo – Kasulu road links with Kasulu – Manyovu and Kasulu – Kigoma roads, and ends at Kidiana village, about 400m before R.Bogwe, along Kasulu – Kibondo Road	8.7	
	d	Western Bypass Road: Starts off at Kidiana village, about 400m before R.Bogwe and ends at the junction to Tulieni Jangwani primary school, Herujuu village, along Kasulu – Manyovu road	13.1	
02	a	Kanyani (along Kigoma - Kasulu road) – Mvugwe village: The road links with Kasulu – Kibondo road at Kidiana village, about 150 before R.Ruchugi. Kasulu western bypass road (12.7) km forms part of this road section.	70.5	70.5
03		Mvugwe – Nduta Junction	59.35	59.35
04	a	Nduta Junction – Kabingo: The road starts of at Nduta junction, and then traverses Nduta refugees’ camps, Nengo, and then links with Kibondo – Kakonko road at Kilemba village.	62.5	88.4
	b	Kibondo Town Link Road	25.9	

This document presents an Environmental and Social Impact Assessment (ESIA) for the following road section: Kasulu - Manyovu section (47.9km), Kasulu Western Bypass (13.1km), Kasulu Southern Link (7.9km), and Kasulu Eastern Bypass (12.4km)

The main objective of the ESIA was to predict and forestall potential environmental and social impacts and propose mitigation measures to lessen any impacts to the environment and indigenous people in project’s area of influence that may arise from the upgrading of the road. This is to ensure that the project delivers minimum disruption to the environment.

The proposed upgrading of Kasulu – Manyovu road will:

- Facilitate more efficient transportation of agricultural products from the project area to markets in the areas of consumption
- Facilitate/ increase tourism activities within the project areas as well as adjoining areas
- Reduce maintenance costs of the road
- Reduce Vehicles Operating Costs
- Improve access to social services such as markets and health services
- Improve the management and transport of tourists to Gombe National Park, Moyowosi Game Reserve and Makere forest reserves

- Complement the on-going effort by the government to upgrade Kidahwe – Kasulu road section (50km) and Kasulu – Nyakanazi sections (202km) to bitumen standard.
- Form an important link between Tanzania, Burundi, Rwanda, and Democratic Republic of Congo (DRC) for imports and exports of goods.

DESCRIPTION OF THE PROPOSED PROJECT

The proposed project is located in Kasulu and Buhigwe Districts in Kigoma region in the western zone of Tanzania and will comprise construction of the following sections of the roads:

- Kasulu - Manyovu section (47.9km): Starts off at Kasulu T-junction and ends at the Munanila roundabout village in Manyovu Division
- Kasulu Western Bypass (13.1km): Starts off at Kidiana village, about 400m from R.Bogwe and ends at the junction to Tulieni Jangwani primary school, Herujuu village, along Kasulu – Manyovu road
- Kasulu Southern Link (7.9km): starts off at the junction to Baraka Secondary school, along Kigoma – Kasulu road and ends at the end of Kasulu roundabout – Manyovu road section
- Kasulu Eastern Bypass (12.4km): starts off at Nyumbigwa village, at the junction to Baraka Secondary school, along Kigoma – Kasulu road and ends about 150m from R.Ruchugi, at Kidiana village, along Kasulu – Kibondo road section

The road upgrading will constitute widening, realignment and paving of the existing earth/gravel road surface by Asphalt Concrete. A total of twelve (12) box culverts and nine ninety eight (98) pipe culverts will be constructed.

The road upgrading will also involve improving safety on various sections of the road with infringed sight distance which are prone to accidents. A total of seven climbing lanes will be constructed at areas with high slopes.

The road upgrading will also involve construction of lined and non-lined side ditches/drains as required.

PROJECT STAKEHOLDERS AND THEIR INVOLVEMENT

Project Stakeholders

The key environmental assessment and monitoring agencies in this project include the following stakeholders:

- African Development bank
- East Africa Community
- Ministry of Works, Transport, and Communication
- Ministry of Natural Resources and Tourism
- Tanzania National Roads Agency
- Vice President's Office - Minister responsible for environment
- National Environment Management Council
- Kasulu and Buhigwe District Councils
- Communities along the project road

Involvement of Stakeholders

Consultation with statutory bodies and institutions were made through direct personal interviews, while the public was consulted through public meetings which were conducted at selected villages. The main objectives of community consultations were to:

- Present the project
- Provide clear and accurate information about the project to the communities along the proposed road
- Obtain main concerns and perceptions of the population and their representatives regarding the road;
- To obtain opinions and suggestions directly from the affected communities on their preferred mitigation measures

Results of Public Consultation

Although the consulted stakeholders are in favour of the proposed project, they had the following concerns:

- The project will create direct and indirect employment to the local people. During recruitment of workers, especially unskilled and semi-skilled labour, priority should be given to the local people. The project will also create petty to youths and women through selling of food, drinks, and other necessities. Upgrading of the road will cause increased agricultural production because of improved access to better prices for agricultural inputs as well as improved access to markets and better prices agricultural produce
- Upgrading of the road will improve access to social services such as health and market services on time and at reasonable cost.
- Upgrading of the road improve transportation services by shortening travel time and costs
- Upgrading of the road will raise household income and standard of living as the number of buyers and so price of agricultural produce will increase
- Upgrading of the road will attract investors to invest their capital, technology and skills in in the project area
- Major sources of domestic water supply to villages along the project road are pipe water from gravity schemes, boreholes with hand pumps, and open traditional wells. Some of these water supply utilities, in particular domestic points, main and distribution pipe lines, and boreholes either cross or are located very close to the road. There therefore likely to be disrupted by road construction activities. To mitigate the impact, the Contractor should work careful so as avoid damaging the utilities. Utilities that will be damaged by construction activities should be compensated by the project accordingly
- Significant vegetation along the project road consists of privately owned exotic trees. Some of these trees are likely to be cleared by construction activities as they are located very close to the road.
- The road upgrading will cause displacement and loss of public and private properties in the form of buildings and farmland along the road. Construction activities should be done in a manner that minimizes impacts to government and private properties.
- The project will open up the project area by enhancing socio-economic development

- The project should consider providing a parking area for truck given the fact that the project road is a trunk road.
- Upgrading of the road is likely to increase the rate of crimes (by robbers and bandits) because of increased interaction between people from neighbouring countries unless precaution measures are taken.
- Construction activities are likely to trigger child labour
- The project is likely increase the spread of sexually transmitted diseases such as HIV/AIDS. To mitigate the impact, the project should plan and implement HIV alleviation interventions
- Upgrading of the road is likely cause increase in infectious diseases and accidents which is likely to overload existing medical facilities. Existing medical services should be strengthened.
- Upgrading of the road is likely to increase traffic accidents involving pedestrians and vehicles, especially at village centres because people are not familiar with road signs.
- Upgrading of the road will improve/ increase social and financial services and infrastructures. It will influence investors to invest in banks, hotels, restaurants, insurances services, etc.
- The road project is likely to cause family instability because project workers tend to seduce local women for sex
- Communities are worried that compensation is not likely to be fair.
- Compensation exercise should be done in a participatory manner where all family members are aware of their entitlements of the affected properties in order to avoid misuse of the money and family conflicts
- Adequate time should be given for the PAPs for relocation
- There was a concern on the indecisive tendency by the government whereby people are informed of the project but the project takes very long to get implemented. This has retarded of people residing along the project as they find it difficult to improve their structures or expand their businesses. They can't also plant crops in their field. The communities are keen to know when the project will be implemented.
- Villagers requested the government to consider compensation of properties within 45m RoW
- Construction activities will increase unplanned and early pregnancy cases, especially to school girls because their lusts they tend to date project workers.
- Owners of exotic trees along the road wanted to know whether they are entitled for compensation

DESCRIPTION OF MAJOR SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Creation of Employment: Construction activities will create direct and indirect employment to the local as well as people from other places. Direct employment will be in the form of skilled labourers as well as non-skilled labourers, while indirect employment will include employment of food vendors (especially women) and other small businesses like soft drinks.

Improved ambient Air Quality: During the operation phase of the project, dust generation will be very low. The only source of deterioration of ambient air quality will be emission due to exhaust fumes from traffic.

Improved Hydrology and Drainage: Upgrading of the road, in particular construction of new side and cross drainages structures will improve the drainage of the existing road. Sedimentation of culverts and road side drains will be reduced due to provision control devices and cover vegetation. Water stagnation within and on roadsides will be eliminated.

Reduction of vehicle operating Costs: Upgrading of the road to bitumen standard will prevent unnecessary breakdowns of vehicles resulting from corrugations. The bitumen road will enable vehicles to travel at relatively higher, resulting into serving in mileage per litre of fuel and so reduced operating costs.

Reduced Rate of Energy Consumption: Reduced consumption of fuel due to improved road will lead to reduced rate of energy consumption (in the form of fuel) for vehicles operating on the roadway and so serving in national foreign currency spent on imported fuel.

Reduction in Travel Time and Comfort to Passengers: The bitumen road will reduce travel as vehicles will be able to travel faster. The served travel time could be used to other productive ventures. In addition, the paved road will make travelling comfortable because of the absence of corrugations and the fact that better passenger buses will be plying the routes.

Diversification of the Local Economy: Upgrading of the project road will attract more investors in the project area. The increased investment will bring in more employment opportunities to the local people including diversification of economic activities hence, reduce dependence on agriculture only.

Improved access to social services: The improved road will enable easy access to social services like modern health facilities, market, and schools. In addition, improved road will attract technocrats to service the project area because of reliable transport.

Increased interaction of people drive for social change: The paved road will encourage people from other parts of the country to live in the area. In migrants will come with new ideas into the project area. Such opportunity will create room for social transformation for both groups, share values, and adopt new cultures and diffusion of cultural values suitable for development.

Increased investment: The paved road will attract investors to invest in agriculture and forestry sectors. The investment will have a multiplier effect on the availability of other services such as guest houses, schools and medical services.

Reduced Transport and Transportation Costs: As upgrading of the road will reduce operating costs of bus operators, the costs of transport and transportation between villages along the project road are expected to be substantially low.

Increased household income: The paved road will increase trading activities along the road, thereby increasing the income of households along the road as customers are likely to increase.

Improved Access to Market and Increased Agricultural Production and Productivity: Upgrading of the road will enable local people to find more paying markets outside the area. For this reason they can sell agricultural produce at better prices and increase household income and therefore enable them to afford other basic needs. In addition, upgrading of the road will lead to increase in agricultural production and productivity because famers will have better access to farm inputs by the local traders.

Improvement of Tourism Industry: Upgrading of this road will influence the increase in tourist activities in the road impact area, particularly in Gombe National Park, Moyowosi Game Reserve, and Makere Forest Reserve.

Improved growth of vegetation due to reduced generation of Dust: Improved air quality due to reduced generation of dust (which is currently causing stunted growth of vegetation) will improve the growth of vegetation because the photosynthesis of vegetation will no longer be impaired by dust.

Complementation of other Development Initiatives: Upgrading of the road will flatter the on-going initiatives by the government to upgrade the following road sections Kidahwe – Nyumbigwa, Nyakanazi – Kabingo, and Kabingo – Kasulu. In addition, the project will augment the initiative by the government of Burundi to connect Tanzania with Burundi through rehabilitation and upgrading of the following road sections: Mugina – Mabanda, Mabanda – Nyanza Lac, Nyanza – Lac – Rumonge, and Rumonge – Bujumbura.

The proposed construction of One Stop Border Post facilities at Munanira (Tanzania border) and Mugina (Burundian border) will even augment the proposed road upgrading as it will reduce the time during border crossing.

Loss of Vegetation and Farmland: This will arise from clearance of land needed for the permanent works (due widening and realignment of existing road) and for temporary use during establishment camps, borrowing of materials, construction of detours or access roads, widening realignment of the existing road, etc. To mitigate the impact, the Contractor shall avoid unnecessary clearing of vegetation, including limiting clearing of vegetation to the corridor of impact. Owners of exotic tree strip forest within RoW shall be advised to harvest them before commencement. In addition, the Owners of farmlands affected by construction works shall be compensated accordingly.

Soil erosion: Clearing of vegetation during establishment of camp, construction of diversion and access roads and earthworks will remove and disturb top soil, leaving behind loose, but infertile soil, which is too poor to sustain good plant growth and susceptible to wind and water erosion, especially in hill sections. In addition cuts and fills will be prone to formation of gullies. The impact shall be mitigated by proper design (providing for erosion prevention measures (including grassing and planting of trees) and maintenance during the operation phase of the road.

Deterioration of ambient air quality: During mobilization and construction deterioration of ambient air quality will result from generation of dust due increased volume and traffic movement, construction activities (extraction, transport, and stockpiling of materials, and processing of construction materials, earthworks, etc.). Deterioration of air quality will also result from emissions of exhaust and bituminous fumes from construction equipment, and processing and application of bitumen products. The impact shall be mitigated by spraying water on diversion along active construction sites and settlements, covering trucks transporting dusty materials with tarpaulin, and equipping workers with respirators. During operation phase of the road, deterioration of ambient air quality will result from increased traffic emissions from diverted and generated traffic. Mitigation of the impact will requires effort by government to encourage proper maintenance of emission control systems, use of fuel-efficient (low carbon) vehicles, or zero carbon vehicles, and introduction of carbon taxing on diesel engine vehicles.

Risk of Road Traffic Accidents: During construction, increased traffic movements and speeds, especially across settlements will increase the risk of traffic accidents. Similarly, during

operation increased traffic volume and speeds of the improved road is likely to increase road traffic accidents, including road kills. The impact shall be mitigated by installing speed humps and posting warning signs across and at approaches to accident black spots.

Deterioration of Visual Scenic Quality: Earthworks, excavation of borrow pits, clearing of vegetation, and improper disposal of wastes generated by construction activities will deteriorate visual and scenic quality. In addition, cuts of hills and borrow pits, especially if located near settlements will also deteriorate visual and scenic quality.

Dust generation by increased traffic and movement of construction equipment will also impair visual quality. The dust generated will also deteriorate scenic quality due to discolouration of vegetation and buildings along the road.

The impact due to accumulation of material and wastes shall be mitigated by having an environmental friendly waste management plan, while that due to borrow pits shall be mitigated by avoidance of locating borrow pits near settlements and reinstating them immediately after their use. The impact due to dust shall be mitigated by suppressing dust generation by among others spraying water on the diversion and other work sites.

Generation of Noise and Vibrations: During construction generation of noise and vibrations will result from borrowing/ processing of materials (e.g. excavation, drilling, and blasting of rocks, crushing of stones), increased traffic volume and movement of equipment during transport of materials, earthworks (including excavation and compaction).

During the operation of the road increased traffic volume from diverted and generated traffic will increase the level of noise and vibrations.

The impact due to increased level of noise and vibrations during construction shall be mitigated by ensuring adequate maintenance of the vehicles, including proper fine tuning of engines, equipping equipment with exhaust mufflers, and avoiding construction works in settlement areas during the night. In addition, construction workers working under severe noise environment shall be equipped with ear plugs. The impact of noise and vibrations during the operation phase of the project cannot be mitigated at the project level.

Risks of accidents to animals and humans: Increased traffic volume and speeds and construction activities during construction are likely to cause accidents to workers and the local people. Unreinstated borrow pits are also likely to cause accidents to livestock and humans by accidental falling in or when became filled with rainwater. During operation, traffic accidents, including road accidents are likely to increase due to increased traffic volume and speeds. To mitigate the impact, the maximum depth of borrow pits shall be 3m, all borrow pits shall be kept self-draining to prevent rainwater water ponding, borrow pits shall be reinstated immediately after completion of their use. Accidents during operation of the road shall be mitigated by posting speed limits and installing speed humps with warning signs at settlements.

Impact Related to Stone Quarrying and Crushing: Potential impacts with blasting and crushing of rocks during quarrying will include dust generation, safety (of workers due to fly rocks accidents during blasting), noise and vibrations, explosive detonation effects on people. The impact shall be mitigated by storage of explosives in accordance with the law, marking drilling, and blasting with flags, and limiting blasting between 08:00 hrs and 16:00 hrs.

Displacement and Loss of Properties: Loss of properties (structures and land) and displacement will result from land acquisition to widen and realign the existing road, borrowing of naturally occurring construction materials, and construction of camps. To mitigate the impact, owners of

affected properties, including exotic strip tree forest shall be compensated in accordance with the law.

Disruption of Public Utilities: Domestic water supply utilities consisting of pipe lines and boreholes with hand pumps and fibre optic cable (telecommunications utility) along and across the project road are likely to be disrupted during the road upgrading. To mitigate the impact, the contractors shall work carefully and closely with District Water Engineer to establish locations of these utilities and work carefully to prevent their damage. In addition, service ducts shall be installed across the road to allow crossing and future extension of domestic water supply system.

Generation of wastes: Construction activities at the sites and the camps will generate substantial amount and types of wastes: solid wastes such as plastic containers, used tyres, metal parts, plastic and cable, batteries, and liquid wastes such as used motor oil, sanitary wastes, and medical wastes. These wastes if not treated or disposed of properly, they are likely to cause occupational health problems to workers, cause contamination of ground and water resources, and impair scenic quality. To mitigate the impacts, the Contractor shall comply with waste treatment and disposal programme provided in the environmental and management plan of this report.

Increased Consumption of Energy and Natural Resources: During construction, increased energy consumption will be in the form of fuel and lubricants for the operation of construction equipment. Increased pressure on natural resources will be due to increased consumption of natural resources in the form of fuel wood and charcoal. The impact shall be mitigated by limiting unnecessary idling of construction equipment and adequately tuning of engines. In addition, under any circumstance the Contractor shall not be allowed to use firewood and charcoal for boiling of bitumen, cooking, and making marker pegs.

Resources Use Conflict: This will result from sharing of social services, in particular water resources for domestic and construction works. The use of water in particular seasonal ones for construction works; especially during dry season when their flows are low, will reduce the quantity of water for domestic purposes, and so create conflicts between Contractors and the local communities. The impact shall be mitigated by avoiding sitting camps in the neighbourhood of village settlements and ensuring that camps are furnished with all the necessary social services to minimize interactions of the workers with the local people. In addition, the Contractor shall not use water resources that are used by the local people for domestic purposes.

Reduction in Rivers Flows: Abstraction of water from seasonal rivers in particular R.Bogwe which is used by locals for gardening will reduce discharges of the river and so availability of water for gardening. To mitigate the impact, the Contractor shall not abstract water from R.Bogwe for construction works.

Soil and water pollution by concrete slurry, concrete, and sedimentation: Potential sources of soil pollution are concrete and concrete slurry, fuel, and oil. Soil pollution will impair regeneration of vegetation. Sources of water pollution will consist of wet cement and concrete products, fuel, oil, sediments etc. If wet concrete product, fuel, and oil find their way into rivers they may cause serious damage. Cement contains lime which is very detrimental to plants and fishes. In addition, deposition of concrete and fine sediments into rivers will also affect fish and their habitat. Fuel and oil will reduce dissolved oxygen in rivers.

Water pollution shall be mitigated by preventing entrance of wet cement and concrete products, oil, and fuel into storm water, putting in place concrete slurry control before concreting is

started, and diverting of concrete slurry by sandbags, soil, or other materials to grassed area or bare ground.

Disruption of community access: Construction of road side drain will create barrier for community access to their residence and business areas. The impact shall be mitigated by providing temporary pedestrian crossing across line drain during construction and permanent ones when the road is completed.

Health problems associated with cement and its wet products: Construction activities involving the use of cement will expose workers to upper tract infection due to inhaling cement dust and skin infection due to prolonged contact with cement. Measures to mitigate the impact shall include personal protection (use of appropriate protection gear), safe handling, and storage, control of exposure to the material exposure control, and first aid measures.

Health problems associated with Hydrated Lime: The use of hydrated lime to stabilize naturally occurring materials will expose workers to following health problems: severe irritation or burning of eyes, including permanent damage, skin irritation, severe irritation of gastrointestinal tract if swallowed, severe irritation of the respiratory system if inhaled. Hydrated lime can also be carcinogenic as may contain trace amounts of crystalline silica in the form of quartz or crystallite. Inhalation of silica can also cause a chronic lung disorder (silicosis). Measures to mitigate the impact include personal protection (use of appropriate protection gear), safe handling, and storage, control of exposure to the material exposure control, and first aid measures. Details of these are included in Environmental and Social Management Plan of this document

Fire and Explosion Risks: Operations of Contractor's camp and other construction activities, which will use flammable liquids (petrol, solvents, etc.) and compressed gases (e.g. oxy-acetylene gases) poses a risk of fire or explosion. To mitigate the impact safe working environment shall be exercised, by maintaining fire extinguishers within easy access of all work areas, and prohibiting smoking in hot work areas

Triggering of child Labour and School Dropouts: Availability of employment from construction activities will tempt school children to abstain from school in search of unskilled job resulting into decline in the quality of education. To mitigate the impact the Contractor shall not employ people under the age of 18 years.

Occupational Health and safety Hazards: Construction activities will expose workers to different chemical health hazards, physical health hazards, and biological health hazards. Physical hazards will include fall from height or being hit by falling object. Chemical health hazards will result from exposure of workers to hazardous construction materials, while physical health hazards will result from general work environment (noise, vibrations, manual handling, fall from height, stepping on or striking against objects, and manual handling injury, and workers being hit by excavating or crane machinery). Biological health hazard will result from drinking unsafe water and food poisoning, and unsafe disposal of sanitary wastes. To mitigate the impacts, detailed measures have been proposed to prevent physical, chemical, and biological health hazards during construction of the road, which include work practice, personal protection, and hygiene.

Increased transmission of HIV/AIDS: During construction, interaction between the immigrant workers and the locals may exacerbate the spread of HIV/AIDS and other sexually transmitted infections. To mitigate the impact, the Contractors shall subcontract NGOs to prepare and implement a HIV/ AIDS awareness campaign.

Increased and unwanted pregnancies: Increased and unwanted pregnancies especially among school girls as project workers could easily entice school girls with money in return for sexual relationships. The impact cannot be mitigated at the project level.

Increased costs of Living: Upgrading of the road is likely to increase prices of cereal crops, which might not be affordable by for some local people. The impact cannot be mitigated at the project level.

Increased Rate of Crime: Upgrading of the road will attract advanced criminals activities as they will be able to move faster, making the life of locals in danger. The impact cannot be mitigated at the project level.

Reduced Economic Activities at the Closure of Project: Closure of the project will make trading activities induced by project activities come to halt, which will affect the livelihood of traders. The impact cannot be mitigated at the project level.

Contribution to Climate Change: Increased traffic volume from diverted and generated traffic will increase the generation of greenhouse gases, the result of which will be increased contribution of greenhouse effect. The impact cannot be mitigated at the project level.

Contribution to Depletion of Ozone Layer: Increased generation of greenhouse gases will increases contribution to depletion of ozone layer. The impact cannot be mitigated at the project level.

Reduced Span of the Road due to Climate Change: Variations of temperatures resulting from global warming are likely to cause bleeding of bitumen and premature failures of hydraulic structures due to cracking. In addition, flooding resulting from global warming may cause serious damage or overtopping of structures. To mitigate the impact, appropriate type of cutback bitumen that that sustains higher temperatures of the project area have been proposed and return period of 100 years have been considered in the design of hydraulic structures.

Fragmentation of Settlements and Impaired Safety of Pedestrians: Cuts across hills if located at settlements tend to fragment the two sides of the road as they create barrier. The impacts of cuts are increased travel time for locals to their dwellings and business areas, and increase the risk of road traffic accidents especially to pedestrians. The impact will be mitigated by installing speed humps and warning signs.

ALTERNATIVES CONSIDERED

Two alternatives have been identified as follows:

No Go, Zero, or Base Alternative: This refers to the alternative of not embarking the proposed road rehabilitation at all. This alternative would imply that the current status quo without the proposed road construction would continue.

Design Alternatives: Design alternatives has considered pavement option in terms of sub-base, base course, and wearing course. Two pavement improvement options have been considered as follows:

- Alternative 1 (ALT1): Upgrading to AC surface, with paved shoulder, Dense Bituminous Macadam (DBM) base layer, and Cemented Material (CM) sub-base material
- Alternative 2 (ALT2): Upgrading to AC surface, with paved shoulder, Crushed Rock (CRR) base layer, and Cemented Material (C1) sub-base material

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Environmental and Social Management Plan (ESMP) intends to set forth “environmental and social conditions” that the project proponent shall adhere to. It aims at ensuring effective implementation of the proposed mitigation measures. The following will be responsible for implementing the ESMP:

TANROADS

TANROADS will be responsible for the overall implementation, administration, and enforcement of the recommendations of the ESIA, including:

- Ensure that the ESMP provisions are included in all tender documents issued for construction work and activities on site and shall monitor/enforce that the Contractors abide by the specifications thereof
- Coordinating the implementation of the ESMP by the contractor
- Provide NEMC with reports on environmental and social compliance as part of their annual progress reports and annual environmental monitoring reports.

Supervising Engineer

The supervising Consultant will be responsible for overall project management. The Consultant will be responsible for ensuring day to day implementation and compliance with the portions of ESMP. The Engineer will ensure that the Contractors provide appropriate training for their staff on ESMP.

Contractor

The contractor will ensure the control and limitations of disturbance to the project site, routes, and its surrounding environment and communities during the construction cycle of the project.

Within 60 days upon notification of contract award, the contractor shall prepare and submit Site Specific Environmental and Social Management Plan (SSESMP) and Health and Safety Plan (SSHSM). The plan shall describe measures to be followed to protect the environment, public, local communities, workers, and ecological habitat in proximity to the project working areas.

National Environment Management Council

NEMC is the main responsible agency for foreseeing development projects carried out in the United Republic of Tanzania adequately address environmental and social issues during the lifetime of the program. NEMC shall therefore:

- Periodically carry out or assign an independent evaluator to carry out compliance monitoring in cases when claim has been raised from any member of the community, Community Based Organization, or Non-Governmental Organization on the negative aspects of the project. During monitoring, District Environmental Officer shall accompany NEMC or an independent evaluator.
- Have the power to request for compliance report on ESMP and take necessary measures including fines to enforce compliance of the ESMP

ENVIRONMENTAL AND SOCIAL MONITORING PLAN

Environmental and Social Monitoring Plan is an objective, periodical, reliable, and continuing process of observation and assessment of environmental changes. It is intended to ensure

implementation of mitigation measures is done the way they have been proposed and in accordance with the regulations and standards. It is therefore based on monitoring indicators, which will have to be compared with targets to gauge the effectiveness of the mitigations plans.

There will be two basic forms of monitoring as follows:

Effects monitoring: This will record the consequences of activities on one or more environmental components. This will involve physical measurement of selected parameters or the execution of surveys to establish the nature and extent of induced changes.

Measurement Based Inspection: This will involve evaluation of trends in the values of environmental and social parameters systematically measured and collected, to ensure that they are within acceptable legal and technical standards. This will involve collection of samples for analysis. In this, water and air samples will be collected and analysed.

The main tools that will be used for monitoring are checklists, visual examinations, and quantitative measurements of environmental effects monitoring parameters. Written records will be kept detailing the dates that monitoring took place and the findings of the monitoring.

To ensure effective implementation of the mitigations measures, the Engineer shall deploy an Environmental and Social Specialist for regular monitoring and reporting of day to day implementation of ESMP by the Contractor. The Environmental and Social Specialist will also advise the Resident Engineer on measures to take against the Contractor in the event that the Contractor fails to comply with SSHSMP and SSESMP as well as other environmental, social, and health and safety requirements of the Contract.

CONCLUSION AND RECOMMENDATIONS

Upgrading of Kasulu - Manyovu road to bitumen standard is economically and socially viable as it will enhance social and economic integration of the entire southern regions of Tanzania, which currently is very difficult to exploit especially during rain seasons due to its poor road.

The project will have both positive and negative impact to the environment and the local communities along it. Measures have been proposed to enhance impacts which are positive to the environment and the local people. For those impacts that are negative, mitigation measures have been proposed to avoid or abate them to the extent possible for the purpose of maximizing benefits of the road project and minimizing detriments of the project intervention to the communities.

The total cost for implementing mitigation measures as well as monitoring, including the cost of compensation of building, but not crops is **TZS 6,850,749,086/= (TZS Six billion, Eight hundred fifty million, Seven hundred forty eight thousand, eighty six only)**

SECTION 1: INTRODUCTION

1.1 BACKGROUND INFORMATION

The Government of the United Republic of Tanzania with the assistance from African Development Bank (AfDB) intends to upgrade/ construct Nyakanazi – Kasulu – Manyovu road section (291km) to bitumen Standard.

The project is being implemented by East Africa Community (EAC) through Tanzania Roads Agency (TANROADS). TANROADS is an Executive Agency under the Ministry of Works, Transport, and Communication; established under the Executive Agencies Act in 2000, with the duty of maintaining and developing trunk and regional road network in Tanzania Mainland.

EGIS International has been commissioned to carry out Feasibility Study, Preliminary Design, and Environmental and Social Impact Assessment, for the upgrading of Kasulu – Manyovu road.

Given the fact that Kasulu – Kibondo – Nyakanazi road section has an ESIA clearance certificate, the scope of this ESIA was limited to the following road sections: Kasulu roundabout – Manyovu Road section, Kasulu Southern Link, Kasulu Western Bypass, and Kasulu Eastern Bypass Road.

The proposed road upgrading will be split into four lots (Contracts) as indicated in the schedule below:

Contract No	Section	Road Section	Length	Total Contract Length
01	a	Kasulu roundabout – Manyovu: The road section starts off at Kasulu T-junction; the point where Kibondo – Kasulu road links with Kasulu – Manyovu and Kasulu – Kigoma roads and ends at Munanila village (Manyovu) roundabout	47.9	77.6
	b	Kasulu Southern Link Road: Starts off at the junction to Baraka Secondary school, along Kigoma – Kasulu road and ends at the end of Kasulu roundabout – Manyovu road section	7.9	
	c	Kasulu North Link Road: Starts off at the Kasulu T-junction; the point where Kibondo – Kasulu road links with Kasulu – Manyovu and Kasulu – Kigoma roads, and ends at Kidiana village, about 400m before R.Bogwe, along Kasulu – Kibondo Road	8.7	
	d	Western Bypass Road: Starts off at Kidiana village, about 400m before R.Bogwe and ends at the junction to Tulieni Jangwani primary school, Herujuu village, along Kasulu – Manyovu road	13.1	

Contract No	Section	Road Section	Length	Total Contract Length
02	a	Kanyani (along Kigoma - Kasulu road) – Mvugwe village: The road links with Kasulu – Kibondo road at Kidiana village, about 150 before R.Ruchugi. Kasulu western bypass road (12.7) km forms part of this road section.	70.5	70.5
03		Mvugwe – Nduta Junction	59.35	59.35
04	a	Nduta Junction – Kabingo: The road starts of at Nduta junction, and then traverses Nduta refugees’ camps, Nengo, and then links with Kibondo – Kakonko road at Kilemba village.	62.5	88.4
	b	Kibondo Town Link Road	25.9	

This document therefore presents an Environmental and Social Impact Assessment (ESIA) for the majority of Contract 1, and Part of Contract 2, i.e. Kasulu - Manyovu section (47.9km), Kasulu Western Bypass (13.1km), Kasulu Southern Link (7.9km), and Kasulu Eastern Bypass (12.4km)

1.2 OBJECTIVES OF THE STUDY

The objective of the study was to carry out an Environmental and Social Impact Assessment, the purpose of which is to incorporate environmental and social considerations into design of the roads. The main objective of the ESIA was to predict and forestall potential environmental and social impacts and propose mitigation measures to lessen any impacts to the environment and indigenous people in project’s area of influence that may arise from the road upgrading. This is to ensure that the project delivers minimum disruption to the environment and surrounding communities.

Specifically, the objectives of this study were:

- To establish physical, biological, socio-economic conditions of the project area
- To predict any adverse (negative) and/or beneficial (positive) environmental and social impacts associated with the road upgrading.
- To propose appropriate mitigation measures and recommend ways in which proposed mitigation measures could be incorporated into the designs.
- To provide cost estimates required to cover the proposed mitigation measures
- To provide environmental and social management and monitoring plans

1.3 APPROACH AND METHODOLOGY

1.3.1 Approach

The ESIA has been carried out in accordance with National Environment Management Council (NEMC) Environmental and Social Assessment Guidelines, Tanzania’s Environmental Management Act (2004), ESIA and Audit Regulations (2005), and Environmental Guidelines of the road sector, as well the Terms of Reference which are appended as Appendix III.

In accordance with Tanzanian Environmental Impact Assessment and Audit (2005) regulations, the proposed project is classified as Type A project, which requires a full Environmental Impact Assessment.

The Environmental Experts approach in the study has been to divide the project's area into Direct Impact Zone (DIZ) and the Area of Influence (AI). The Direct Impact Zone is the area that will be immediately and directly affected by the actions undertaken during the construction phase and post-construction phase of the project. This area includes the site itself, underneath crust and marginal zones up to 100m on both sides of the centreline of the road. It also includes earmarked naturally occurring material borrow areas (borrow pits, quarries, sand pits, contractors campsites, and equipment /materials storage areas. The 100m has been chosen to accommodate/give allowance for establishment of material borrow areas, contractor's campsites or materials storage yard close to the road alignment.

The DIZ was determined on the basis of the following factors:

- The distance of travel of noise, dust, vibrations and exhaust fumes from construction plants and machinery from the site boundary
- Marginal zones and developments from the site within 100m as it is within this distance that impacts are likely to be felt

The AI is the area beyond the DIZ where most of the environmental impacts will be induced or influenced by the project activities. It is not subject to direct contact with the site, but is directly or indirectly affected by the presence of the proposed road. Areas around sources of naturally-occurring construction materials are also considered as areas of influence. Villages that are linked to the project road through village roads are also considered to be the areas of influence.

1.3.2 Methodology

The Consultant's first approach in this study was to register the project with National Environment Management Council (NEMC) for Environmental Impact Assessment (ESIA). The project was registered on 30th November 2016 with a registration No. 6563.

The project was then screened by NEMC to determine whether it requires an ESIA or not. Following receipt of decision by NEMC on 25th January 2017 that the project requires a full ESIA, the project registration was followed by scoping exercise.

Scoping is a process in the ESIA which identifies issues that are likely to be of most importance during the ESIA and eliminates those that are of little concern in order to focus the ESIA study on the significant effects and so ensure time and money are not wasted on unnecessary investigations. The scoping process enabled the expert to develop the terms of reference for detailed ESIA. The scoping report and terms of reference were reviewed by NEMC and found to be adequate and approved on 3rd April 2017. The approved terms of reference and approval letter are attached as Appendix III. The scoping process was followed by detailed ESIA study which involved desk work and field surveys.

In order to identify and understand the environmental and social issues adequately, the ESIA experts used different methods in collecting qualitative and quantitative data. This included reviewing some literatures, site observation, public consultation meetings, and face to face interviews with key informants as described hereupon.

1.3.2.1 Deskwork

During the ESIA study, a number of relevant documents were collected and detailed reviews of important secondary data were carried out. The documents review included the following: Socio-economic profile report for Buhigwe and Kasulu Districts, policies related to environment and socio-economic, legislations, and guidelines, topographic maps, geometric design reports and drawings, materials report, hydraulic and hydrological report, and economic evaluation of the project. During the desk review, important information was collected on project background, objectives, and design of the proposed project. This gave the experts additional information about the project and the scope of work. Information obtained from desk review further contributed to the improvement of data collection tools.

1.3.2.2 Consultation

The study was conducted in a participatory and consultative manner in order to gather compressive information appropriate to the study.

Face Interviews with key informants

Interviews were conducted with relevant local government officials as well as governmental and non-governmental institutions that are interested or likely to be affected by the road upgrading. The interviews were aimed at gathering additional information with regard to current environmental and social profile as well as concerns related to possible impacts of the proposed road upgrading. The outputs of the interviews were identification of additional issues and impacts, which should be considered in the ESIA study.

Public Consultation

The experts conducted consultative meetings in sampled villages. The public meetings were attended by women, youth, old people, as well as children. The output of the meetings was identification of additional key issues pertaining to the road project including perceptions, knowledge, and attitudes of these communities.

1.3.2.3 Field Survey

The stakeholders' consultations were followed by project field visit, the purpose of which was to obtain detailed information about the project area to compliment information gathered during the interviews and meetings with stakeholders.

During the site visit, the ESIA experts took advantage of the knowledge of the local people to gather specific knowledge about the project site, such as presence and location of burial and cultural, and archaeological sites, concealed public services/utilities etc., that are likely to be affected by the road project.

1.3.2.4 Tools Used

During the study, the experts used the following tools:

- Topographic map sheets at a scale of 1:50,000 for characterization of environmental features of concerning along the project road as well as spatial analysis of the study area under ARCGIS 10.3 before being used as base maps in mapping and spatial analysis of spatial data
- Global Positioning System (GPS) instrument for locating and mapping of features of significant environmental and social interest that were encountered along the project road corridor.

- ExpertGPS software for downloading data from GPS instrument and converting to other formats for further processing.
- SPSS (Statistical Software for Social Scientist) for analysing socio-economic data

1.3.2.5 Data Processing and Analysis

Data obtained from participatory methods and tools were analysed during field work. Further analysis was made through comparison and cross-checking with relevant and dependent secondary sources within the respective study villages. The primary data from the questionnaires were analysed by using SPSS and Excel statistical software while other data were compiled manually

1.4 REPORT STRUCTURE

This report is divided into eleven Chapters, of which Section 1 introduces the report, followed by discussion of Policies, Legislation, and Institutional Frameworks that are relevant to the project in Section 2. Section 3 describes the project, including its justification. Section 3 is followed by baseline information in Section 4, whereby the existing environmental and social conditions of the project area are discussed in detail. Section 5 presents and analyses feasible alternatives that were considered to reach of the objective of the road project.

Although mitigation measures have been proposed to mitigate potential adverse impacts that would be caused by the project, not all the impacts can be fully mitigated. Residual effects will be therefore some residual effects that may arise as a consequence of the project after implementation of the mitigation measures. Section 8 discusses such residual effects and measures to management such residual effects.

Plans to manage and monitor proper implementation of the proposed mitigation measures are presented in 9.

During the ESIA study, a number of stakeholders were consulted to obtain views and opinions which should be considered in the preparation of this report. The synthesis of the views and opinions are presented in Chapter 10.

Finally Section 11 gives a conclusion and recommendations on the proposed project. The remaining part of the report presents a list of appendices, which consists of maps, photos, list of stakeholder that were consulted, including minutes of consultative meetings and Terms of Reference.

SECTION 2: POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

2.1 POLICIES AND STRATEGIES

2.1.1 National Environmental Policy, 1997

The National Environment Policy (NEP, 1997) is the main policy document governing environmental management in the country. The policy addresses environmental issues as both natural and social concerns, and adopts the key principle of sustainable development.

The policy requires ESIA to be mandatory for all development projects which are likely to have significant environmental impacts. The intention is to ensure that the development projects are implemented in an economically sustainable manner while safeguarding environmental and social issues for the benefit of the present and future generations.

Relevance to the Project

This ESIA has been carried out to fulfil the requirement of the policy, since the proposed road project is likely to have significant adverse impacts to the environment.

2.1.2 National Policy on HIV/AIDS, 2001

The policy formulation is the result of the Government's effort with technical support from the World Health Organization Global Programme on AIDS (WHO-GPA) that led to the establishment of National HIV/AIDS Control Programme (NACP) under the Ministry of Health. One of the government strategic initiatives is to establish Tanzania Commission for AIDS (TACAIDS) under the Prime Minister's Office. The Commission provides leadership and coordination of national multi-sectorial response to the HIV/AIDS epidemic. The management functions, institutional and organizational arrangement of TACAIDS are outlined in the National Policy.

The Policy identifies HIV/AIDS as a global disaster, hence requiring concerted and unprecedented initiative at local, national, and global levels. It recognizes HIV/AIDS as an impediment to development in all sectors, in terms of social and economic development with serious and direct implication on social services and welfare. Thus, the policy recognizes the linkage between poverty and HIV/AIDS, as the poor communities of the society are very vulnerable. The following objectives of the policy are relevant to the project:

- Prevention of transmission of HIV/AIDS;
- Enhance sectorial roles through participation and financial support;
- To identify human rights abuses in HIV/AIDS and to protect People Living with HIV & AIDS (PLHAs) and everyone else in society against all forms of discrimination and social injustice
- To provide appropriate effective treatment for opportunistic infections at all levels of the health care system
- Promote and participate in research on HIV/AIDS, including dissemination of scientific information and development of HIV vaccine;

- To work closely with the Ministry the Ministry of Home Affairs, NGOs and Faith Groups in the fight against drug substance abuse that increases the risk of HIV transmission

Relevance to the Project

During project implementation of the project influx of people in the project area will accelerate the spread of the disease. In order to contribute towards observing the objectives of the National Policy on HIV/AIDs, the project Contractor will be required to have HIV/AIDs programme aimed at promoting awareness of HIV/AIDs among its service providers and its employees, despite that the HIV/AIDs knowledge is known to most of people.

2.1.3 National Human Settlements Development Policy, 2000

The overall goal of the policy is to promote development of sustainable human settlement and to facilitate provision of adequate and affordable shelter to all people, including the poor. The policy outlines a number of objectives including the environmental protection within human settlement and protect natural ecosystem against pollution, degradation and destruction with the aim of attaining sustainable development.

The major issues in the policy include:

- Poor management of solid and liquid waste, leading into environmental deterioration
- Emission of noxious gases from vehicles and industrial activities as a major cause of air pollution in urban areas
- Encroachment into fragile and hazardous lands (river valleys, steep slopes, and marshlands leading into land degradation, pollution of water sources, etc.
- Increasing dependence on fuel wood and charcoal as a main source of energy in human settlements leading into depletion of forests, hence environmental deterioration and air pollution and
- Unauthorized sand mining in river valleys leading into environmental hazards

Relevance to the Project

The policy is relevant to the project since during construction of the road solid and liquid wastes will be likely to be generated. During construction, residents living in the neighbourhood of the project are likely to be affected due to deterioration of ambient air quality by smokes and dust due to increased movement of construction machinery and equipment; and vehicles. Improved accessibility to forests is likely to increase due to improved road and hence increased harvesting of trees for firewood, charcoal, and timber production. The Contractor shall ensure that:

- Wood is not used as his source of energy
- Sand is not sourced from river valleys
- Minimum distance from material borrow areas is 100m
- Erosion control measures are in place during construction
- Solid and liquid waste generated by the project are managed in accordance with legislations
- As much as practical, emissions of noxious gases are minimized.

2.1.4 National Land Policy, 1995 (Revised in 1997)

The National Land Policy recognizes the need for protecting environmentally sensitive areas. The policy emphasises on the protection of environment and natural ecosystems from pollution, degradation, and physical destruction.

In addition, the policy recognizes the importance of social services such as water, roads, energy, and solid waste management for environmental protection. Finally, the policy identifies the need for conservation and preservation of prehistoric/ historic sites and buildings.

Relevance to the Project

During construction different types of wastes will be generated, water utilities across and within the RoW are likely to be disrupted.

- All Contractors will have the obligation to manage wastes in accordance with Environmental and Social Management Plan.
- Disrupted water supply utilities shall be reinstated by the Contractors accordingly.

2.1.5 National Water Policy, 2002

The policy objective is to develop a comprehensive framework for sustainable management of the national water resources. In this case the policy recognizes the need to protect water sources against pollution and environmental degradation.

The policy recognizes the role of road transport system as one of the effective tool in the implementation of water resource management activities.

Relevance to the Project

The project are has water scarcity. Degradation of scarce water sources will have serious impact to the communities. During construction the Contractor shall ensure construction activities do not cause pollution of water source.

2.1.6 National Forest Policy, 1998

This policy demarcates and reserves in perpetuity for the benefit of the present and future inhabitants, sufficient forested land and land capable of forestation, to ensure environmental stability and maintenance of the ecological balance including atmosphere equilibrium which is vital for sustenance of all life forms, human, animal and plant. With regards to ESIA, the policy calls for environmental assessment of any investment which would convert forest land to other land use or may cause potential damage to forest environment. Road construction is identified as a relevant development activity under this policy.

Relevance to the Project

Upgrading of the road is likely to cause clearing trees from exotic tree forests that are located along the project road.

2.1.7 National Gender Policy, (1992), Revised in 2002

The objective of this policy is to provide guidelines to ensure gender sensitive plans, programmes, and strategies in all sectors and institutions. The policy gives emphasis on gender equality. The policy aims at establishing strategies on poverty eradication through ensuring that

both women and men get access to existing resources for their development. It values the role played by both men and women in bringing about development in the society. The road sector is also highly committed to gender mainstreaming at all levels, through provision of equal opportunities to both men and women in road works and related activities.

The policy:

- Calls for equal opportunity for all to participate and implement development activities without gender bias, including sex.
- Identifies environmental degradation as one of the major factors that increase burden to women, especially in rural areas, where women walk long distances to fetch water and fuel wood.

The policy requires the project management to ensure that gender issues are given emphasis. It also requires that women and men are given equal employment opportunities in the project, whenever possible.

During construction, the contractor will have the obligation to ensure that as much as possible men and women are given equal opportunities during recruitment of construction workers.

2.1.8 National Transport Policy, 2003

The National Transport Policy aims at enhancing transport safety and environmental protection, through taking steps to review and update national legislation in transport operations and safety requirements.

The policy has seven objectives and goals, of which one is relevant to this project. The objective which is relevant to this project calls for sufficient emphasis on all aspect of environment protection and management at the design, development, and operation stages of transport infrastructure, to ensure sustainability.

Relevance to the Project

This ESIA has been carried out to fulfil the requirements of the policy.

2.1.9 National Strategy for Growth and Reduction of Poverty, 2003

The National Poverty Reduction Strategy (NPRS) is a national organizing framework for putting the focus on poverty reduction on the country's development agenda. The strategy emphasis is on the growth momentum to fast track the targets of vision 2025 for high and shared growth, high quality livelihood, piece, stability and unity, good governance, high quality education, and international competitiveness.

Among issues of the strategy aims that are relevant to this project are:

- Development of infrastructure such as roads
- Paying attention to mainstreaming cross-cutting issues such as environment, HIV/AIDS, gender, employment, and settlement

Relevance to the Project

The strategy is relevant to the project as follows:

- The project is in line with the interest of the strategy - to develop transport infrastructures
- The ESIA has been carried out to meet the concerns of the strategy.

- The fact that ESIA has been conducted for this projects shows that Environmental conservation, control of the spread of HIV/AIDS, gender, employment, and resettlement are being given adequate attention.

2.1.10 Tanzania`s Property and Business Formalization Programme, 2004

Tanzania`s Property and Business Formalization Programme (TPBP) or in Kiswahili “Mpango wa Kurasimisha Rasilimali na Biashara za wanyonge Tanzania (MKURABITA)” was founded to empower the marginalized majority in the informal sector so that they can use their properties and business assets and other opportunities in the modern market economy, and thus increase their income. Under such facilitation, they can effectively participate in the reduction of income poverty and contribute to the attainment of Medium Development Goals (MDG) targets.

Notably, both MKUKUTA and MKURABITA are interrelated economic interventions affected by the government in an effort to provide relief to the Tanzania masses of medium and lower ranks.

Among the strategies of MKURABITA are preparation and development communication systems in rural areas that will enable the coordination of formalization of properties and business assets of the programme.

Relevance to the Project

The proposed project is in line with the programme as it addresses one of the strategies of the programme – development of communication systems in rural areas that will enable the coordination of formalization of properties and business assets of the programme.

2.1.11 Energy Policy of Tanzania (1992)

The objective of the policy is to provide input into development process through the establishment of an efficient energy production, procurement, transportation, distribution and end use in an environmentally sound manner and with due regard to gender issues.

The policy recognizes the critical role of energy in all sub-sectors of the economy, including the road sector. It underscores the importance of having sufficient supply and efficient use of energy in order to realize sustainable development and satisfy basic needs of the society.

The policy recognizes the relationship between road condition and fossil fuel consumption energy by vehicles, which is one of the important sources of energy in the country. Therefore, the policy recognizes the need to rehabilitate roads to minimize fuel consumption.

Relevance to the Project

The policy is relevant to this project because fossil fuel is the major source energy supply in the transport sector. A poor road condition is associated with higher consumption of fuel. Upgrading of the road will result into not only reduced fuel consumption and transportation costs but also reduced emission.

2.1.12 Agricultural and Livestock Policy (1997)

The number and nature of guidelines that constitute Tanzania Agricultural and Livestock policy is complex. However, the overall aim is to promote and ensure a secure land tenure system to encourage the optimal use of land resources, and facilitate broad-based social and economic development without upsetting or endangering the ecological balance of the environment. The

major theme is the conversion of land into an economic asset to which all citizens should have equal access, especially in response to the vulnerability of smallholders and livestock keepers who do not produce a surplus. The focus is therefore on the commercialization of agriculture so as to increase income levels and alleviate poverty.

On the other hand the villages are required to develop land use plans where by a certain amount of land is put aside for livestock grazing while the area for agriculture is also categorized. This is done to minimize conflict between farmers and livestock keepers. It has also an advantage on proper land management and conservation. However, during the study it was observed that the land use plan do not exist in almost all villages. The lack of land use plan result into conflicts between different land users.

2.1.13 Mineral Policy of 1998:

The National Minerals Policy also addresses that the mining activities should be undertaken in a sustainable manner. Reclamation of lands after mining activities is recommended. As far as this project is concerned, mining activities is directed to quarrying activities and borrow pits.

This policy signifies the relevance to this road project whereby during consultation, communities raised their concern regarding borrow pits. Though identification of the borrow pits sites is scientifically done depending on various factors (distance, quality, types, quantity etc.), it is crucially important to involve nearby communities / leaders during the process. Equally important is the aftermath of the project construction whereby by refilling or restoration of destructed environments is essential for communities' and their properties safety and security.

2.2 LEGAL FRAMEWORK - ACTS

2.2.1 The Constitution of Tanzania

The Policy, legal framework to address the social dimensions, impacts, and implications of the project is based on the following articles of the Constitution of the United Republic of Tanzania of 1977:

- Article 24 (1): Subject to provisions of the relevant laws of the land, every person is entitled to own property, and has a right to the protection of his property held in accordance with law.
- Article 24 (2): It shall be unlawful for any person to be deprived of property for the purposes of nationalization or any other purposes without the authority of law which makes provision for fair and adequate compensation.

Relevance to the Project

Realignment of the road, borrowing of naturally occurring construction materials, and construction of camps outside the Right of Way (RoW) will cause loss of properties in terms of buildings and land. Affected people will have to be compensated because payment of compensation is both a legal and constitutional right under Article 24 of the Constitution of the United Republic of Tanzania of 1977.

2.2.2 Environmental Management Act No 20, 2004

The Environmental Management Act (EMA) governs environmental management issues including ESIA requirements in the country. The Act also defines environmental management tools of general scope to facilitate consistent policing and enforcement.

The following sections are relevant to this project:

- Section 6: specifies that every person has a stake and duty to safeguard and enhance the environment and inform relevant authority of any activity that may affect the environment
- Section 57: prohibits human activities within 60m from a riverbank.

Relevance:

There are construction activities that are likely to tempt the Contractor to have unnecessary activities near water course include borrowing of construction activities such as sand and gravel. Such activities shall not be approved by the Engineer.

- Section 81: Stipulates that any developer of a project to which ESIA is required to be carried out by the law shall undertake at his own cost ESIA before commencing the project.

Relevance:

This ESIA has been carried out to fulfil the requirement of EMA, 2004 since the project is likely to have adverse impacts to the environment and communities.

- Sections 106, 109, and 110: Prohibits polluting the environment with solid wastes, liquids, or substances containing hazardous chemical, oil, or mixture containing oil.

Relevance:

The Contractor will generate solid and liquid wastes as well as hazardous wastes that are likely to pollute the environment if not managed properly.

2.2.3 Water Resources Management Act, 2009

The Act, which repeals the Water Utilization (Control and Regulation) No 42 of 1974, provides for institutional and legal frameworks for sustainable management and development of water resources, outlines principles for water resources management, and provides for the prevention and control water pollution, participation of stakeholders and the general public in the implementation of water policy.

The Following Sections of the act are relevant to this Project:

- Section 10: Vests ownership of all water in the United Republic of Tanzania
- Section 34: Prohibits anthropogenic activities within 60m from water resources

Relevance to the Project

There are likely to be attempts by the Contractor to borrow construction materials such as sand and gravel near or within water courses.

Section 39: Requires that a land owner or an occupier to take all reasonable measures to prevent water source pollution

Relevance to the Project

During the construction across rivers, the contractors will have the obligation to prevent polluting water sources. For example, the Contractor shall not be allowed to site a construction camp near a water resource or open a borrow pit near a water source

Section 43: Requires that a permit be obtained from Water Basin Officer prior to abstraction of surface or ground water.

Relevance to the Project

The Contractor shall obtain water abstraction permit from relevant water basin authority before abstracting water from the ground or surface resources.

2.2.4 Land Act Cap. 114 (No. 4), 2004 (amendment of Land Act 1999)

The act regulates land allocation including village lands. It specifies that all lands continue to be public. Land is vested in the President as Trustee for and on behalf of all the citizens of Tanzania. The act establishes three categories of land: general, village and reserved. In addition, land may be declared ‘hazard land’ where its development might lead to environmental damage, e.g. locations such as wetlands, mangrove swamps and coral reefs, steep lands and other areas of environmental significance or fragility.

The Act recognises customary tenure as of equal status to granted rights of occupancy, and allows livestock keepers to own pasture land either individually or in groups. Importantly the land act promotes gender equality by recognizing equal access to land ownership and use by all citizens- men and women – and giving them equal representation on the land committees. The Acts also recognize land as a property and have value.

Section 156 of the Land Act 1999 requires compensation to be paid to any person for the use of land of which he / she is in lawful or actual occupation as a communal right of way and with respect to a way leave. These include:

- Any damage suffered in respect of trees, crops, and buildings as result of creation of way leave;
- Damage due to surveying or determining the route of that way leave.

It is the responsibility of the government department of Ministry, Local Government authority or corporate body that applied for right of way to pay compensation.

Relevance to the Project

All affected properties outside the existing RoW as the result of upgrading of the road project will be compensated for in accordance with the law.

2.2.5 Village Land Act Cap. 114 (No. 5), 1999

The Village Land Act Cap 114 (No. 5 of 1999) confers the management and administration of village lands to Village Councils, under the approval of the Village Assemblies, although the Minister of Lands is entitled to decide on the amount of land which can be owned by a single person or commercial entity. The Act also provides for the fundamental principles of National Land Policy which are the objectives of the Village Land Act, 1999 aimed at:

- Ensuring that existing rights and recognized long standing occupation or use of land are clarified and secured by the law

- Ensuring that land is used productively and that any such use complies with the principles of sustainable development; to take into account that an interest in land has value and that value is taken into consideration in any transaction affecting that interest and
- To pay full, fair and prompt compensation to any person whose right of occupancy or recognized long-standing occupation or customary use of land is revoked or otherwise interfered with to their detriment by the State under this Act or is acquired under the Land Acquisition Act No. 47 of 1967 (RE 2002)

2.2.6 Land Acquisition Act 1967 (Revised Edition, 2002)

Under the Land Acquisition Act, 1967, the President may, subject to the provisions of this Act, acquire any land for any estate or term where such land is required for any public purpose.

Land shall be deemed to be acquired for a public purpose where it is required, for example, for exclusive Government use, for general public use, for any Government scheme, for the development of agricultural land or for the provision of sites for industrial, agricultural or commercial development, social services, or housing or; where the President is satisfied that a corporation requires any land for the purposes of construction of any work which in his opinion would be of public utility or in the public interest or in the interest of the national economy, he may, with the approval, to be signified by resolution of the National Assembly and by order published in the Gazette, declare the purpose for which such land is required to be a public purpose and upon such order being made such purpose shall be deemed to be a public purpose; or in connection with the laying out of any new city, municipality, township or minor settlement or the extension or improvement of any existing city, municipality, township or minor settlement; etc.

Upon such acquisition of any Land the President is compelled on behalf of the Government to pay in respect thereof, out of money provided for the purpose by Parliament, such compensation, as may be agreed upon or determined in accordance with the provisions of the Land Acquisition Act, 1967.

The President may also revoke a right of occupancy if in his opinion it is in public interest to do so. Accordingly, the land for which a right of occupancy has been revoked reverts back to the Government for re-allocation pursuant to the existing need (s). It should also be noted here that, though the land belong to the government some changes on the land act has taken place. Land has value to the owner; therefore any land taken from the user has to be compensated. Based on this act the villagers affected by the project are claiming that they should be compensated for the lost farms and land used for residential purposes.

Relevance to the Project

Although the majority of the road will follow the existing alignment, there are sections where realignment of the road and so land acquisition will be inevitable in order to improve the safety of the road. In addition, land acquisition will be necessary for borrowing of naturally occurring construction material such as sand, gravel, and hard stone.

Owners of the land who will be affected due to road realignment and material bowing shall be be compensated accordingly.

2.2.7 Occupational Health and safety Act No. 5 of 2003

This act sets provisions for the safety, health, and welfare of persons at work in factories and other places of work. It is also meant to provide for the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with activities of persons at work; and to provide for connected matters.

Under the following sections of the act, the Contractor has the following obligations:

- Sections 11 and 13: Appoint a safety and health representative and health and safety committee for the workplace, whose functions are stated in Sections 12 and 14 of the act
- Section 15: Register the workplace (camps and quarry) with Chief Inspector of Occupational Health and Safety Agency (OSHA)
- Section 54: Provide and maintain readily accessible clean, safe, and wholesome drinking water to his workers
- Section 55: Provide and maintain clean, sufficient and suitable sanitary conveniences
- Section 58: Provide and maintain First Aid Kit, which shall be under the charge of a person who has received first aid training from recognized institution, who shall be readily available during working hours
- Section 60: carry out risk assessment whenever an activity involving the use of hazardous processes, hazardous equipment, or hazardous chemical substances has to be carried out
- Section 62: equip workers with effective and appropriate Personal Protective Equipment (PPE)
- Section 68: Provide and maintain sufficient and suitable means of eye flushing system for workers
- Section 70: Restrict the extent to which workers may be exposed to ionizing and non-ionizing radiations in the course of their employment
- Section 74: Provide Materials Safety Data Sheet (MSDS) in respect of hazardous chemicals containing detailed essential information regarding their identity, supplier, class, hazards, safety precautions, and emergency procedures.

The Contractor shall comply with all the above requirements of the law.

2.2.8 HIV and AIDS (Prevention and Control) Act, 2008

According to the Act, it is the duty of every person, institution and organization living, registered, or operating in Tanzania to (among others):

- Promote public awareness on causes, modes of transmission, consequences and control of HIV and AIDS
- Reduce
 - The spread of HIV and AIDS
 - Prevalence of STIS in the populations
 - Adverse effects of HIV and AIDS

The Act also gives the duty to employers and private sectors to

- Integrate or prioritize HIV and AIDS in their proceedings and public appearances

- Advocate against stigma and discrimination of people living with HIV and AIDS

During the project implementation from mobilization, construction to decommission the contractor will be obligated to do the following:

- Promotes public awareness on causes, modes of transmission, consequences and control of HIV and AIDS
- Develop and implement the programme to prevent and control the spread of HIV/AIDS and STIs

2.2.9 Road Act No. 13, 2007

This Act, which repeals the Highway Act Cap 167, provides for road financing, development, maintenance, management and other related matters on finance, offences, penalties and recovery. The Act classifies and declares the project road to be a public road thus listing it under the first schedule of Trunk Roads as T1, in trunk and regional roads ordinance. Also relevant clauses to the project are included under Parts IV, V and VII of the act covering aspects such as,

- Execution of the road works
- Road safety
- Restriction on the use of roads
- Serving notice to holders of land to be affected by the road and matters related to compensation under section 36,
- Regulation on maximum weight, speed and dimensions under section 42.

The following sections are relevant to the proposed road project:

- Section 16: states that "where it becomes necessary for the Road Authority to acquire a land owned by any person.....the owner of such land should be entitled for compensation for any development on such land in accordance with the Land Acquisition Act, Land Act, Village Land Act and any other written laws".

Relevance: The Act and its regulations changed the road reserve of regional and trunk roads from 45m (stipulated in Highway Ordinance, Cap 167) to 60 m (between 22.5m and 30m from the centreline of the existing road). This implies that all the affected properties which are located between 45m and 60m are entitled for compensation. In addition any land acquired outside the current RoW shall also be compensated in accordance with the law.

- Section 29: Specifies that the road reserve is exclusive for the use of the road, development and expansion or any related activities. According to the Act, the road authority may permit any person or authority to temporarily place public utilities such as lighting, telegraph, adverts, telephone, electric supplies and posts, drains, sewers, and mains only in such cases where such use do not hinder any future use of the road reserve by the road authority.

Relevance: Among the public utilities that are located within the road reserve are power lines, water supply pipe lines, and domestic points. Such utilities are likely to be affected by the project.

- Section 30: Stipulates that road authority is responsible for the protection of environment.

Relevance: During implementation as well as operation of the road, all possible measures shall be taken to avoid or abate devastation of the environment. In addition, the design of the road will ensure safety measures such as provision of zebra crossing are taken into considerations.

During upgrading and operation of the road, the Employer and Contractors will observe all the requirements of this act in order to have smooth execution of its activities

- Section 33: The road authority shall ensure the safety of road users during the design, construction, maintenance, and operation of a public road by providing sidewalks, overhead bridges, zebra crossings and other matters related thereto.

2.2.10 Grave (Removal) Act No. 9 of 1969 (Revised Edition, 2002, Cap 72)

The Act gives the right to the Minister responsible for lands to cause a grave and any other dead body buried on a land which is required for public purpose to be relocated. The Act requires the Minister to serve the persons interested with a notice of his intention to do so.

The Act requires that removal, transportation and re-instatement of a grave or dead body, be carried out with due regard to the views of the persons interested and the religious susceptibilities of the members of the religious community to which the person belonged whose grave or dead body it is.

Before the removal of the graves the Act provides for the manner in which the grave has to be removed in terms of serving notices of grave removal intention to respective persons or a religious body.

The Act states that compensation payable under graves removal shall be limited to the reasonable expenses incurred in the removal, transportation, reinstatement and re-interment of the grave or dead body and any placatory or expiatory rites or other ceremony accompanying such removal and re-interment

In certain circumstance, removal of grave can be undertaken by a person interested. In such a case, the interested person shall be compensated, for expenses incurred in the removal, transportation, reinstatement and re-interment of the grave or dead body and any placatory or expiatory rites or other ceremony accompanying such removal and re-interment.

Relevance to the Project

Although the survey did not notice any grave within the RoW, it is a possibility that has to be considered. According to the Act, the contractor shall communicate with relevant authorities for relocation of such graves.

2.2.11 Employment and Labour Relations Act, 2004

The following sections of the act are relevant to this project:

- Section 5: prohibits employment of children under the age of fourteen years. A child at the age of 14 year and above may only be employed for light works, which are not likely to cause harm to the child's health and development, and does not prejudice the child's attendance at school, participation in vocational orientation or training programmes approved by the competent authority or the child's capacity to benefit from the instruction received. The act also prohibits employment of a child under the age of eighteen years in any work site where work conditions may be considered hazardous.

Relevance: The road construction is likely to trigger employment of children under 18.

- Sections 14, 15, and 45 of the act require that an employer provides to his employee with the following:

- i) A written employment Contract (Section 14) in a language known to the employee (Section 14), stating their rights
- ii) A written statement of particulars, stating among others remunerations (Section 15)
- iii) Specifies working hours of 45 hours per week (Section 19)

2.2.12 Public Health Act No 1, 2009

This act provides for the promotion, preservation, maintenance of public health with a view to ensuring the provisions of comprehensive, functional, and sustainable public health services to the general public and to provide for other related matters.

Section 30 of the act requires any occupier or owner of any premises to keep his premises free from breeding sites of mosquitoes, other disease vectors, vermin, and other diseases causative agents

Relevance: The Contractor shall keep both the construction camp free from breeding sites of mosquitoes as well as other diseases vectors. On regular basis, or as directed by the Engineer, the Contract shall fumigate the camps' houses as well as their surroundings.

2.2.13 Workers Compensation Act No 20, 2008

This is an act to provide for compensation to employees for disablement or death caused by or resulting from injuries or diseases sustained or contracted in the course of employment, to establish the fund for administration and regulation of workers compensation and to provide for related matter.

The following objectives of the act are relevant to this project:

- i) Provide adequate and equitable compensation for employees who suffer occupational injuries or contract occupational diseases arising out of, and in the course of their employment and in case of death, for their dependants
- ii) Provide for rehabilitation of employees who have suffered occupational injuries or contracted occupational diseases in order to assist in restoring their health, independence and participation in society
- iii) Provide for a framework for effective, prompt, empathetic consideration, settlement, and payment of compensation benefits to employees and their dependants.
- iv) Give effect to international obligations with respect to worker's compensation and
- v) Promote prevention of accidents and occupational diseases

The following sections of the Act are relevant to this project:

Section 19: Where an employee has an accident resulting into employee's disablement or death, the employee or dependants of the employee shall subject to this Act be entitled for compensation provided by this Act.

Section 22: Where an employee contracts a disease set out in the Third Schedule of the Act, or any other disease, and the disease has arisen out of, and in the course of employee's employment, the employee shall, subject to the provision of this Act, be entitled to the compensation.

Section 23: When an employee who has contracted an occupational disease set out in the Third Schedule of this Act was employed in any work involved in the handling of or exposure to any

agent mentioned in the Schedule in respect of that disease, it shall be presumed, unless contrary is proved that the disease arose out of, and in the course of the employee's employment.

Section 33: An employee or any other person on behalf of the employee shall, as soon as possible after an accident has occurred, give written or verbal notice of the accident to the employer and he may also give notice of the accident to the Director General in a prescribed form.

Section 35: An employee or trade union, on behalf of the employee, as soon as possible, after the occurrence of an occupational disease shall give a written notice to his employer or to the employer where the employee was last employed

Sections 36 through 41: Provides for procedures that has to be followed for claiming for compensation

Relevance: The road construction workers will be exposed to risks of not only occupational injuries and diseases, but also to fatal accidents.

2.2.14 Occupier's Liability Act No 54, 1968

The Act determines the care that an occupier is required to show toward persons entering on the premises in respect of dangers to them, or to their property on the premises, or to the property on the premises of persons who have not themselves entered on the premises, that are due to the state of the premises, or to anything done or omitted to be done on the premises, and for which the occupier is responsible by law.

The Act stipulates that an occupier of premises owes a duty to take that care that in all the circumstances of the case is reasonable to see that a person, and the person's property, on the premises, and property on the premises of a person, whether or not that person personally enters on the premises, will be reasonably safe in using the premises.

The duty of care applies in relation to the

- (a) Condition of the premises,
- (b) Activities on the premises, or
- (c) Conduct of third parties on the premises.

Nevertheless, an occupier has no duty of care to a person in respect of risks willingly assumed by that person other than a duty not to

- (a) Create a danger with intent to do harm to the person or damage to the person's property,
- (b) Act with reckless disregard to the safety of the person or the integrity of the person's property.

2.2.15 Forest Act No. 14, 2002

This Act deals with the protection of forests and forest products in forest reserves and the restrictions and prohibitions in forest reserves. Any contravention of the restrictions and prohibition is considered an offence under this act and subject to enforcement. The act 2002 requires that for any development including mining development, road construction and construction of building within a Forest Reserve, Private Forest or Sensitive Forest, the proponent must prepare an Environmental Impact Assessment for submission to the Director of Forestry. The law also requires licences or permits for certain activities undertaken within the

national or local forest reserves, such as felling or removing trees, harvesting forest produce, entering a forest reserve for the purpose of tourism or camping, mining activities, occupation or residence within the reserve, cultivation, erecting any structures.

The Act enables local government authorities, including village governments to have power over some forests that are within their areas of jurisdiction.

Relevance: The project road borders several exotic tree forests.

2.2.16 Explosives Act (Cap 45) No. 56, (Revised Edition 2002)

The act provides rules for the control of manufacture, import, export, purchase, sale, possession, and use of explosives. The act is relevant to this project because the Contractor will use explosives for blasting of rocks. The following sections are relevant to this project:

- Section 28: Specifies how explosives and detonators have to be stored.

Relevance: The Contractor shall store explosives and detonators in accordance with Section 28 of the act.

- Section 32: Requires that a licence from Commissioner of Mines is obtained before one starts using a magazine

Relevance: The Contractor shall construct a magazine for storing all explosives and before using the magazine, the Contractor shall obtain a licence from the Commissioner of Mines

- Section 38(1): Specifies that explosives should only be used by a holder of blasting certificate issued by the Commissioner of Mines.
- Section 40: Specifies that blasting and supervision of blasting should only be done by a holder of blasting certificate

Relevance: The Contractor shall ensure that blasting and supervision of blasting is done by a holder of blasting certificate from Commissioner of Mines.

2.2.17 Land Use Planning Act No 6, 2007

Under the provisions of the Town and Country Planning Ordinance also the President is empowered to acquire any land for project of public interest. The 1956 ordinance after its revision in 1961, states:

- Section 45(1): where it appears to the President that it is necessary to acquire any land within a planning area for the scheme applicable thereto and agreement for the acquisition thereof between the Local Authority and the owner of such land cannot be reached, the President may acquire such land under any law relating to the compulsory acquisition of land.
- Section 45(2): without prejudice to the generality of the provision of subsection (1) of section 45, the power of the President hereunder shall extend to the acquisition of land which has not been developed in accordance with the scheme applicable thereto which, in his opinion, it is necessary to acquire in order to secure its good development or the proper, orderly and continuous development of a planning area or any part of it or the good development of neighbouring land.
- Section 45(3): without prejudice to the provisions of any law relating to the compulsory acquisition of land, the purposes for which land may be acquired under the provisions of this ordinance shall be deemed to be the public purposes.

- Under section 50 (ii) the value of any land within a Planning Area shall, for the purposes of determining the amount of compensation payable, be deemed to be the value of such land on the material date together with the value of any development carried out thereafter with planning consent.
- Section 52, on compensation for injury caused by scheme, allows that any person whose land is affected by any scheme and suffers loss thereof, or whose mining rights or forestry rights are rendered abortive by operation of a scheme shall upon proper claim be entitled to recover as compensation from the local government authority the amount by which his land is decreased in value in so far as it was reasonably incurred, the amount of abortive expenditure or the loss or injury suffered. Under Section 56(1), a claim for compensation shall be made by serving upon the local government authority a notice stating the grounds of claim and amount thereof, within six months from date of emergence of such scheme provision or as it may be specified in the scheme.

Relevance: Since the corridor of RoW will be extended from existing 45m to 60m, a corridor of 7.5 m on both sides of the road will have to be acquired in accordance with the law. In addition land acquisition will result from realignment of the existing road.

2.2.18 Mining Act No 14, 2010

The following Sections are relevant to this project:

- Section 52: This section describes the obligations of a holder of a mining license. The following obligations are relevant to this project:
 - Demarcate and keep demarcated in the prescribed manner the mining area
 - Take all appropriate measures for the protection of the environment in accordance with the Environment Management Act
 - Implement the proposed plan for relocation, resettlement of, and payment of compensation to people within the mining areas in accordance with the Land Act;
- Section 54: Application for primary Mining License

Prior to commencing of extracting of materials from any borrow pit or quarry, the Contractor shall be required to obtain a Primary Mining license from Zonal Mines Officer.

2.2.19 Antiquities Act No 22, 1964 (Revised Edition: 2002)

This is an Act to provide for the preservation and protection of sites and articles of paleontological, archaeological, historical, or natural interest and for matters connected therewith and incidental thereto.

The following Sections are applicable to this project:

- Section 4: Prohibits the excavation of any monument, or any search for relics in monument which is a place of ordinary habitation or occupation without the consent of the owner
- Section 5: Prohibits doing the following to a monument or a protected object declared as such by the Minister or included in a list published by the Commissioner or to any place, site or structure which he knows or has reasonable cause to believe to be a monument:
 - To destroy, injure, or deface the same or make any alteration, addition or repair thereof

- Alter the course of cultivation so as to affect to its detrimental any part thereof of paleontological, archaeological, historical or natural interest
- Section 8: Relics discovered in Tanzania to be the property of the Republic.

Relevance: Every relic discovered in Tanzania, whether before or after the appointed day, other than a relic properly included in the list delivered to, and signed by the Commissioner

- Section 10: Discovery and excavation

Relevance: The relevant part is one which stipulates that any person who, discovers a relic or monument, or any object or site which may reasonably be supposed to be a relic or monument in Tanzania, otherwise than in the course of a search or excavation, shall forthwith report to the same to an administrative officer, the Commissioner, the Conservator or the Curator of the Museum.

2.2.20 Atomic Energy Act No 7, 2003

The following sections are relevant to the proposed road project:

- Sections 11, 17, and 20: Prohibits the possession, use, exportation, store, or transport an ionizing radiation source unless licenced and registered to do so by the Commissioner of Atomic Energy Commission.
- Section 15: Prohibits employment or cause a person who is not a qualified expert to operate a nuclear apparatus.

Relevance: The Contractor(s) is likely to use a nuclear gauge for measuring filed densities and moisture content of materials. To be able to use the nuclear gauge, the Contractor shall obtain a licence to own and use the gauge from the Commissioner of Atomic Energy Commission and shall also ensure that operators of the gauge are trained in accordance with the law.

2.2.21 Industrial and Consumer Chemicals (Management and Control) Act, 2003

The act provides for the management and control of the production, importation, transportation, exportation, storage, dealing, and disposal of chemicals and for matters connected therewith.

- Section 29: Requires a certificate be obtained before one imports a chemical.

Several chemicals such as bitumen products, concrete additives, etc. are likely to be imported by the Contractors.

- Section 43: Prohibits importation of chemical wastes in the country

The Contractors shall comply with all the above requirements of the law

2.2.22 Contractors Registration Act No 17, 1997 (Revised Edition 2007)

The Act provides for the registration of Contractors and establishes a Board to regulate the conduct of Contractors in Tanzania and for related matters. The act requires that every Contractor be registered with Contractors Registration Board (CRB) before undertaking any construction; installation, erection or alteration works.

All the Contractors as well as their sub-Contractors who will be involved in the project execution shall be registered with CRB.

All the Contractors shall equally abide by all the requirements of this Act in terms of supporting the activities of the board during inspection of any site for road construction, installation works for the purpose of verifying and ensuring that the works are being undertaken by registered contractors; and that the works comply with all governing regulations and laws of the country; the body responsible for regulating the conduct of contractors in Tanzania.

2.2.23 Engineers Registration Act No 15, 1997 (Revised Edition 2007)

This is an act which formed the Engineers Registration Board, a statutory body with the responsibility of monitoring and regulating engineering activities and the conduct of engineers and engineering consulting firms in Tanzania through registration of engineers and engineering consulting firms. Under the law, it is illegal for an engineer or an engineering firm to practice Engineering profession if not registered with the board. The board has also been given legal powers and has the obligation to withdraw the right to practice from registered engineers if found guilty of professional misconduct or professional incompetence.

Relevance: During construction of the road, every worker either from the Contractor(s) or Engineer(s) side who will carry out the duties of an Engineer as required by the Contract shall be registered with ERB. In addition, the Engineer and his staff who will carry the duties of engineers shall be registered with ERB.

2.2.24 Architects and Quantity Surveyors Act No 16, 1997 (Revised Edition 2010)

This act provides for establishment of the Board of Architects and Quantity Surveyors responsible for registering and regulating the conduct of the Architects, Quantity Surveyors and Architectural and Quantity Surveyors Consulting Firms.

The Act requires that any person who carries out duties of a Quantity Surveyor be registered with the Architect and Quantity Surveyors Registration Board (AQRB).

During construction of the road, every worker either from the Contractor(s) or Engineer(s) side who will carry out the duties of Quantity Surveyor shall be registered AQRB.

Relevance: The road project proponent shall comply with the requirements of this act and shall assist the board during inspections of the project works.

2.3 LEGAL FRAMEWORK - REGULATIONS

2.3.1 Environmental Impact Assessment and Audit Regulations, 2005

Environmental Impact Assessment and Audit Regulations provide rules relative to the procedures for and carrying out of environmental impact studies and environmental audits as provided for under the Environmental Management Act (2004).

They prohibit the carrying out of projects without an environmental impact assessment required under the Environmental Management Act and define the contents and form of an environmental impact assessment and the basic principles of an environmental audit. A developer shall apply for an environmental impact assessment certificate in the form as prescribed by these Regulations. The final decision on an environmental impact assessment shall be taken by the Minister. The Regulations also provide for public hearings in relation with environmental impact assessments and appeal against decisions of the Minister.

Relevance: This ESIA has been carried out in accordance with the regulations.

2.3.2 Road Management Regulations, 2009

The following sections are relevant to the proposed road project:

Section 28(a): Specifies that the road reserve width for trunk and regional roads as sixty metres, consisting of thirty metres from either side of the centre of roadway for carriage way roads.

Relevance: The road proposed to be upgraded is classified as a trunk road and therefore will have a road reserve width of 60 m.

2.3.3 Hazardous Waste Regulations, 2009

The regulations are made under Environmental Management Act No. 20 of 2009. According to Section 16 of the regulations, a licence issued by Director of Environment (NEMC) is required before one is allowed to dispose of hazardous wastes.

Relevance: The Contractor shall dispose of all hazardous wastes, in particular waste oil, used batteries, and plastic bottles through a company with NEMC certified permit.

2.3.4 Land (Compensation Claims) Regulations, 2001

This regulation is made under the Land Act No 4 of 1999. The regulations provide the basis for eligibility for compensation. It sets out the rights and entitlement for the one claiming compensation.

According to the regulation, the following are eligible for compensation/ resettlement:

- Holder of right of occupancy (Section 22 of the Land Act of 1999);
- Urban or peri-urban land acquired by the President under Section 60 of the Land Act, 1999.

Sub-section 2 of Section 9 applies to all applications or claims for compensation against government or Local Government authority, public body, or institution. According to Section 10(1), compensation at the option of the Government shall take the form of a combination or any of the following:

- Monetary compensation
- Plot of land of comparable quality, extent and productive potential to the land lost;
- A building or buildings of comparable quality, extent and use comparable to the building or buildings lost
- Plants and seedlings
- Regular supplies of grain and other basic foodstuffs for a specified time.

Relevance: For this project, compensation of affected properties will be in monetary terms

2.3.5 Land (Assessment of the Value of Land for Compensation) Regulations, 2001

The Land Regulations were made under section 179 of the Land Act 1999, and provide all specific forms required for Management and Administration, Granted Right of Occupancy, Mortgage, Lease, Easement, Co-occupancy and others including compensation forms (Forms 69 and 70).

These regulations set out criteria for the assessment of compensation of land. The basis for assessment of the value of any land and un-exhausted improvement shall be the market value of such land. The market value is arrived at by the use of comparative method proved by actual recent, sales of similar properties or by use of income approach or replacement cost method, in case the property is of special nature and not saleable. The assessment is done is done by Qualified Valuer and verified by the Chief Valuer of the Government or his/ her representative

In addition, compensation issues include the following opportunity cost which is based on the following:

- The Market Value of the Real Property
- Disturbance allowance
- Transport allowance
- Loss of profits /income or accommodation
- Cost of acquiring or getting an equivalent land
- Any other immediate costs, loss or capital expenditure incurred to the development of the subject land and
- Interest at market rate

Accommodation allowance

Accommodation allowance is estimated by assessing the market rent of the building and multiplying it by thirty-six months.

Loss of profit

Loss of profit is estimated by assessing the net monthly profit of the business carried out on the land (evidenced by audited account where necessary and applicable) and multiplying by thirty-six months.

Disturbance allowance

Disturbance allowance is calculated by multiplying value of the land by average percentage rate of interest offered by commercial banks on fixed deposits for twelve months at the time of loss of interest in land.

Transport allowance

Transport allowance is determined by taking actual costs of transporting twelve tons of luggage by rail or road (which ever cheaper) within twenty kilometres from the point of displacement. No payment shall be made for transport allowance, accommodation allowance, and loss of profit for unoccupied land at the date of loss of interest on land.

Interest

Interest is determined by average percentage rate of interest offered by commercial banks on fixed deposits and will be recoverable until such compensation is paid (Sub-section 3 of Section 13). The following procedures outlined in Section 6 of the regulation shall apply:

- Publication of notice by Commissioner for lands on public notice board;
- Notification of the occupier of the land;
- Submission of claims for compensation by occupier;

- Physical appearance of occupier on specified date, time and place where assessment is to be made
- Valuation for compensation by Commissioner or the authorized officer
- Preparation of compensation schedule and submission of the schedule with claim for compensation to the Compensation Fund.
- Verification and acceptance or rejection of payment by the Fund within not more than 30 days from the date of receipt of claim.

If the person does not agree with the amount or method of payment or dissatisfied with time taken to pay compensation he /she may apply to the High Court. The high court shall determine the amount and method of payment and make any additional costs and inconveniences incurred.

To comply with the requirements of the law:

- Prompt compensation shall be paid for acquired land or damaged properties.
- The project shall involve a Qualified Valuation Officer and follow all procedures as outlined in The Land (Compensation Claims) Regulations (2001) and The Land (Assessment of Value for Compensation) Regulations (2001)

Relevance: The project proponent shall make use of these current Land Acts of 1999 for payment of compensation

2.3.6 Mining (Safety, Occupational Health & Environment Protection) Regulations, 2010

The Mining (Safety, Occupational Health and Environment Protection) Regulations, 2010 were established under the Mining Act No 14, 2010.

The following Sections are relevant to the project:

- Part III: General Safety Procedures
- Part IV (Reclamation Requirements, Rehabilitation Bond and Mine Closure)
- Part IV: Emergency Preparedness
- Part X: Mine Accidents, Incidences and Enquiries
- Part XIV: Reclamation Requirements, Rehabilitation Bond and Mine Closure
- Solid Waste Regulations, 2009

2.3.7 Solid Waste Regulations, 2009

The following sections are relevant to this project:

- Section 17: Prohibits the following hazardous substance to be deposited in receptacles: asbestos or asbestos-containing material, explosives, fireworks, firearms, batteries, hot ashes, flammable liquid, highly flammable materials, infectious material, pressurised containers (other than a pressurised container commonly used for containing domestic products such as fly spray, hair spray and similar materials), or radio-active material
- Section 35: The Contractor has the duty to ensure that before placing any solid wastes into receptacles plastic materials are separated from non-plastic materials

Relevance: Hazardous material, waste oil, medical wastes, plastic bottles and bags shall be separated from other wastes and disposed of through a company with appropriate permit from NEMC.

2.3.8 Atomic Energy (Protection from Ionizing Radiation) Regulations, 2004

The regulations specify the minimum requirements for protection of people against exposure to ionizing radiation and for the safety and security of radiation sources, hereinafter referred to radiation safety, protection and security

The following sections are relevant to this project:

- Section 16: Requires any person intending to engage in a practice or possess a radiation source shall apply for a licence/ registration to the Commission for an authorization.
- Section 17: Requires a permit to import, export or transport any apparatus, article, plant, installation or other material or substance which is a source or intended to be used for the purposes of an undertaking involving the emission of radiation
- Section 19: Holder of a licence shall bear the responsibility for establishing and implementing the technical and organizational measures that are needed for ensuring protection and safety for the practices and sources for which they are authorized.
- Section 28: Requires every user of ionizing radiation equipment shall to appoint a qualified expert employed by him to be a Radiation Safety Officer in relation to his undertaking. The duties of the radiation Safety Officer shall be to:
 - i) Advise the user appointing him in all matters pertaining to the protection of workers, patients, the public and the environment from ionizing radiation
 - ii) Advise the user regarding formulation, the observance and enforcement of local rules for the protection of workers, patients, the public and the environment from ionizing radiation;
 - iii) Advise and liaise with the Commission regarding the implementation of radiation protection measures at his work place
 - iv) Assist the Commission in the enforcement of the provisions of this regulation in relation to the undertaking in respect of which he is appointed
 - v) Assist the licensee in keeping all records of the practice as prescribed in these Regulations.
- Section 32: Specifies that licensees and employers of workers who are engaged in activities that involve or could involve occupational exposure are responsible for the protection of the said workers against any occupational exposure which is not excluded from these Regulations
- Section 40: Employers and licensees shall maintain records of exposure for each worker for whom assessment of occupational exposure is required. Such worker exposure records shall include information on:
 - i) The general nature of the work resulting in exposure, the doses and intakes at or above the relevant recording levels and the data upon which the dose assessments are based;
 - ii) The periods of employment with different employers, if any, and the corresponding doses and intakes in each period of employment

- iii) The doses or intakes due to emergency interventions or accidents, which shall be distinguished from doses and intakes received during work in normal conditions.
- Section 52: Licensees is responsible to protect the public from exposure to ionizing radiation delivered by a practice or source for which they are responsible.
- Section 60: Registrants or Licensees is responsible for the safety and security of the sources under their responsibility, from the moment of their acquisition throughout their entire operational life and up to their final disposal.
- Section 61: Licensees shall ensure that the following relevant requirements with regards to storage of radiation sources are met:
 - i) When not in use radiation sources is kept in a place of storage assigned for this purpose only, bearing the appropriate warning symbol
 - ii) The place of storage shall be adequately shielded such that at the outside surface of its walls or containment the radiation dose shall not exceed 0.01 mSv per hour, and shall be chosen so as to minimize risks from fire or flood
 - iii) The place of storage shall be inspected regularly and checked for possible contamination;
 - iv) The place of storage shall be sited and designed so as to ensure that both during storage and in the course of transfer of radiation sources to and from the store, the sources do not give excessive exposure to any person
 - v) All radiation sources shall be clearly labelled, giving information on their activity and nature (physical form)
- Section 72: Licensees shall ensure that the following relevant requirements with regard to transport of radioactive materials are met:
 - i) The Radiation Safety Officer shall be responsible for the precautions to be taken in the movement of radioactive materials from one area to another within the establishment
 - ii) Radioactive materials shall be transported within the licensed premises only in containers provided for the purpose and should properly be labelled. Such containers shall be designed to provide adequate protection for all persons during loading, transport and unloading
- Section 73: Transport of radiative source shall be subject to a licence issued by the Commission for that purpose

Relevance: The Contractor is likely to use nuclear gauges (containing radioactive material) for measuring densities of compacted materials and moisture content. The Contractor shall comply with all the above requirements of the law.

2.3.9 Factories (Building Operations and Works of Engineering Construction) Rules, 1985

These rules were made under Section 55 of Factory Ordinance (Cap 297), 1950 and made available under Government Notice 18. The following sections of the rules apply to this project:

- Section 123: Protection of workers against excessive noise level
- Section 124: Prohibits subjecting workers to unnecessary strenuous working position and movement

- Section 126: Obligation of employer to provide appropriate PPE to his workers
- Section 127: Avail suitable and sufficient fire-fighting equipment and materials
- Section 129: Requires the Contractor to:
 - i) Provide for his workers shelter and accommodation for interruption of work during bad weather, clothing and for taking meals
 - ii) Provide for workers clean and safe wholesome adequate drinking water at convenient point, clearly marked “DRINKING WATER”
- Section 131: Obligation of the Contractor to provide for his workers sanitary facilities
- Section 134: Obligation of the Contractor to avail first aid facility at every work site
- Section 135: when number of workers exceeds 250, the Contractor is obliged to provide and maintain in a good order and clean condition at or near the site of operation or work and conveniently easily accessible a properly constructed and suitable a first-aid room. The first aid room shall be used only for the intended that purpose of treatment or rest.
- Section 136: Provide adequate number of trained and qualified first aiders for rendering the service to workers.

Relevance: The Contractor shall comply with all the above requirements of the law

2.3.10 Government Notice No. 196 of July 2013

Government notice No 196 of July 2014 specifies a minimum wage of TZS 12,500/days or TZS 325,000/month (5 days per week) for construction workers.

Relevance: This will be the minimum wage the Contractor shall pay to workers of the project.

2.3.11 Non-Citizens (Employment Regulations), 2015

This act regulates and realigns the legal regime for employment and engagement in other occupations by non-citizens in Mainland Tanzania and provide for related matters.

The following sections are relevant to the project:

Section 9(1): A non-citizen shall not engage in any occupation for reward, profit or non-profit unless he:

- (a) Has a valid work permit that allows that person to engage in the occupation specified in the valid work permit or
- (b) Is the holder of a valid certificate of exception issued to him under this act

Section 9(2): A person shall not employ, engage or cause to be employed or engaged in any occupation a non-citizen unless

- (a) The non-citizen has a valid work permit that allows that person to be employed in the occupation specified in the valid work permit or
- (b) The non-citizen has a valid certificate of exception issued to him under this act

Relevance: The Contractor or supervising consultant shall ensure that all his non-citizen employees have valid work permits or certificate of exceptions.

2.4 ENVIRONMENTAL MANAGEMENT GUIDELINES

2.4.1 Environmental Assessment and Management Guidelines for Road Sector, 2011

The road sector guideline has been prepared to address environmental issues in all projects that fall under the road sector. The guidelines have been established according to Environmental Management Act of 2004. It underscores the need to incorporate environmental and social issues into road projects from planning stage through, design, construction, up to operation and maintenance stage.

The guidelines outline the procedures for carrying out EA and Management for road construction projects and provide an institutional and legal framework for environmental management in the road sector. Thus, the guidelines outline the administrative and legal procedures that should be followed by project proponents.

Unlike the national guidelines the road sector guidelines categorizes projects into major and non-major impact projects. The guideline classifies EA studies into three types:

- Initial Environmental Examination (IEE)
- Limited Environmental Analysis (LEA)
- Environmental Impact Assessment (ESIA) – Phase1 and Phase 2

The road sector guideline outlines resettlement plan and compensation procedures. It recognizes the considerable impacts of road infrastructure on human settlement and local community properties, including adjacent land use.

2.4.2 Environmental Code of Practice for Road Works, 2008

The Environmental Code of Practice for Road Works has been prepared to guide the intervention of road engineers, Contractors, and environmental specialist, and technicians during the planning, design, construction, and operation phases, so that direct adverse environmental impacts of the project can be avoided or minimized.

These mitigation measures should in most cases be integrated in the technical specifications and bill of quantities to ensure that the road contractor can include them in the construction costs so as to achieve sustainable environmental protection

The objective of purpose Environmental Code is to:

- Establish specific environmental criteria for road works in Tanzania
- Provide technical assistance
- Ensure general understanding of environmental impacts and define environmental criteria to minimise such impacts
- Ensure that road engineers and technicians can find solutions for any problems arising during road constructions or maintenance activities
- Facilitate the preparation of environmental assessment for road development projects

Relevance: These guidelines were closely followed while preparing this ESIA report.

2.4.3 The Road Sector Compensation and Resettlement Guidelines, 2009

The Road Sector Compensation and Resettlement Guidelines were developed by The Ministry of Works in 2009. The purpose of these guidelines is to provide a consistent approach on compensation and resettlement procedures and practices in the road sector. The guidelines are intended to guide the user in the preparation of a Compensation and Resettlement Action Plan (RAP) prior to commencement of construction works.

The objectives of the guidelines are:

- To create awareness on compensation and resettlement issues among the various road agencies and other stakeholders
- To ensure transparency in the compensation and resettlement process
- To clarify respective roles and obligations of each responsible institutions
- To provide technical guidance
- To clarify reporting requirements
- To ensure information flow and public participation
- To provide logical methodology for compensation and resettlement in the road sector

Relevance: The preparation of RAP has been undertaken in accordance with, among others The Road Sector Compensation and Resettlement Guidelines.

2.4.4 Environmental Impact Assessment (EIA) procedures (March 2002)

The National Environment Management Council (NEMC) developed ESIA guidelines and procedures using information from international agencies (NORAD, DANIDA, ODA, ADB, World Bank) and checklists from United Nations Environment Programme (UNEP). The guidelines are contained in five volumes:

- Vol. 1: Procedures and General Information on EIA
- Vol. 2: Screening and Scoping Guidelines
- Vol. 3: Report Writing Guidelines and Requirements
- Vol. 4: Review and Monitoring Guidelines
- Vol. 5: General Checklist of Environmental Characteristics

Relevance: These guidelines were closely followed while preparing Environmental and Social Impact Assessment for this project.

2.5 CONVENTION, TREATIES, AND PROTOCOLS

2.5.1 East African Community Treaty, 1999

The Republic of Uganda, the United Republic of Kenya, and the United Republic Tanzania signed the treaty for the establishment of the East Africa Community on the 30th of November, 1999.

The following articles of the East African Community, of which Tanzania is a member, are relevant to this project:

- Article 5: The promotion of sustainable utilization of the natural resources of the Partner States and the taking of measures that would effectively protect the natural environment of the Partner States
- Article 112: Integrate environmental management and conservation measures in all developmental activities such as trade, transport, agriculture, industrial development, mining, and tourism in the Community.

Relevance: The project proponent shall comply with all the above articles.

2.5.2 East African Community Protocol on Environmental and Natural Resource Management, 2005

The East Africa Community Protocol on Environmental and natural Resource Management govern the Partner States in their cooperation in the management of environment and natural resources over areas within their jurisdiction including trans-boundary environment and natural resources.

The following articles are relevant to this project:

- Article 4 - Principles: Requires that Partner States manage the environmental and natural resources in the community in accordance with the following principles:
 - i) Principle of sustainable development
 - ii) The principle of public participation in the development of policies, plans, processes and activities
 - iii) The principle of strategic environmental assessment and environmental impact assessment of projects, policies and activities
- Article 8 – Sustainable Development: The Partner States are required to ensure that conservation and management of environmental and natural resources are treated an integral part of national and local development plans. They are also obliged to ensure that consideration is given to environmental factors in the formulation of all development plans

Relevance: This ESIA is being carried out to fill the requirement of the article

- Article 13 – Management of Water Resources: Relevant item in this article is the one that gives the obligation of each Partner State to protect and conserve the water resources and their ecosystem in the community through protecting and the water quality, preventing the introduction of alien species into the water resources, and protecting and conserving biological diversity in the water resources

Relevance: During construction the road, especially across rivers as well as where the contractors have to abstract water from the rivers for construction purpose, the contractors shall ensure that water resources (rivers and irrigation channels) are protected from pollution.

- Article 21 – Soil and Land Use Management: The partner states are required to:
 - i) Control loss of surface soils and vegetation cover caused by poor and inappropriate land use
 - ii) Regulate the inflow and application of agro-chemicals to water bodies
 - iii) Ensure that all forms of land use, including but not limited to public works, urban centres, mining and disposal of wastes, do not result in land degradation and pollution

- iv) Take measures to control fires, forest exploitation, land clearing for cultivation, overgrazing by domestic and wild animals

Relevance:

- As much as it is practical, construction activities, in particular clearing works, construction in steep slopes, and development of borrow areas will ensure erosion control measures are in place
- During construction, the Contractor shall not be allowed to use firewood as a source of energy
- Treatment of wastes by burning shall be done in a controlled manner
- The Contractor shall not be allowed to dispose of concrete wastes or slurry on water courses
- Article 28 - Management of Chemicals: The Partner States are obliged to take all necessary measures to ensure environmentally sound management of chemicals

Relevance: During construction of the proposed road the contractor shall ensure chemicals such as concrete additives; paints, fuel, lubricants, concrete, etc. are handled in a manner that there are no leakages to the ground or water resources.

- Article 29 - Management of Wastes and Hazardous Wastes: The article requires that Partner States take measures to minimize and ensure segregation of wastes at source points up to final disposal

Relevance: During construction of the proposed road the contractor shall use methods and technologies that minimize the amount of wastes generated. They shall also prevent leakages of wastes until disposed of at designed point.

- Article 30 – Pollution Control and Management: The article requires that Partner States take all reasonable measures in the event of occurrence or discovery of oil spill or other oily residues or mixtures into the environment for the purpose of preventing damage to the environment. The Partner States shall also be required to adopt measures for the safe handling, use, transportation and storage of toxic chemicals and hazardous substances

Relevance: During construction, as much as possible, the contractors shall prevent leakages of hazardous materials during transport, handling, use, and storage of chemical so that they do pollute water and land resource

- Article 31 - Environmental Impact Assessment and Audits: The articles requires that an environmental Impact assessment be carried out for a trans-boundary activities and projects that are likely to have significant adverse environmental impacts

Relevance: This ESIA has been carried out to fulfil the requirement of the article

2.6 INSTITUTIONAL AND ADMINISTRATIVE FRAMEWORK

2.6.1 Government Agencies Responsible for Environmental Issues

The administrative and institutional arrangements for environmental management for all sectors in Tanzania are stipulated in the Environmental Management Act No. 20 of 2004. There are seven (7) institutions mentioned by the act, of which the Minister Responsible for Environment is the overall in-charge for administration of all matters related to the environment. The legal institutions for environmental management in the country include:

2.6.1.1 National Environmental Advisory Committee

The EMA 2004 stipulates the obligations of the National Environmental Advisory committee as to advice the minister responsible for environment or any sector ministry on all matters regarding the environment. In this particular development project, the national advisory committee has to recommend to the minister or sector ministry on the protection and management of the environment based on the ESIA report. It further review and advise the minister on any environmental standards, guidelines and regulations pertinent to the environmental protection.

2.6.1.2 Minister Responsible for Environment

The Minister responsible for Environment, VP Office is the overall responsible for all matters relating to environment, responsible for all policy matters necessary for the promotion, protection, and sustainable management of Environment in Tanzania.

2.6.1.3 Director of Environment

The Director of Environment coordinates various environmental management activities being undertaken by other agencies and promotes the integration of environment consideration into policies, plans and programmes, strategies and projects.

2.6.1.4 National Environment Management Council (NEMC)

EMA 2004 gives National Environment Management Council (NEMC) the overall responsibility for undertaking the enforcement, compliance, review and monitoring of Environmental Impact Assessment and in this regard facilitates public participation in environmental decision-making. NEMC is responsible for screening and reviewing big investments and projects of the national significance.

2.6.1.5 Sector Ministries

Sector ministries, in this case the environmental section in the Ministry of Works through TANROADS is responsible for the following duties as far as the project is concerned,

- Coordinate the activities related to the environment within the ministry, PMO,
- To ensure that environmental concerns are integrated into the ministry or in a department of development planning and project implementation in a way this protects the environment,
- To prepare and coordinate the implementation of environmental action plan at the national and local levels and
- To ensure that sectorial standards are environmentally sound, and the like.

The Ministry of Lands and Human Settlements Development will be responsible for coordinating all activities related to valuation, compensation, and resettlement procedures.

Department of Works: Safety and Environment Division

The Sector Environment Sections in the Department of Works under which TANROADS falls, is responsible for ensuring: Compliance by the Department with the requirements of the Environmental Management Act (2004) and ensuring all environmental matters are implemented and reports to the Director of Environment. It is also responsible for liaising with the Director of Environment and NEMC on matters involving environment.

The Department of Works has four main sections as follows: Transport Infrastructure, Transport Policy and Planning, Technical Services, and Safety and Environment.

Since Department of Works has a main stake in the road sector, the ministry formulates policy, sets standards and specification; define the long term strategic plans; monitors and controls application of the regulations; and participates in the management of the executive agencies. In the Ministry, environment falls under Safety and Environment section.

Under the Safety and Environment section there is a Safety and Environment Unit (SEU) responsible for implementation of environmental management matters in the road sector. For environmental assessment of road projects, the SEU:

- Prepares strategic environmental assessment (SEA)
- Screens application form to determine the level of environmental assessment
- Assesses and comments on environmental assessment
- Advises the ministry for approval of environmental assessment reports
- Participates in ESIA review in collaboration with NEMC
- Controls the implementation of environmental management plan (EMP)
- Promotes public environmental awareness
- Assist in the development and implementation of the environmental management system
- Advises the ministry on all environmental issues related to road construction, upgrading, and maintenance and operation

Ministry of Works, Transport, and Communication and TANROADS: Transport Sector

Under the present structure, the transport sector is under the Ministry Works, Transport and Communication (MWTC), and PMORALG. The MWTC is responsible for the overall policy and planning for the transport sector including the road sector. The development and management of road sector is divided between MWTC and PMORALG. The MWTC is responsible for the overall policy of development and management of the trunk and regional roads and PMORALG is responsible for the development and management of district, urban and feeder-road network.

Under MWTC comes TANROADS, which was established under Executive Agencies Act 1997. It is responsible for maintenance and development of the trunk and regional roads. TANROADS procures and manages contracts for design, maintenance, emergency repairs, spot improvements, upgrading, upgrading, and construction of its roads. TANROADS is also responsible for improving road safety and reducing the negative environmental impacts of its road network.

TANROADS is further divided into 21 regions. Each regional office ensures adequate procurement and administers the roads and bridges maintenance and development works, and supervises its consultants and contractors. Under the new act, EMA 2004, environment responsibilities have been delegated to Sectorial Ministries. The MWTC did set up its Road Sector – Environmental Section which oversees management of the environment within the road sector.

2.6.2 Regional and District Administrative Structures

The Regional Administration Act No. 9 of 1997 provides for Regional Commissioners to oversee Regional Secretariats, with District Commissioners directly supervising the District Councils. Local authorities oversee the local planning processes, including establishing local environmental policies.

The National Environmental Policy establishes a policy committee on environment at regional level chaired by the Regional Commissioner, mirrored by environmental committees' at all lower levels, i.e. at the district, division, ward and village or "street" councils.

At Local Government level, an Environmental Management Officer should be designated or appointed by each City, Municipal, District or Town Council. In each City or Municipality or District, Environmental Committees should be established in order to promote and enhance sustainable management of the Environment.

The Village Development Committee is responsible for proper management of the environment in their respective areas. The District Council designates for each administrative area as township, ward, village, "street", "hamlet" an Environmental Management Officer to coordinate all functions and activities related to protection of environment in their area.

2.6.2.1 Regional Secretariat

The Regional Secretariat, which is headed by Regional Environmental Management Expert, is responsible for coordination of all environmental management programmes in their respective regions and in liaison with the Director of Environment. The Regional Environmental Management Expert is responsible for:

- Advising the local authorities on matters relating to the implementation of and enforcement of environmental by-laws/Act
- Creating a link between the region and director of environment and the director general of the council (NEMC)

2.6.2.2 Local Government Authorities (City, Municipal, District, Township, Ward, Village, sub-village "Mtaa", "Hamlet")

The environmental management officer under the local government authority is responsible for promoting environmental awareness in the respective area on the protection of the environment and conservation of natural resources. Furthermore, he is the one to prepare, review, and approve the ESIA for local investments.

Under the Environmental Management Act (2004), the City, Municipal, District and Town Councils are headed by Environmental Inspectors who are responsible for environmental matters. The functions of the inspectors are to:

- Ensure enforcement of the Environmental Management Act in their respective areas,
- Advise the Environmental management Committee on all environmental matters,
- Promote awareness in their areas on the protection of the environment and conservation of natural resources,
- Collect and manage information on the environment and the utilization of natural resources,
- Prepare periodic reports on the state of the local environment,
- Monitor the preparation, review and approval of ESIA's for all local investors
- Review by-laws on environmental management and on sector specific activities related to the environment,
- Report to the DoE and the Director General of the NEMC on the implementation of the Environmental Management Act,

- Perform other functions as may be assigned by the local government authority from time to time.

All of the above institutions are responsible for the environmental management of the project and their link to this project are specified in functions as enumerated in the respective sections above.

SECTION 3: DESCRIPTION OF PROJECT AND JUSTIFICATION

3.1 PROJECT BACKGROUND

3.1.1 Project Justification

The project road passes through areas with potential for variety of economic opportunities in particular agriculture. Crops grown include among others coffee, bananas, cotton, maize, beans, palm oil, and cassava. The road also provides transportation route for the agricultural and mining produce to and from great Lakes country in particular the eastern Democratic Republic of Congo. Other products include mercantile from Kigoma and Kasulu centres, rice, ground nuts, coconuts, salt, oranges, simsim, pineapples, apples, pears, etc. from western regions of Tanzania regions to Bujumbura.

The local communities in the project area face numerous difficulties in finding markets for their produces due to lack of reliable and efficient transportation system. As a result prices that are offered by traders for local products and produces are far much lower because of the lack of competition among the traders and transporters because of poor road condition.

Although the existing road is passable during the dry seasons, some of its sections become impassable during rain seasons, which hinder transportation of goods and passengers. The road improvement is part of the Government strategy to develop its road network to support socio-economic development of the Country.

Recently, Kasulu – Manyovu road had been deteriorating at an alarming rate despite huge amount of money injected for its routine and sometimes periodic maintenances. This is due to high traffic traversing this road most of which carry agricultural produces like coffee and staple crops (beans, bananas, pea nuts different types of fruits) from Kigoma to Kasulu, the fast economically growing districts to other neighbouring districts namely Ngara, Biharamulo, Muleba, Bukoba, Bukombe and Kahama and to other far districts namely Chato, Geita and Mwanza city. Apart from heavy traffic, this road is the only linkage between Kigoma region and Kagera region through Lusahunga- Biharamulo road and Ngara through Lusahunga – Rusumo road. The upgrading of the Kasulu - Manyovu road to bitumen standard will therefore increase the interconnectivity of these isolated districts to other districts and probably improve the social and economic interaction between the people of Kigoma region and others parts of Tanzania. It will also connect neighbouring country of Burundi to Tanzania. It will improve trading between these neighbouring countries of East Africa community.

The costs of maintaining the existing gravel road are high as it requires recurrent gravelling and grading. In addition, frequent break downs of vehicles are results of the poor road surface.

Upgrading of this road coupled with the upgrading of the Nyakanazi – Kasulu road section will facilitate efficient transportation of people and agricultural products between Tanzania and Burundi as the road provides a shorter link between Tanzania and Burundi trough the central corridor.

Upgrading of the road will therefore:

- i) Facilitate more efficient transportation of agricultural products from the project area to markets in the areas of consumption

- ii) Facilitate/ increase tourism activities within the project areas as well as adjoining areas
- iii) Reduce maintenance costs of the road
- iv) Reduce Vehicles Operating Costs
- v) Improve access to social services such as markets and health services

In addition, upgrading of the road will complement the on-going effort by the government to upgrade Nyakanazi – Kasulu section (222.3km) to bitumen standard.

2.1.4 Project Location

The proposed project road is located in Kasulu and Buhigwe Districts, in the north-western part of Tanzania in Kigoma Region. Kasulu and Buhigwe are among the six (6) districts of Kigoma Region. Others are Kakonko, Kibondo, Uvinza, and Kigoma. The location of the project area in Tanzania is shown by Figure 1, while the location of the project area with respect to Kigoma is shown by Figure 2.

Kasulu District is bordered to the north by Burundi, to the east by Kibondo District, to the south by Uvinza District, to the west by Kigoma District, and northwest by Buhigwe District. Buhigwe District is bordered to the north by Burundi, to the east by Kasulu Rural District and Kasulu Urban District, and to the west by Kigoma Rural District.



Figure 1: Location of the Project Area in Tanzania

Source: Survey and Mapping Division, Ministry of Lands, Housing and Human Settlements Development

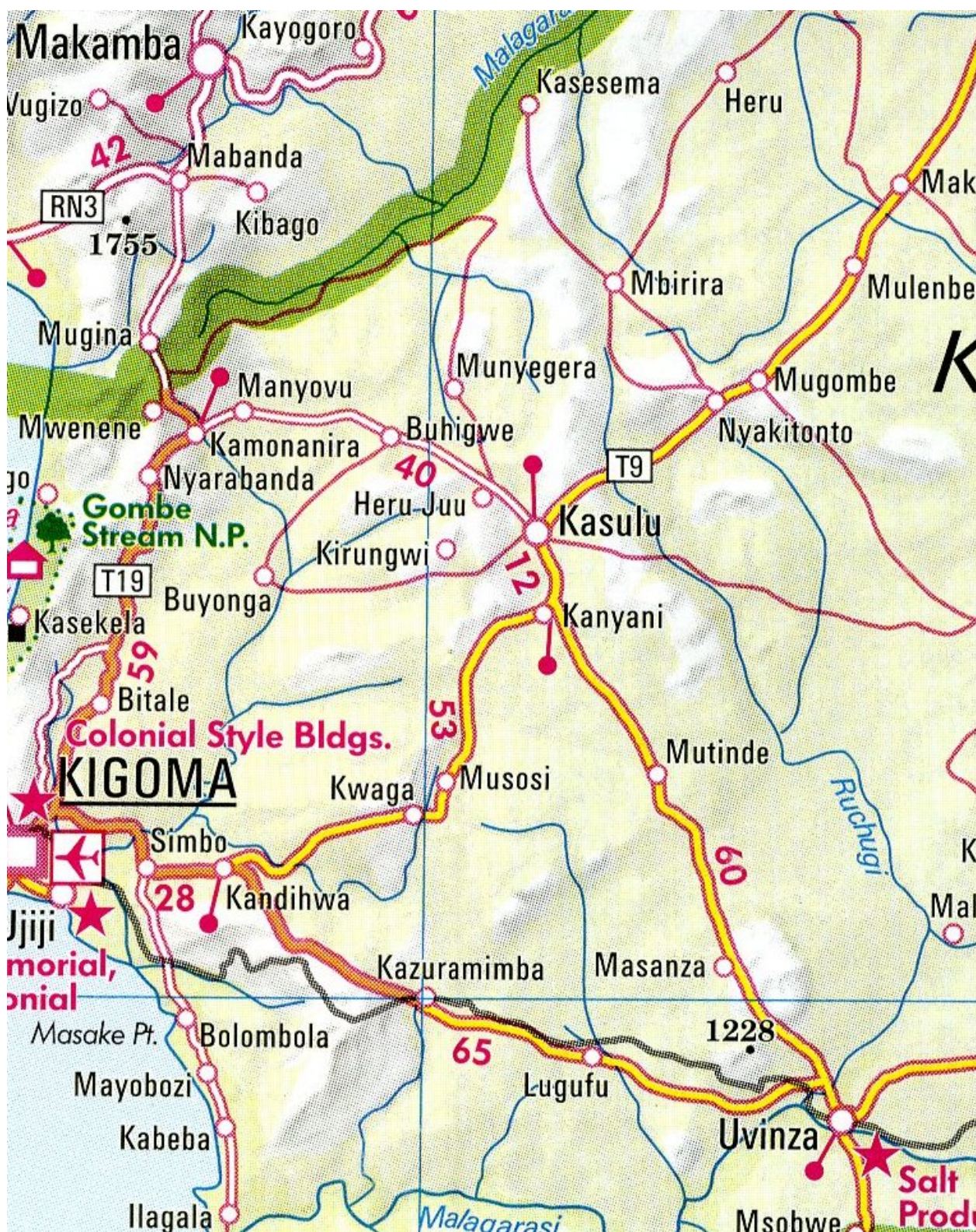


Figure 2: Location of the Project Area with Reference to Kigoma

Source: Survey and Mapping Division, Ministry of Lands, Housing and Human Settlements Development

The locations of the Kasulu roundabout – Manyovu Section, Western Bypass Road, Eastern Bypass, and Kasulu Town Link Road are as follows:

Kasulu roundabout – Manyovu Road Section

Kasulu – Manyovu Road (47.9) Section starts off at Munanila village in Manyovu Division; at the roundabout, which is located about 3km from the border with Burundi and ends at Kasulu Town Centre, at the T-junction; where Kibondo – Kasulu road links with Kasulu – Manyovu road. The road traverses ten (10) villages as shown in Table 1 below.

Throughout the discussion in this ESIA report, the reference of distance measurements (chainage convention) to any point along Kasulu – Manyovu Road Section is made from the point at Munanila roundabout, where Kasulu – Munanila and Mwandiga – Manyovu road sections are connected.

The chainages are presented as Km A+bbb, of which the first number (A) represents the distance in Km, while the second number (bbb) represents the distance in metres. Km A+bbb therefore refers to the chainage at the distance of A.bbb Km

Notably, the majority of the road is located in Buhigwe District. About 33 Km (from Km 0+000 to 36+300) is located in Buhigwe District, while only about 11 Km (Km 36+300 to 47+100) is located in Kasulu District. The following table (Table 1) lists villages through which the main road alignment passes. Locations of some of these villages are shown by Fig. 1b through 7b in Appendix IV.

Table 1: Locations of Villages along the Project Main Road Alignment

No.	Village	District	Location (Chainage in Km) at village Centre
1.	Munanila	Buhigwe	00+000 (Manyovu Division)
2.	Mkatanga	Buhigwe	01+700
3.	Musagara	Buhigwe	02+900
4.	Kibwigwa	Buhigwe	09+100
5.	Bwelanka	Buhigwe	16+900
6.	Mulera	Buhigwe	21+200
7.	Buhigwe	Buhigwe	21+700
8.	Songambele	Buhigwe	28+600
9.	Kirunga	Kasulu	38+400
10.	Herujuu	Kasulu	40+200
11.	Kasulu	Kasulu	47+100

Kasulu Eastern Bypass Road

Kasulu Eastern Bypass road (part of Contract 2): starts off at Nyumbigwa village, at the junction to Baraka Secondary school, along Kigoma – Kasulu road and ends about 150m before R.Ruchugi, at Kidiana village, along Kasulu – Kibondo road section.

Kasulu Western Bypass Road

Western Bypass Road: Starts off at Kidiana village, about 400m before R.Bogwe and ends at the junction to Tulieni Jangwani primary school, Herujuu village, along Kasulu – Manyovu road

Kasulu Southern Link Road

Kasulu Southern Link starts off at the junction to Baraka Secondary school, along Kigoma – Kasulu road and ends at the end of Kasulu roundabout – Manyovu road section.

The locations of Kasulu roundabout – Manyovu road section is shown by Figures 1b through 7b in Appendix IV, while locations of Kasulu Southern Link, Kasulu Eastern Bypass, and Western Bypass Roads are shown by Figure 3 below and Figure 8b in Appendix IV.

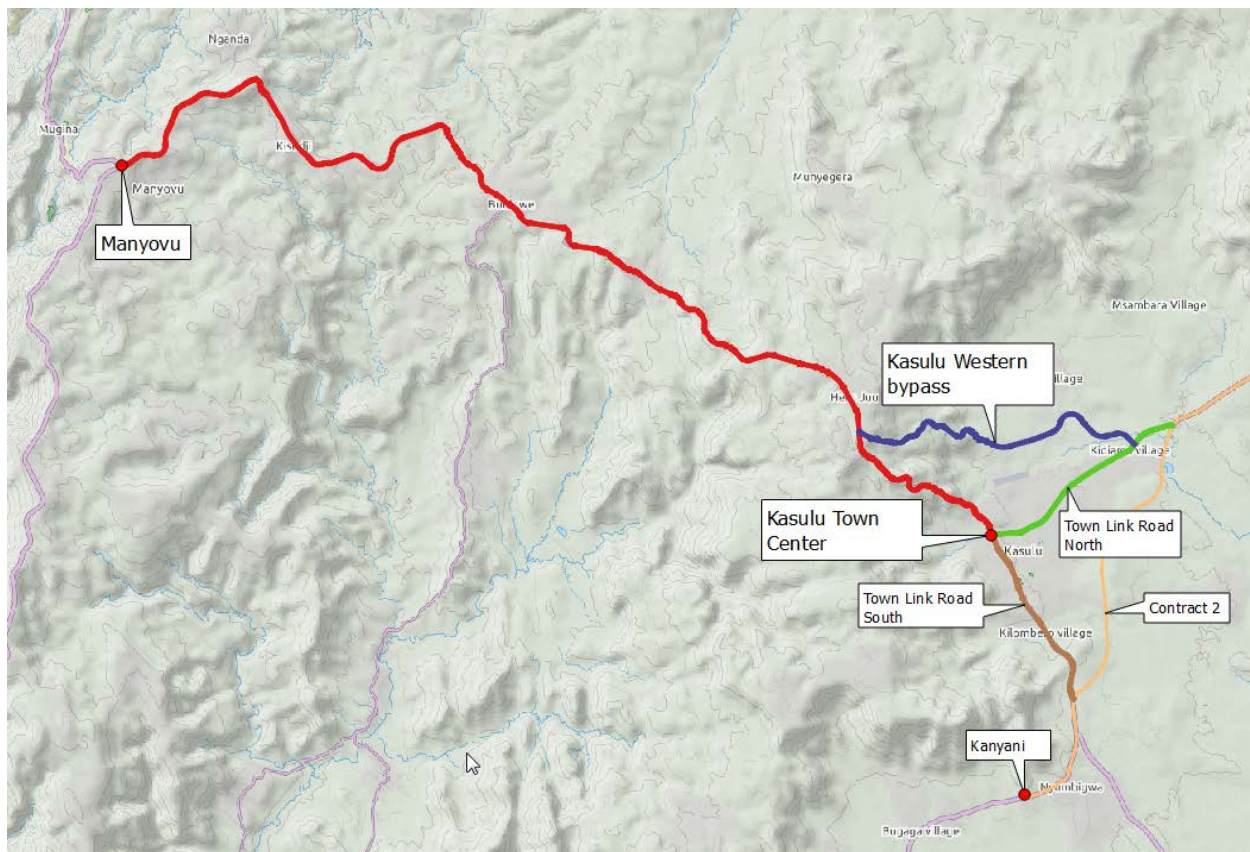


Figure 3: Map Showing Locations of Kasulu – Manyovu Road Section, Kasulu Bypass Road, and Kasulu Town Link Road

Source: Data collected by the Consultant overlain on Google Earth

3.2 DESIGN CONCEPT

The road upgrading will constitute:

- Widening, realignment and paving of the existing earth/gravel Manyovu – Kasulu roundabout Road (47.9km) to Asphalt Concrete (AC) for both carriageway and shoulders
- Construction of the non-existent Kasulu Western Bypass Road (13.1km) by AC for both carriageway and shoulders
- Upgrading of Kasulu Southern Link Road (7.9km) by AC for both carriageway and shoulders.
- Construction of Eastern bypass Road (12.4km)

New cross drainage structures will be constructed to replace the existing structures as they are hydraulically inadequate. In addition, new hydraulic structures will be constructed for the non-existent bypass section. A total of twelve (12) box culverts and ninety eight (98) pipe culverts will be constructed.

The road upgrading will also involve improving of safety on various sections of the road with infringed sight distance (sharp horizontal and vertical curves), which are prone to accidents. Improvement of the road will also involve introducing a number of safety features such as climbing lanes, non-motorised lane, service roads in town sections, and widening of shoulders in town sections.

A total of seven climbing lanes have been proposed for Kasulu roundabout - Manyovu section at the following sections:

Starting Point	Ending Point	Length	Side
8+150	14+400	6250	LHS
20+160	21+330	1170	RHS
22+140	25+125	2985	RHS
27+050	28+330	1280	RHS
42+585	45+155	2570	LHS
46+835	48+630	1795	LHS
48+300	49+550	1250	RHS

On average, in rural road sections the proposed road will have double carriageways of 7.0m width, and 2.0m wide shoulders. The road upgrading will also involve construction of lined and non-lined side ditches/drains as required.

All box culverts will be 7.0 wide and will have 2.0m protected foot path (with guard rails) on both sides of the bridge. With exceptions of bypasses and a few sections, the proposed road will almost follow the existing alignment.

In addition, the design has incorporated the following safety aspects:

General Accident Situation	Designed Countermeasure
Pedestrian/vehicle conflicts	<ul style="list-style-type: none"> • Pedestrian/vehicle segregation (sidewalks or wide shoulders) • Raised pedestrian crossings • Speed control/Traffic calming measures
Vehicular Loss of control	<ul style="list-style-type: none"> • Road markings • Delineation • Speed controls • Guardrails
Darkness	<ul style="list-style-type: none"> • Reflective signs • Reflective road markings • Delineation
Poor visibility	<ul style="list-style-type: none"> • Improve sightlines

	<ul style="list-style-type: none"> • Realignment • Conspicuity
Poor driving behaviour/ lane discipline	<ul style="list-style-type: none"> • Road markings • Enforcement/Awareness
Collision with roadside obstacles	<ul style="list-style-type: none"> • Better delineation • Guardrails
Skidding	<ul style="list-style-type: none"> • Appropriate surface texture
Turning movements	<ul style="list-style-type: none"> • Turn prohibition • Channelization / right turn lane • Acceleration / deceleration lanes
Light / heavy vehicle conflicts	<ul style="list-style-type: none"> • bus bays / lay by • Manageable gradients • Climbing lanes
Parked vehicles	<ul style="list-style-type: none"> • Parking controls • Parking provision
Roadside Stalls	<ul style="list-style-type: none"> • Service roads • Wide shoulders

A One stop Border Post (OSBP) facility has been proposed to be constructed at Manyovu/ Mugina border between Tanzania and Burundi.

An OSBP is a border post that combines two stops for national border control processing into one and consolidates border control functions in a shared space for exiting one country and entering another. It uses simplified procedures and joint processing wherever appropriate as opposed to the traditional post where two sets of activities are performed separately at each border post:

- Procedures required to exit a country and
- Procedures required to enter another country

In the existing border post, exit procedures are carried out on one side of the border for persons, vehicles, and goods leaving the country. Entry procedures are carried out on the other side for persons, vehicles, and goods arriving in the country. Activities generally involve immigration, customs, and other border control functions depending on the size and characteristics of the border and the national laws that govern border controls. For the user, the existing border post involves going through a variety of paperwork, procedures and payments and then driving a few hundred meters and repeating the process on the other side.

Border controls at the existing traditional two stop border post takes long, especially when mistakes or miscalculations delay payment. This adds cost directly affects the cost of imports to consumers. A second cost derived from border delays and poor facilitation on the route is high inventory costs. When supply routes are not reliable, buyers choose other sources of goods. Falsification of documents may be prevalent where two stop border posts are in operation due to non-sharing of intelligence. This is demonstrated by disparities between export and import of the two border countries. Declaring of differing values for goods is usually motivated by the desire to avoid or reduce duties payable. Failure to collect all revenues affects the bordering countries heavily. Therefore, there is a strong relationship between the time and reliability lost on corridors, including border crossing time, and growth in trade with its potential impact on economic growth, revenue collection, and job generation.

An OSBP means that parking and entry into the building will be done only once. All procedures related to documentation and passports will be processed in a single public hall for exiting one country and entering the adjacent country. If inspection of cargo is required, it will be done once through a joint inspection involving all necessary agencies of both countries at the same time. Scanning of cargo, if deemed necessary, will be done once.

For passenger cars and buses, introduction of OSBP procedures will cut down the border processing time to almost in half. For example, at a tradition border, buses stop at one side of the border and the passengers go into the terminal. Luggage and cargo are off loaded and inspected as needed. This takes one to two hours, then the bus is driven to the other side of the border and the same processing is repeated for another one to two hours. Passengers will enter one terminal and do both exit and entry processing. Cargo is off loaded once and inspection done jointly. Most bus clearances will be done in one hour. Freight processing is more complicated and the gains are dependent on a great deal of coordination which takes more time to achieve. Nevertheless, the potential time reductions are also considerable, if more gradual.

In addition to reducing processing time due to single window processing and single administrative documents, a common control zone will facilitate in cases of irregular migration. In cases of refused entry ineligibility or for cancellation of visa/permit, the readmission to the country of departure could be almost an automatic system process.

Completion of the on-going construction of the OSBP will therefore enhance the operation of the proposed road upgrading project through reduction of border crossing time and costs

3.3 PROJECT ACTIVITIES, MATERIALS, WASTES, AND EQUIPMENT

Upgrading of the road will entail the following main activities:

3.3.1 Mobilization Phase

3.3.1.1 Activities during Mobilization Phase

The mobilization phase of the project, which is estimated to take about 6 months, will entail the following activities:

- Land acquisition for the construction of camps and materials borrow sites. Land acquisition will involve compensation of land.
- Establishment of construction of camps (Contractors' and Engineer's camp), which shall include among others residential houses and site offices, workshops (mechanical, carpentry, steel workshops), material and equipment storage areas, materials processing yards (e.g. concrete pre-cast yard, concrete batch plant, asphalt facility), including sanitation facilities. The following activities will be involved during establishment of the camp:
 - a) Clearing of camp construction site
 - b) Excavation works for foundation
 - c) Construction of a foundation: concrete or/and block works
 - d) Construction of timber sub – structure
 - e) Roofing works
 - f) Construction of sanitation facilities

- g) Installation of electrical infrastructure
- h) Installation of water and wastewater infrastructure
- i) Construction of fence for campsites
- Identification of naturally-occurring material borrow sites (sand, fill, gravel borrow and quarry sites), including land acquisition of land for the sites
- Identification of sources of water for domestic and construction works
- Transport and assembling of construction plants and equipment to the construction site
- Transport of fuel and construction materials from sources to the construction site

Notably, acquisition of land for sitting the campsite and sources of construction materials will precede mobilization of equipment and construction of the camp.

3.3.1.2 Materials required during Mobilization Phase

The following materials will be required during mobilization phase of the project:

- Cement, sand, and aggregates for block and concrete works
- Water for general construction works and dust abatement
- Timber, galvanised iron sheets, paints, nails, etc. for roofing and fencing works
- Electrical works: conduits, cables, fittings
- Plumbing works: Poly Vinyl Chloride (PVC) and Galvanised Steel (GS) pipes, fittings
- Fuel for the operation of construction machines and equipment
- Fencing wire and poles for fencing off the camps from the neighbourhood

Cement, galvanised iron sheets, nails, fence wire, electrical and plumbing utilities will mainly be obtained from either Dar es Salaam, while sand, aggregates, and timber will be obtained locally.

3.3.1.3 Equipment Required During Mobilization Phase

The major equipment which will be required during mobilization phase of the project will include:

- Bull dozers/motor graders, excavators for site clearing, excavation, and grading of the camp construction site
- Light duty vehicles and trucks for the transport of construction materials, small machines and staff
- Water pumps, block making machines, stationery concrete mixers and trans mixers, etc. for making of blocks and concrete mixes for concrete works
- Electric power generator(s)

3.3.1.4 Wastes Generated During Mobilization Phase

Mobilization phase of the project will generate the wastes shown in Table 2 below.

Table 2: Wastes likely to be generated During Mobilization Phase

Aspect	Solid Waste	Liquid Waste	Gaseous Waste
Site clearing and excavation	Earth, green cutting	None	Generation of air pollutants (dust)

Aspect	Solid Waste	Liquid Waste	Gaseous Waste
Construction of foundation(s): block/concrete works	Concrete, blocks, hessian cement bags	Water slurry, wash-down water	None
Construction of the main structure	Cement bags, mortar, steel reinforcements, nails, timber, iron sheet wastes, etc.	Concrete slurry	Paint
Installation of electrical infrastructure	conduit pipes, cables	None	None
Installation of water infrastructure	PVC and GS pipes	None	None
Labour force	Plastic bottles/ bags, food wastes	Sanitary wastes	None
Servicing of construction equipment	Used batteries, used tyres, used metals parts, used oil and fuel filters, empty oil drums	Waste oil	None

3.3.1.5 Treatment and Disposal of Wastes Generated During Mobilization Phase

The treatment methods for the wastes generated during mobilization phase shall be based on re-using, re-cycling, burying, or burning, and on site treatment.

- During site clearing, top soil and green cutting shall disposed of in old borrow pits or other areas approved by the Engineer
- Concrete and cement blocks wastes shall be disposed of in borrow pits during their reinstatement as approved by the Engineer.
- Metal wastes such as GS pipes, nails, reinforcement bars, and used equipment parts shall be disposed of by recycling. They will be collected and stored; until enough quantities are obtained before being disposed of by the Contractor to steel rolling factories in Dar es Salaam through NEMC approved metal scrap disposing companies. The metal scraps disposing companies shall be approved by the Engineer.
- Degradable materials such as paper cement bags and paper boxes shall be treated on site by either controlled burning.
- Non degradable wastes such as plastic, PVC pipes, and plastic bottles shall be collected and transported and given freely to plastic factories in Dar-es-salaam where they will be recycled.
- Used batteries, empty metals drums, used oil filters shall be disposed of through NEMC approved disposing companies as described in sub-section 2.4.2.5
- Temporary pit latrines shall be constructed at active mobilization sites (camp sites) for the disposal of sanitary wastes.

3.3.2 Construction Phase

3.3.2.1 Construction Activities

The construction phase of the project, which is estimates to take 24 month for each of the two lots and will encompass following major activities:

- Earth works to facilitate widening and re-alignment of the road. Earth works will entail the following activities:
 - a) Clearing and grubbing (clearing of vegetation, including trees (only trees within the road prism shall be removed)
 - b) Removal of top soils
 - c) River dredging
 - d) Cutting and filling
 - e) Road widening and re-alignment and compaction
 - f) Excavation to facilitate construction storm water drainage system such as side drains and cross drains (culverts), etc.
- Construction of detours and diversions and construction of access roads to sources of naturally-occurring construction materials
- Demolition of buildings within the RoW
- Demolition/ dismantling of the existing hydraulic structures (culverts)
- Collection and disposal of dredges, spoilt, demolition materials from the existing road and its furniture, buildings, and excavated earth materials
- Extraction of naturally-occurring construction materials. This will include:
 - a) Excavation and transport of natural sand, gravel, and sub-base materials to construction sites.
 - b) Stone quarrying (including blasting), crushing and transport of crushed aggregates to construction sites
 - c) Transport and handling of fuel, lubricants etc. from their sources to the project site
- Fabrications and installation of pipe culverts
- Construction of box culverts and road side drains. Construction of culverts will involve such activities as excavation, cutting, bending, and fixing of re-bars, concrete works, and protection works
- Filling and reshaping the road section to sub-grade level
- Abstraction of water from surface and underground sources for the treatment and compaction of different road layers as well as mitigation of generation of dust
- Laying of C1 cement-stabilized sub-base pavement layers, including compaction and curing with water
- Laying of CRR (Crushed Rock) pavement layer, including compaction and slashing
- Heating of bitumen
- Priming of CRR pavement layer with hot bitumen

- Pre-coating of stone chippings with bitumen
- Spraying of hot bitumen on CRR pavement layer
- Spreading of different two layers of chippings on the bitumen sprayed on CRR layer

3.3.2.2 Materials Required During Construction Phase

During the project construction, the following materials (Table 3) will be required:

Table 3: Materials required During Construction Phase

No	Material	Usage	Source
1.	Ordinary Portland Cement (OPC) and Pozollana Portland Cement (PPC)	Production of mortar, laying of C1 and C2 pavement, construction of structural works (culverts), production of asphalt concrete	Dar es salaam, Tanga, Mbeya
2.	Sand	Production of mortar and general concrete works	Stone crusher dust and sand pits (to be established by Contractors)
3.	Crushed aggregate	Concrete works (Structural works), construction of drainage systems, production of chippings for production of Asphalt Concrete	Table 8
4.	Steel reinforcement bars	Reinforced concrete works (construction of drainage structures	Dar /imported
5.	Steel shutters and form works	Concrete works	Dar
6.	Soft timber	Production of timber formworks and shutters	Locally
7.	Nails	Nails for fixing timber form works	Dar es salaam/ imported
8.	Hard stone	Construction and protection of drainage structures, production of base course material, production chippings for surfacing	Table 8
9.	Gabion boxes and mattresses	Protection works	Imported
11.	Natural gravel	For C1 pavement layers	Borrow pits (Table 6)
12.	Earth fill material	Sub-grade layers	Borrow pits (Table 6)
13.	Different grades of bitumen	Priming and production of laying of Asphalt Concrete	Imported
14.	Thermoplastic paints	Road marking and metal marking paints for sign board marking	Dar/ imported
15.	Geo-textile fabrics	The soil stabilization, drainage, and erosion control	Imported
16.	Water	Drinking, concrete works, spraying during compaction and curing of C1 pavement layers, laying of CRR pavement layer, dust suppression	Rivers and boreholes
17.	Concrete admixtures	For different treatments of concrete	Imported
18.	Different grades of lubricants (oil and grease)	Lubrication of construction equipment	Dar
19.	Diesel and gasoline fuel	Operation of construction machines and equipment	Dar
20.	Assorted spare parts and consumables	Repair of equipment and operation of mechanical workshop etc.	Dar/ imported

Lubricants, fuels, bitumen, concrete, and paints are among hazardous and toxic substances that will be used during the construction phase of the road. Lubricants, fuels, bitumen, and concrete present a threat to the quality of surface and ground water as well as soil in the event of accidental spillage or leakage.

3.3.2.3 Equipment Required During Construction Phase

The construction phase of the project road will require a wide range of construction machines, machinery and equipment, as well as vehicles and trucks for transport of staff and construction materials. The following table (Table 4) gives the basic machinery, equipment, and vehicles that will be used during construction phase.

Table 4: Machinery & Equipment Required for Construction Works

No	Machinery/equipment	Activity for which it is required
Construction Equipment: Type and Characteristics		
1.	Backhoe excavator	General earth works, e.g. excavation of drains and river dredging
2.	Bull dozer with ripper	General earth works
3.	Wheeled loader	General earth works and transport of concrete
4.	Motor grader	General grading works, including earth works
5.	Vibrating/sheep foot roller compactor	Compaction works
6.	Vibrating steel drum roller compactor	Compaction works
7.	Tandem roller compactor: 8 – 10 ton	Compaction works
8.	Pneumatic Tired Roller (PTR) compactor	Compaction works
9.	Hydraulic hammer	Piling works
10.	Truck mounted crane	Lifting of construction materials e.g. pre-cast culverts
11.	Asphalt plant	Production of asphalt plant
Construction Machines		
1.	Concrete batching plant	Preparation of concrete (batch concrete mixing)
2.	Pug mill	Mixing of cement-stabilized sub-base material
3.	Concrete truck mixer (trans mixer))	Concrete mixing
4.	Concrete mixer	Concrete mixing
5.	Stationery bitumen heater	Heating of bitumen
6.	Bitumen distributor/ sprayer	Distribution of bitumen
7.	Mechanical broom	Cleaning of road surface
8.	Single jaw crusher:	
9.	Stone crushing plant with associated screens	Production of chipping (aggregates) from hard stones)
10.	Quarry dump trucks	Transport of stones and aggregates
11.	Dump trucks	Transport of construction materials and wastes
12.	Power bloom and blower	Blowing of surfaces before paving
13.	Equipment for geotechnical investigations	Geotechnical investigation works
14.	Concrete vibrator and poker	Vibrating concrete
15.	Dewatering pump	Dewatering to allow for waterless construction
16.	Air compressor and wagon drill	To create pressurised air during drilling and cleaning during road surfacing etc.
17.	All essential supporting units such as electric power generators, mobile workshop, tyre repair shops, welding	Repair and maintenance of machinery and equipment

No	Machinery/equipment	Activity for which it is required
	facilities, services trucks, low-bed trailer (low-loader) units etc.	
Transport Facilities		
1.	Light duty vehicles	Transport of light construction materials, stationery machines, and staff
2.	Water and fuel tankers	Dewatering of earth surfaces to attain effective compaction, minimizing generation of dust, and transport of fuel

3.3.2.4 Wastes Generated During Construction Phase

The wastes generated during construction phase of the project will result from operation of construction campsite, machinery, and equipment maintenance, batch plant operations, road construction, concreting activities, and construction of structures. The wastes which will be generated during construction phase of the project are shown in Table 5.

Table 5: Wastes likely to be generated during Construction Phase

Aspect	Solid Waste	Liquid Waste	Gaseous Waste	Hazardous Waste
Operations of Campsite				
	Paper	Sanitary waste	-	-
	Litter	-	-	-
	Toner, cartridges	-	-	-
	Paper litter	Sanitary waste	-	-
	Plastic bottles/bags	-	-	-
	Aluminium cans	-	-	-
	Food wastes	-		
				Biohazard wastes (medical wastes) including swabs, dressings, syringes, needles, pharmaceutical product packing materials
Machinery and equipment Maintenance				
	Plastic and glass (containers), used tyre, metal (used parts), plastic and cable parts, used lead-acid batteries,	Waste oil and grease, battery acid (dilute sulphuric acid)	Refrigerant/ air conditioning gas, Emission of greenhouse gases and air pollutants (hydrogen gas etc.)	Gases that are compressed, liquefied, or dissolved under pressure may be hazardous. Flammable liquids including oil, grease and petroleum compounds are also hazardous
	-	Lubricant, coolants (radiator fluid), hydraulic fluid, waste water)	-	-

Aspect	Solid Waste	Liquid Waste	Gaseous Waste	Hazardous Waste
Earth Works and demolition				
	Green cutting, dredges, top soil	-	-	-
	Demolition wastes (earth, concrete, timber, iron sheets)	-	-	-
Road Construction				
	Earth, sand, dredges, aggregates, stones	Wastewater	Emission of air pollutants	-
	Bitumen	Bitumen, oil	-	-
	Bitumen containers (drums)	-	-	-
	Cement packing (hessian or paper bags)	-	-	-
	Metal cans	Paints (road marking etc.	Emission of air pollutants	
Batch Plant Operations				
	Concrete additives, additives empty drums, concrete waste	Concrete wastewater slurry	Emissions of greenhouse gases and air pollutants	-
Concreting activities and Bitumen Surfacing				
	Concrete, cement bags	Curing compounds/water slurry	Emission of greenhouse gases and air pollutants	-
	-	Wash-down water	-	-
	Bitumen		Bituminous air emissions	
Construction of drainage cross structures				
	Concrete	Wastewater		
	Steel	-	-	-
	Earth	-	-	-
	Metals (nails, reinforcements)	-	-	-
Surfacing with bitumen				
	Empty bitumen drums, bitumen contaminated soil	Bitumen		

3.3.2.5 Treatment and Disposal of Wastes Generated During Construction Phase

The treatment methods for the wastes generated during construction phase will depend on whether they are degradable, non-degradable, hazardous, or non-hazardous. Depending on the nature of the wastes, the wastes will either be re-used, re-cycles, buried, or burnt.

- Green cutting and top soil shall be stockpiled for site reinstatement and top soiling of cleared areas to promote vegetation. Excess top soil shall be spoiled in borrow pits in areas approved by the Engineer.

- Metal wastes such as iron sheet, nails, metal cans, reinforcement bars, and used machine parts shall be disposed of through NEMC certified metal scrap collectors who will transport them to steel foundry factories in Dar es Salaam for recycling.
- Used oil filters (with metallic housing) will be hot drained, then disposed of through NEMC certified companies who will transport them to Dar es Salaam for recycling.
- Used lead-acid batteries shall be collected and transported to Yuasa battery factories in Dar es Salaam for recycling by a NEMC certified waste collectors
- Motor oil (engine, transmission, and hydraulic oils) have value even after it has been drained from equipment, as it be recycled, and turned into fuel oil or used as a raw material for the refining and petrochemical industries. The oil can be reprocessed and used in furnaces for heat or in power plants. It can also be sent to a refinery that specializes in processing used oil and re-refined into lubricating base oils that can be used to formulate engine oils meeting API (American Petroleum Institute) specifications. Since we do not have used oil collection centres in Tanzania, the contractor should enter into an agreement with its supplier of lubricants or any NEMC certified company to collect oil to be used in steel rolling furnaces in Dar es Salaam.
- Sanitary wastewater at camps shall be disposed of by the use of water closets, septic tanks, and soak away pits, while at active construction sites will be disposed of by the use of mobile toilets or pit latrines
- Non degradable wastes such as plastic bottles shall be collected and transported to Dar es Salaam through NEMC certified waste collectors for recycling by plastic recycling factories (used to make plastic bags).
- Biodegradable wastes such as paper bags and paper boxes will either be treated by controlled burnt or burying on site
- Non-bio gradable wastes such as hessian bags will be treated on site by controlled burning.
- Before demolition buildings along the road, owners of the properties shall be allowed to salvage valuable materials such roofing iron, windows, doors, and timber. Non-degradable demolition materials such as cement blocks and clay bricks will be collected so that they are used to fill pits and quarries during their reinstatement. The contractor shall add soil to any area backfilled with blocks to fill large voids and top prevent future settlement. The backfilled areas should be capped with at least 60 cm of soil, contoured to match the surrounding grade, covered with top soil, and if necessary re-vegetated.
- Empty bitumen drums shall be disposed of through NEMC certified companies who will transport them to steel smelting factories in Dar es Salaam for recycling.
- Excess bitumen (though rare to happen) will be returned to the containers (drums) for future use
- Excess concrete will be used as bottom materials during reinstatement of pits and quarries as described in Sub-Section 2.4.1.5
- Food wastes shall be treated by composting
- Inert or readily bio degradable materials from the construction camp will be used to fill quarries and pits
- Used tyres shall be disposed of through NEMC certified companies

- The Contractor shall either construct an incinerator at the camp for the incineration of medical wastes or shall transport the medical wastes to a hospital with an incinerator facility for incineration.

3.3.3 Demobilization Phase

3.3.3.1 Demobilization Activities

After completion of road construction, Engineer's camps shall be reverted to the TANROADS who will decide on their future use. However, Contractors' camps shall be closed out. The main activities during demobilization phase, which will take 1 year, will engross the following:

- Collection and disposal of storage facilities such as pallets, packing, boxes
- Collection and disposal of construction materials and wastes such as waste oil, sewage, solid wastes (plastics, wood, metal, papers, etc.) at the workshop, site office etc. to authorized dumpsite
- Disassembling and transport of construction machines, machinery and equipment
- Removal of temporary infrastructure, installations and equipment from the campsite
- Rehabilitation/landscaping of the campsite to the original condition by shaping and grading
- Handing over of permanent structures and facilities in the campsite to TANROADS who will decide its future use
- Restoration of material borrows areas to safer condition.

3.3.3.2 Materials required During Demobilization Phase

Materials required during demobilization phase will include fuel for the operation of equipment, soils and tree seedlings for reinstatement of borrow pits and campsite. During this phase, labour, water, and energy will also be required.

3.3.3.3 Equipment Required During Demobilization Phase

The equipment required during demobilization phase will include vehicles and trucks for transport of wastes, graders and bull dozers and front loaders for the landscaping the campsite surroundings.

3.3.3.4 Wastes Generated During Demobilization Phase

The following wastes will be generated during demobilization phase of the project:

- Hazardous waste such as used lubricants (oil and grease), used lead-acid batteries, empty bitumen drums, rejected bitumen, empty plastic bottles, etc.
- Empty barrels and tins
- Plastic and paper packing
- Used equipment parts

2.4.3.5 Treatment and Disposal of Wastes Generated During Demobilization Phase

The wastes generated during demobilization will be treated or disposed as phase will be treated or disposed described in sub-sections 2.4.1.5 and 2.4.2.5.

3.3.4 Operation and Maintenance Phase

3.3.4.1 Operation and Maintenance Activities

The maintenance activities of the project road will pertain to the road pavement and its embankments, hydraulic and drainage structures and road furniture and where necessary, re-surfacing/patching. The main activities during maintenance phase will entail the following:

- Installation of damaged or stolen signboards.
- Road re-marking with thermo-plastic paint
- Maintenance of damaged road sections, which will include such activities as:
 - Transport of construction materials from their sources to the construction sites
 - Sealing of cracks and patching of pot holes
 - Routine de-silting and clearing of debris from road side and cross drains
 - Repair and replacement of road furniture (side and cross drains)
 - Proper disposal of wastes from road-maintenance activities
 - Maintenance of grass covers on road sides and management to reduce pollutant concentrations in runoff.
 - Road side grass slashing
- Storage and management of maintenance materials and equipment.
- Awareness rising on proper road use and road environment management to the communities.
- Monitoring and evaluation of road performance and management

Other activities will include design/ planning of and implementation of HIV and AIDS awareness campaigns. This activity will span from mobilization to decommissioning phases.

3.3.4.2 Materials Required During Operation and Maintenance Phase

The following materials will be required during operation phase of the maintenance phase of the project:

- Thermoplastic paints for road marking
- Sign boards to replace damaged or stolen ones
- Bitumen for repair of pot holes/patching
- Crushed aggregates, cement, and sand for repairs of potholes and drainages structures

3.3.4.3 Equipment Required During Operation and Maintenance Phase

The main equipment which will be required during maintenance phase of the project will be:

- Pneumatic/hydraulic demolishing machine
- Air compressor
- Roller compactor for compaction
- Concrete-bitumen processing plant
- Back hoe loader for de-silting of side drains and a during spot resurfacing

3.3.4.4 Wastes Generation during Operation and Maintenance Phase

The wastes generated during operation and maintenance phase of the project will mainly consist of litter, silt, and construction material wastes and will be disposed as described in sub-sections 2.4.1.5 and 2.4.2.5

3.3.5 Project activities from Mobilization to decommissioning phase

3.3.5.1 HIV/AIDS/STIs Awareness Campaign:

Campaign to be undertaken during mobilization, construction and decommission phases amongst workers for the duration of the contract shall include the display AIDS/'STIs awareness posters in all buildings frequented by workers employed on contract, where such buildings fall under the control of the contractor. AIDS/STIs awareness shall be included in the orientation process of all workers to be employed on the contract. Sexual abuse and exploitation of children shall also form part of this campaign.

3.3.5.2 AIDS Prevention Campaign

As part of the contract the Contractor shall be required to make condoms available to all workers. This activity shall be carried out during mobilization, construction, and decommission phases of the contract.

3.3.5.3 HIV/AIDS/STIs Training

Training will be conducted as per HIV/AIDS policy at work place by a qualified Contractor's staff or organization. This activity will be undertaken during the construction phase.

3.3.5.4 Employment of Local Staff that is gender sensitive

Gender mainstreaming awareness will target both individuals and local communities.

Activities to be undertaken during mobilization and construction phases

- Provision of information to women on potential employment opportunities in the road works especially for neighbouring communities
- Organizing meetings with women groups
- Employ women as much as possible. Sections that women are competitive include traffic control, store keeping, landscaping, surfacing, top soiling and variety of labour-intensive tasks and control and circulation of traffic
- Awareness creation on gender sensitivity at camp sites, constructions sites and roads including the use of gender sensitive language in all road works
- Preparation of gender disaggregated data for various activities
- Promotional billboards to raise awareness and integration of gender issues during road construction
- Training for various categories of workers: drivers, operators, supervisors, inspectors, top management team on gender mainstreaming and sensitivity etc.

3.3.6 Potential Sources of Naturally-occurring Construction Materials

Borrow pits are sites where stones, sand, gravel or other granular soils will be extracted for the road construction. The term “pit” is used when granular material is extracted. The term “quarry” is used where consolidated rock is removed.

3.3.6.1 Sources of Gravel Materials

Several borrow sites for fill, sub-grade, base, and sub-base materials have been identified along and off the existing road alignment. The following table (Table 6) lists locations of the identified sources, together with estimated quantities.

The vegetation around the existing borrow sites is generally characterised by grassland and scattered miombo woodland.

The survey noted that borrowing of gravels from existing borrow sites have involved clearing of a significant number of trees and no re-instatement has been done after their uses.

It is worth to note that the identified borrow areas in Table 6 are only for information to the Contractor. The Contractor is therefore not bound to use the identified borrow areas.

Table 6: Sources of Gravel Materials (Sub-grade and Sub-base layers)

No	Name	Chainage (Km)	Off set (m)	Direction	Estimated Quantity (m ³)
1.	BP1	2+900	400	RHS	45,000
2.	BP2	35+500	off-road	RHS	40,000
3.	BP3	68+600	450	RHS	50,000
4.	BP4	76+060	500	LHS	35,000
5.	BP5	109+700	off-road	LHS	50,000
6.	BP6	137+600	off-road	RHS	40,000
7.	BP7	168+300	100	LHS	40,000
8.	BP8	192+100	1100	RHS	40,000
9.	BP8	223+200	100	RHS	35,000
10.	BP9	252+400	off-road	LHS	50,000
11.	BP	288+100	off-road	LHS	30,000

Source: Adapted from Materials Report of this Project

3.3.6.2 Hard stone and aggregates for Road Surfacing from Crushed Rock

Suitable sources of rocks for concrete mix, base, and Asphalt Concrete have been identified at four locations are indicated in Table 7 below.

Table 7: Potential Sources of hard stone

Quarry No	Chainage	Offset (m)	Remarks
Q1	16+100	5km LHS	Mugamba Hill, south of Kalela Village, accessible
Q2	46+500	3km LHS	Bugaga Hill, difficult access & no overburden
Q3	57+400	3km LHS	Ngala Hill, limited access
Q4	82+300	4km LHS	Zazi Hill, limited access, mostly big boulders
Q5	286+100	1km LHS	Kakonko Hill, accessible & no overburden
Q6	On Burundi Road	0.2Km RHS	13.8km from Nyakanazi junction, accessible & no overburden

Source: Adapted from Materials Report of this Project

3.3.6.3 Sand

Suitable sand sources are reported to be scarce in the vicinity of the project area. Most of the sources visited have sands which are highly silty and very fine. The only sources which are suitable for construction works and widely used in the area were those found at the locations listed in Table 8 below. It may therefore be necessary to produce sand as a by-product from the production of crushed stone road base and surfacing aggregate.

Table 8: Potential Sources of Sand

No	Location	Source Name	Remark
1.	273+400	Myowosi River Sand	River Sand
2.	Kigoma	Bugera Sand Pit	Pit sand, Kigoma town
3.	Kigoma	Kagongo Sand Pit	Pit sand, 1.5km at Ujiji and 3.7km RHS

Source: Adapted from Materials Report of the Project

3.3.6.4 Water

Among the many rivers crossing the route (Table 9), samples were collected from free flowing permanent sources and tested during the centreline soil survey and the feasibility study period and the results indicate that the waters are acceptable for use in both concrete and other construction works.

Table 9: Potential Sources of Water for Construction Works

No.	Location (km)	Name of the River
1.	4+100	Kidahwe
2.	7+300	Mkuti
3.	11+100	Ruiche
4.	31+400	Kasengezi
5.	37+500	Muzie
6.	80+000	Ngalangara
7.	101+800	Ruchigi
8.	113+300	Makere
9.	147+100	Malagarasi
10.	193+900	Pemji
11.	273+400	Moyowosi

3.3.7 Materials that will be imported

The following materials shall be obtained from outside the project area.

- Cement
- Reinforcement bars
- Concrete admixtures
- Timber
- Steel form works and shutters
- Gabions boxes and mattresses for construction and protection of drainage structures
- Paints

- Geo-textile fabrics
- Spare parts
- Bitumen

3.4 STAFFING AND SUPPORT

At minimum, the following staff will be required:

- Engineers for general supervising of construction works: Will be obtained both locally in Tanzania and outside Tanzania
- Surveyors: Most of these will be obtained locally in Tanzania
- Technicians for supervision of artisans: These will be obtained from within Tanzania and outside Tanzania
- Other skilled labourers: Artisans specialized in woodwork, steel fixing, concrete works, metal work, operators, and drivers for operations of construction machinery, equipment, heavy duty trucks and light duty vehicles, and construction machines, and support staff such as accountants etc.). These expected to be obtained from within Tanzania
- Unskilled labourers that will be required for general works which do not required specialised skills. It is anticipated that most of the unskilled labourers will come from within the project area.

Their exact number cannot be established now by the Consultant. However, based on Consultant's experience of past projects of similar size, the Contractor will need around 600 staff (inclusive of expatriates).

3.5 REQUIRED OFF SITE INVESTMENT

The following off site facilities will be required during implementation of the project:

3.5.1 Power Source

The fact that not all the villages along the project road are not connected to TANESCO National power grid and the fact that that construction camp likely be constructed at a village which is not connected to national power grid will necessitate Contractor to install dedicated diesel driven generators to supply power to the camps and for the operation of electrically-operated equipment at work sites.

3.5.2 Water Supply

Water will be required for construction activities such as concrete works, earthworks, laying of some of the pavement layers, dust suppression, as well as for domestic purposes at the camps. Water for construction works will be obtained from rivers and boreholes. Domestic water will be pumped directly from boreholes to storage tanks before being distributed by pipelines. Water for construction works will be pumped from rivers and delivered to work sites by water tankers. The main sources of water are described in subsections 2.4.6.4 and 4.2.4. The amount of water required during construction of the project is yet to be established.

3.5.3 Diversions and Access Roads

Diversion roads will be created to divert traffic away from active construction sites, especially during construction of cross drainage structures. Access roads will be constructed to construction materials borrow sites which are located off the main alignment.

3.5.4 Other Facilities Required

Other infrastructures that will be required during construction include:

- Fuel storage tanks. The tanks will have to be placed on secondary containment basins to catch any possible spills or leak. Underground fuel storage tanks shall not be allowed
- Storage facilities for construction materials (cement, bitumen, paints, steel, timber etc.)
- Mechanical workshop for repair and maintenance of construction machinery, equipment, and vehicles.
- Accommodation and offices for the Contractor and Engineer (Engineer) key and support staff. The housing will be furnished with all necessary services such as water and sanitation facilities. Since it is not a Contractual obligation for the Contractor to provide housing for his staff, it cannot be established now whether the Contractor will construct a labour camp. Otherwise, the rest of the staff will be required to rent houses in the neighbourhood of the camps.

3.6 LAND REQUIREMENT

When it is considered that the proposed project road is classified as a trunk (with a road reserve of 60m, which will almost follow the existing alignment, the total land area of land that will be required for road rehabilitation is approximately 288 hectares. In addition, the project will require about 5 hectares of land for the construction of camps. Other places to be affected, whose areas cannot be determined now, will include material borrow areas (borrow pit, sand pit, water boreholes, and quarry sites), as well as detours and access roads. Nonetheless, such area will only be occupied by the project during its construction phase.

SECTION 4: BASELINE CONDITIONS

4.1 PROJECT BOUNDARIES

4.1.1 Spatial Boundaries of the study area

The study area was mainly confined to the RoW, potential sources of naturally-occurring construction materials (water, gravel, hard stone, fill materials, sand) and their access roads, camps, diversions and detours and the area immediately after the RoW (100m on both sides). The 100m has been chosen to accommodate/give allowance for establishment of borrow pit, contractor's campsite or materials storage yard close to the road alignment. The DIZ was determined on the basis of the following factors:

- The distance of travel of noise, vibrations, dust, and exhaust fumes from construction plants and machinery from the site boundary
- Marginal zones and developments from the site within 100 m as it is within this distance that impacts are likely to be felt

The study has also considered the area beyond the DIZ (AI) where most of the environmental impacts will be induced or influenced by the project activities. It is not subject to direct contact with the site, but is directly or indirectly affected by the presence of the proposed road. Areas around sources of construction materials are also considered as areas of influence. Villages that are linked to the existing road through village roads can be considered to be the AI.

4.1.2 Temporal Boundaries

The temporal boundaries of the project consist of the durations for mobilization, construction, and demobilisation phases of the project. In addition, the temporal boundaries are the design periods of the road and its components (road pavement, culverts etc.). The following are the estimated temporal boundaries of the project:

Phase	Time
Mobilization period:	6 months
Construction period:	24 months
Demobilization period:	1 year (inclusive of defect liability period)
Design life of the road pavement:	20 years
Design return period for pipe culverts:	25 years
Design return period for box culverts:	50 years

4.1.3 Institutional Boundaries of the project

The road project falls under the Ministry of Works, Transport, and Communication. The project is being implemented by TANROADS, which has the primary function of maintaining and developing the road network of Tanzania.

When it comes to fulfilment of other legal frameworks, then comes Vice Presidents office with the following institutions:

- Division of Environment who coordinates environmental management activities like coordination of environmental policy and issuing environmental clearance or ESIA approvals.
- National Environment Management Council – coordinates Environmental Impact Assessments, Monitoring and Auditing
- Buhigwe and Kasulu Districts through which the project road passes there are institutional bodies, which includes the following: District Executive Directors their teams of experts in various fields - engineering, water, health, community development, natural resources, environment, land, property valuation etc.
- At lower levels comes Ward Development Committee and finally at the Community or village level comes Village council with all the village leaders etc.
- Ministry of Natural Resources and Tourism through Tanzania Forest Services agency

These are the institutional boundaries of the road project where the consultant liaised with.

4.1.4 Administrative Boundaries

As noted earlier, the project road is administratively located in Kasulu and Buhigwe Districts, in Kigoma Region and traverses three wards namely Munanila, Muhinda, Buhigwe, Janda, and Muhunga (Buhigwe District), and Murufiti and Muzye (Kasulu District).

4.2 PHYSICAL ENVIRONMENT

4.2.1 Topography

The topography of the main project road alignment is generally characterised by undulating to rolling terrain which are dissected by a few seasonal drainages. Elevations of the project road vary from 1300 – 1760 Above Sea Level (ASL), with Kasulu and Munanila having the lowest and highest elevations (1300m and 1760m ASL) respectively. The following table (Table 10) describes the topography, including elevations variations for different sections of the road as one travels from Munanila (Manyovu) to Kasulu.

Table 10: Description of Topography across the Project Road

No.	Project Section	Description of Topography	Variations of Elevations in meters ASL
Manyovu – Kasulu round about			
1.	00+000 – 02+900 (Munanila – Musagara)	Progressive drop in elevations, with the highest elevations at Munanila and the lowest at Musagara. Slopes are rather steep	1760–1600
2.	02+700 – 09+100 (Musagara – Kibwigwa)	Undulating to rolling topography with steep to gentle slopes, with Musagara as the highest point	1600–1520
3.	09+100 – 16+900	Undulating to rolling topography with gentle to steep slopes	1600–1420

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No.	Project Section	Description of Topography	Variations of Elevations in meters ASL
	(Kibwigwa – Bwelanka)		
4.	16+900 – 21+200 (Bwelanka – Mulera)	Undulating to rolling topography with gentle to steep slopes	1420 – 1360
	21+200 – 21+700 Mulera - Buhigwe	Undulating with gentle slopes	1360 - 1360
5.	21+700 – 28+600 (Buhigwe – Songambele)	Undulating to rolling, with steep slopes between Km 23+000 – 27+700	1360-1460
6.	28+600 – 38+400 (Songambele – Karunga)	Undulating to rolling, with elevations rise as one travels towards Karunga	1460-1700
7.	38+400 – 40+200 (Karunga – Herujuu)	Undulating topography with gentle slopes	1700-1700
8.	40+200 – 47+100 (Herujuu – Kasulu)	Progressive drop in elevations, with the highest elevations at Herujuu and the lowest at Kasulu. Slopes are rather steep	1700-1300
Kasulu Southern Link Road			
1.	Junction to Baraka sec. school (Nyumbigwa) – Km 4+100	Undulating to rolling topography with gentle to moderate slopes. Between Km 3+900 and 4+100 the road traverses a flood plain	1,280 – 1,300
2.	4+100 – 4+800	Sudden rise in elevations with steep slopes towards Kasulu.	1,260 - 1,300
3.	4+800 – 6+600	Undulating to rolling topography with gentle to moderate slopes.	1,300 – 1,320
4.	6+600 – 8+200	Undulating topography with moderate to gentle slopes	1,300 – 1,320
Kasulu Eastern Bypass Road			
1.	Nyumbigwa – Kigondo Rd crossing	Undulating to rolling topography with gentle slopes.	
2.	Kigondo Rd crossing – R.Mgandazi	Progressive fall in elevations, with rather steep slopes	
3.	R.Mgandazi - Kidiama	Undulating to nearly flatland topography with gentle slopes.	
Kasulu Western Bypass Road			
1.	Kidiama to Kabanga	Progressive rise elevations, with moderate slopes	1220 – 1,260
2.	Kabanga – Herujuu	Progressive rise in elevation, with moderate slopes, then mountainous topography, with steep slopes towards Herujuu	1,260 – 1,720

Source: Consultant's Survey and interview with local people

4.2.2 Climate

The project area is characteristically by tropical climate with a distinct long wet rainy season beginning from late October to May with short dry spell of 2-3 weeks in January or February followed by a prolonged dry season. The average rainfall is between 1,300mm and 1,500mm. Mean daily temperatures which vary inversely with altitude range between 16⁰C in December, January to 30⁰C in September.

4.2.3 Geology and Soils

The majority of the soils along the project road are *Rhodic Ferralsol*. The soils are characterised by a fine-textured subsurface layer of low silt-to-clay ratio, high contents of kaolinitic clay and iron and aluminium oxides, and low amounts of available calcium or magnesium ions. They are composed of weathered soils with high iron or aluminium content.

This soil is characterised by low natural fertility and tendency to fix phosphates. It is suitable for a wide range of crops, with maintenance of soil organic matter and periodic liming.

4.2.4 Water Resources and Hydrology

4.2.4.1 Surface Water and Hydrology

Kasulu roundabout - Manyovu

The majority of the road is located on ridges, which facilitates natural drainage. The main alignment of the project road crosses only one, but a seasonal river which is located nearly at one end of the project road. The river, namely R.Lusungwe is located at Km 46+900 (spatial location shown by Fig. 1b and Fig. 8b in Appendix IV). The river is characterised by banana plants, large eucalyptus trees on the upstream, and shrubs on the downstream. Its 2 lane, 2-span bridge which is constructed of masonry piers and concrete beam has guard rails, but without pedestrian walkway (Photo 2). It's downstream riparian is used for raising tree nurseries, while its upstream is use for gardening (Photo 1).

Kasulu Western Bypass

The proposed western bypass traverses two seasonal rivers namely R.Bogwe at around Km 2+900 (Kidiama village) and R.Karunga across mountainous land around Km 9+300. Spatial locations of the rivers are shown by Fig. 8b in Appendix IV.

Kasulu Southern Link Road

Kasulu southern link traverses seven (7) rivers as described in the table (Table 11) below. The spatial locations of rivers are shown by Fig. 1b in Appendix IV.

Table 11: Rivers across the Project Roads

N ^o	River	Chainage	Village	Brief Environmental Profile
1.	R.Nyansato	0+900	Nyumbigwa	A seasonal river which is characterised by riverine trees on both its upstream and downstream riparians. Its crossing is constructed of single carriageway bridge without guardrail. Both upstream and downstream riparians are used for agriculture.

N ^o	River	Chainage	Village	Brief Environmental Profile
2.	R.Nyasasa	1+300	Nyumbigwa	A seasonal river which is characterised by riverine trees on its upstream and grass on its downstream riparian. Its single carriageway crossing is constructed of Armco culvert, without guardrail. Both upstream and downstream riparians are used for agriculture.
3.	R.Nyachingwe	3+000	Nyumbigwa	A seasonal river which is characterised by acacia trees on both its upstream and downstream riparians. Its crossing is constructed of 2-carriageways Armco culverts.
4.	R.Ruvumba	3+400	Nyumbigwa	A seasonal river which is characterised by yellow cassia trees on its upstream riparian and fig trees on its downstream riparian. Its crossing is constructed of single carriageway bridge without guardrail. It's upstream riparian is used for farming.
5.	R.Mgandazi	4+000	Nyansha	A perennial river which is characterised by elephant grass on its upstream riparian and acacia trees on its downstream riparian. Its crossing is constructed 2-carraigeways box culvert without guardrail. Both upstream and downstream riparians area used for farming. Commonly grown crops are banana, palm, mango, and sugar cane.
6.	R.Kibagwe	5+800	Nyansha	A seasonal river which is characterised by yellow cassia trees on its upstream and yellow cassia and guava trees on its downstream riparian. The river has been encroached by settlements on both upstream and downstream riparians.
7.	R.Kasulu	6+800	Kasulu	A seasonal river, with 2 Armco culvert crossing. The river has been encroached by settlements to as far as 8m from edge of the river and the river is polluted by domestic solid wastes.

Source: Field Survey and Interview with local people

Kasulu Eastern By pass Road

The bypass traverses one seasonal river namely R.Mgandazi, which borders Mkombozi and Kivule villages. The river is characterised by elephant grass and boggy soil. Since the bypass is a non-existent road, the river does not have a bridge. The water course is currently used for paddy and garden farming.

4.2.4.2 Ground Water Resources

Groundwater is abundant along the project road. This is evidenced by the fact that among sources of drinking are among sources of drinking water for the Districts as indicated in sub-section 4.2.6.

4.2.4.3 Surface and Ground Water Quality

Data on the quality of domestic water supply was not available to the consultant during the study. However, the quality groundwater supply from shallow wells and boreholes that have been drilled through district water authorities can be guaranteed. The quality of water supply from shallow open traditional wells and surface water from rivers cannot be guaranteed as they are prone to pollution by anthropogenic activities, including agricultural nutrients and faecal matter.

4.2.4.4 Flood Plains

A floodplain is flat or nearly flat land adjacent to a stream or river that stretches from the banks of its channel to the base of the enclosing valley walls and experiences flooding during periods of high discharge, mainly during rainy season. It includes the floodway, which consists of the stream channel and adjacent areas that carry flood flows, and the flood fringe, which are areas covered by the flood, but which do not experience a strong current.

It is the natural place for a river to dissipate its energy. Meanders are formed over the floodplain to slow down the flow of water and when the channel is at capacity the water spills over the floodplain where it is temporarily stored.

Manyovu – Kasulu roundabout Section

As noted earlier, the majority of the road is located on ridges and so it is naturally drained. The road therefore does not cross any flood plain.

Kasulu Western Bypass Section

The road traverses one flood plain across R.Bogwe. The flood plain is used for farming by the locals.

Kasulu Town Link Section

The road traverses one flood plain across R.Mgandazi. Again, as noted earlier, the flood plain is used for farming by the locals, resulting into substantial siltation of openings of bridges and culverts.

4.2.5 Road Side Air Quality

The typical air pollutants from road transportation sources are Carbon Monoxide (CO), Nitrogen Dioxide (NO₂), Sulphur Dioxide (SO₂) and volatile compounds; and particulate matters (dust).

The amount of dust generated is determined primarily by the volume of traffic using the unpaved road as well as the speed, weight, and number of wheels of the vehicle. The abrasive resistance of the road surface material and the amount of fines (earth road likely to generate more dust than gravel road) whether in the initial road surface material mix are also important contributing factors. The season variation of the project area, reflecting variations in temperature, humidity, and rainfall is also a contributing factor affecting the dust generation.

Obviously, during wet season, the time during which this study was carried out the amount of dust generated is low, since the rainfall disperses dust and maintains air quality.

During dry season, despite the low traffic volume, the amount of dust generated was considerable high, to the extent of impairing vision of motorists using the road. Crops and vegetation near the road is covered with the airborne dust. The generated dust particles can affect the growth the crops and other vegetation along the project road. Dust abrading leaf surfaces, dust blocking stomata (clogging of pores) of plants, dust increasing the amount of absorbed incident radiation. These are just a number of different impacts dust can have on vegetation and plants. But overall, the effects seem to be a reduction in photosynthetic abilities, the result of which can be stunting their growth due to shading effect, and clogging of the plant's pores.

To pedestrians, other road users, and residents living along the unpaved earth project road, the traffic-generated dust penetrates their homes causing a nuisance and health problems such as hay fever and allergies. Fine particles resulting from traffic actions can be washed off during precipitation events and carried into nearby streams increasing their respective particulate loading. For motorists using the unpaved roads the traffic-generated dust reduce visibility and cause driving hazards.

Despite the fact data on pollutant concentration along the roads was not available, considering the low traffic volume on the project road and the fact that settlement areas are open (which facilitates pollutant's dilution/dispersion), ambient air quality has been projected to be insignificantly affected by vehicular emissions.

Presently the Manyovu – Kasulu roundabout road and Kasulu Southern Link receive higher emission and pollution due to particulate matter than the non-existent eastern and western bypass roads because there is almost no traffic along this section. Nevertheless, emissions diminish as one move away from the urban area.

This study has tried to estimate current daily traffic emission, particularly Carbon Dioxide based on the current traffic volume counts – Annual Average Daily Count (AADT), which is defined a measure used primarily in transportation planning and transportation engineering. Traditionally, it is the total volume of vehicle traffic of a highway or road for a year divided by 365 days. AADT is a useful and simple measurement of how busy the road is.

One of the primary determinants of CO₂ emissions from mobile sources is the amount of carbon in the fuel. Carbon content varies, but typically we use average carbon content values to estimate CO₂ emissions

Based on United States Environmental Protection Agency, a gallon (3.8 litres) of gasoline gives a carbon content value of 2,421 grams, which produces 8,877g of CO₂. (The carbon content is multiplied by the ratio of the molecular weight of CO₂ to the molecular weight of carbon: 44/12), while diesel produces 2,778 grams of CO₂.

The Intergovernmental Panel on Climate Change (IPCC) guidelines for calculating emissions inventories require that an oxidation factor be applied to the carbon content to account for a small portion of the fuel that is not oxidized into CO₂. For all oil and oil products, the oxidation factor used is 0.99 (99 per cent of the carbon in the fuel is eventually oxidized, while 1 per cent remains un-oxidized).

Therefore:

CO_2 emissions from a gallon of gasoline = $2,421 \text{ grams} \times 0.99 \times (44/12) = 8,788 \text{ grams} = 8.8 \text{ kg/gallon} = 2.3 \text{ Kg/litre of gasoline}$

CO_2 emissions from a gallon of diesel = $2,778 \text{ grams} \times 0.99 \times (44/12) = 10,084 \text{ grams} = 10.1 \text{ kg/gallon} = 2.7 \text{ Kg/litre of diesel}$.

The following table (Table 11) summarizes the computation of the amount of carbon dioxide along the main which is the currently generated by traffic based on AADT. The current daily traffic CO_2 emission is therefore estimated to be around 45 tons/day

Table 12: Estimates of Amount of CO₂ Currently Generated by Traffic Daily in Kg/day Based on AADT

No.	Type of vehicle	No of vehicles [a]	Type of fuel	Average fuel consumption (Km/litre) [b]	Estimate of Fuel consumed in 77km = (77/b) x a [c]	Amount of CO ₂ Currently generated in kg: [c] X [d] where d= 2.3 (for gasoline engines) and 2.7 (for diesel engines)
1.	Motor cycle	1,758	Gasoline	20	6,768.3	15,567
2.	Medium car/ Station wagon	570	Gasoline	9	4,876.7	11,216
3.	4WD vehicle	73	Diesel	8	702.6	1,897
4.	Pickup	17	Diesel	8	163.6	442
5.	Daladala	56	Diesel	8	539.0	1,455
6.	Medium bus (30 – 35 passengers)	0	Diesel	6	0.0	0.0
7.	Large bus (40 seater capacity)	3	Diesel	2	115.5	312
8.	Light Truck (LGV) – Rigid 2-axles (3-6 tons)	5	Diesel	5	77.0	208
9.	Medium Truck (MGV) –	13	Diesel	2	500.5	1,351

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No.	Type of vehicle	No of vehicles [a]	Type of fuel	Average fuel consumption (Km/litre) [b]	Estimate of Fuel consumed in 77km = (77/b) x a [c]	Amount of CO ₂ Currently generated in kg: [c] X [d] where d= 2.3 (for gasoline engines) and 2.7 (for diesel engines)
	Rigid 2-axles (7-10 tons)					
10	Heavy Truck (Rigid 3 or 4 axles), typically 12-15 tons capacity,	10	Diesel	2	385.0	1,040
11.	Articulated Truck (4 -7 axles), typically 25-32 tons capacity,	8	Diesel	1.5	410.7	1,1089
Total Current daily emissions of CO2 (Kg)						44,577

4.2.6 Noise and Vibrations

Manyovu – Kasulu roundabout Road and Southern Link

Despite the fact that data on noise pollution of the project area was not available during the time of conducting the survey, it goes without saying that like air emission, the level of noise and vibrations due to traffic is dependent on the volume of traffic, speed, and the type of pavement. Since the traffic volume is low, the noise and vibrations levels are rated to be insignificantly low.

Eastern and Western Bypasses

Since the western and eastern are non-existent, the noise and vibrations levels are zero along the alignment.

4.2.7 Scenic and Visual Impacts

The most common sources of deterioration of scenic and visual qualities along roads are caused by the presence of unreinstated Borrow Pits (BPs) and stockpiles of construction materials leftovers. The survey noted several unreinstated material BPs along the project road. Some of these pits are located very close to the road, creating an eye sore to by passers. Some of these unreinstated borrow pits are located in settlement areas and so poses serious danger to children residing in its neighbourhood as they are likely to be drowned if the borrow pits are filled with rain water. Some of these BPs are located as close as 10m from the centreline of the road. These BPs pose safety concern to traffic, especially in the event of traffic accident.

4.2.8 Road Conditions and Safety

The geometry of the existing gravel road is such that it is narrow and in a number of sections it has infringed sight distance because of sharp horizontal curves (sharp corners). Some approach roads to hydraulic structures (culverts and bridges) are curved and so presents safety concern. For safety reasons, horizontal re-alignment will be necessary in such road sections in order to improve design speed as well as sight distance. The following table (Table 13) describes typical road sections where horizontal realignment may be necessary to improve road safety.

Table 13: Typical Road Sections where Realignment might be necessary to improve Road Safety

No	Road Section	Proposed and Reason for Geometrical Realignment	Characteristics across the new alignment
1.	Km 0+200	Realignment to LHS to reduce sharp horizontal curve	A private land with a few medium income settlements
2.	Km 3+400	Realignment to RHS to reduce sharp horizontal curve	Farmland with a few settlements
3.	Km 4+700	Realignment to RHS to reduce sharp horizontal curve	A private land with a strip of eucalyptus trees on both sides of the road between Km 4+700 and 4+800 both sides
4.	Km 5+500	Realignment to LHS to reduce sharp horizontal curve	A private land with a strip of eucalyptus trees on both sides of the road between Km 6+000 and 6+500 on both side and between Km 6+500 and 7+000 on RHS
5.	Km 7+400	Realignment to RHS to improve a blind curve	Private farmland with a few settlements

No	Road Section	Proposed and Reason for Geometrical Realignment	Characteristics across the new alignment
6.	Km 7+500	Realignment to LHS to improve a blind curve (Photo 3)	Private farmland with a few settlements
7.	Km 7+600	Realignment to RHS to improve a blind curve	Private farmland with a few settlements
8.	Km 8+100	Realignment to LHS to reduce sharp horizontal curve	Private farmland with a few settlements
9.	Km 11+100	Realignment to LHS to improve a blind curve at Belanka village section (Photo 4)	Village section with substantial number of settlements
10.	Km 13+800	Realignment to LHS to reduce sharp horizontal curve	Private open farmland with a few settlements
11.	Km 15+000	Realignment to RHS to reduce sharp horizontal curve	Private open farmland with a few settlements, but with very steep topography. Realignment not feasible
12.	Km 17+000	Realignment to LHS to reduce sharp horizontal curve	Private open farmland with a few settlements, but with very steep topography. Realignment not feasible
13.	Km 20+000	Realignment to LHS to reduce sharp horizontal curve	Private open farmland
14.	Km 21+800	Realignment to RHS to reduce sharp horizontal curve	Private open farmland with settlements
15.	Km 22+100	Realignment to LHS to reduce sharp horizontal curve	Private open farmland with settlements
16.	Km 24+700	Realignment to LHS to reduce sharp horizontal curve	Open land on steep slope, whose soil is susceptible to erosion
17.	Km 26+000	Realignment to LHS to reduce sharp horizontal curve	Private open farmland with very steep erodible soil. Realignment not feasible
18.	Km 29+300	Realignment to LHS improve blind curve on steep slope	Open land on steep slope, whose soil is susceptible to erosion
19.	Km 30+100	Realignment to LHS to reduce sharp horizontal curve	Open land with erodible soil. Realignments is not feasible because of steep topography
20.	Km 30+300	Realignment to LHS to reduce sharp horizontal curve	Open land with erodible soil
21.	Km 30+400	Realignment to LHS to reduce sharp horizontal curve	Private open land with very steep slope and erodible soil. Realignment not feasible because of topography
22.	Km 42+100	Realignment to LHS to reduce sharp horizontal curve	Open private land
23.	Km 42+600	Realignment to RHS to reduce sharp horizontal curve	Open private land
24.	Km 43+000	Realignment to LHS to reduce sharp horizontal curve	Private land with eucalyptus trees with very steep slope and erodible soil. Realignment not feasible because of topography
25.	Km 43+300	Realignment to LHS to reduce sharp horizontal curve	A private land with steep slope, covered with shrubs. Realignment not feasible because of topography

Source: Consultant's Field Survey

4.3 HUMAN ENVIRONMENT

4.3.1 Population

Buhigwe District Council

Buhigwe District has an area of 1,700 square kilometres. According to the 2012 National Census, Buhigwe District has a total population of 254,342 comprising 120,690 male and 133,652 female.

Kasulu District Council

According to 2012 population and housing census, Kasulu had a total population of 634,038 comprising of 306,789 males (48.4%) and 327,249 females (51.6%). Its population growth rate was 2.4% per annum. The current population density is 57 people per km² while average household size each 5.7 people.

Regarding the household structure of the interviewed households, the result of the study shows that 28.6% of the interviewed households are composed of individuals between 0 - 6 years, followed by the group aged between 19-45 years (21.1%), and those aged between 7-14 years (22.1%) the fourth group are those of 15-18 years (16.9%). The fifth groups are between 46 – 60 (7%) and 61 – 70 (2.6%). It can be seen that most of the productive manpower to feed the households comes from the 19 – 45 and 46 – 60 groups (29.9%).

4.3.2 Gender Issues

In general communities and societies within the road impact area are based on a patriarchal relationship. This implies that authority is vested in the male as a head of household. Traditionally in most of the study area women do not own land and are not entitled to own land and therefore do not have inheritance rights over land and livestock. Additionally, women within this traditional setup are denied the right to own basic property. However, changes are being initiated at different levels. In all village governments women participate (in both development and political activities) and the participation of women in the community level activities have been reported as being far much better and effective compared to men. The youth participate in most of the social and economic activities but within the communities their social status is low. There also appears to be gender role differentiation among the youth, young women are given limited opportunities compared to young men who for example are much more mobile in looking for economic opportunities outside their villages. In almost all villages, position of elders is ranked highly in social sense but they lack economic opportunities and are often supported by their children or close relatives. In village and community level meetings women participate and are equally involved in the discussions, though tend to shy off, with little contribution to the discussions.

The division of labour in the family and in the communities is based on gender and age. Most of the domestic chores are undertaken by women in addition to other activities such as farming and small business. Cooking, child rearing and other domestic chores such as washing clothes and cleaning houses are the major household activities on which women spend most of their time more than 8 is spent on these activities. Rural woman may rest only for 4 to 6 hours a day. Women in urban areas have more time for resting and relaxation comparing to rural women in Tanzania if not for all African countries. Limited differentiation exists in terms of the division of labour in the families and households among the different ethnic groups in the study area.

Most of villages within the road corridor have formed women groups mainly for economic purposes. The rest have not formed the groups but some are in the process of doing so. Most of the villages which have already formed women groups have on average of two groups. The membership to these groups is small but nonetheless this represents efforts that are being made to bring to the forefront gender issues in the social and economic spheres. Some of the groups are mixed with both male and female membership. A number of these groups receive credits from SACCOS, TASAF and district councils. The groups are often formed around a specific development issue such as economic, environmental, health etc. Others are formed around religious institutions especially the church (women and Choir groups are common) which apart from their religious activities are also involved in social activities. Among major challenges that affect the efficient management of these groups included limited capacities and skills to manage such groups, lack of motivation, access to credit facilities and generally low levels of education of the members.

In the project area, women are involved in several development activities and therefore play both production and reproduction roles. Women are involved in most agricultural work which includes production activities, processing, and marketing. Apart from playing the reproductive role women also bear the burden of taking care of the children, the old, the sick members of the families. . Among domestic chores that are normally unpaid include fetching water, collection of firewood, food preparation etc. As observed previously because of the nature and structure of the family relationships women's contribution especially at the family level is not given social recognition it deserves. This explains to a large extent the increasing levels of poverty among women and their low status. Women in the area are also constrained in terms of access to credit facilities, productive resources, education, training opportunities, and appropriate technologies to simplify their work (e.g. heavy work load), skills, and knowledge etc. Women have been mobilized to form economic groups. Women groups get loans for economic enterprises are being supervised by the district Community department.. Additionally, a number of civil societies have been formed to address gender issues and increase women participation in various development activities.

Women participation in the road works within the road impact area was not reported in any village. The road construction will have a potential for the increase of women and family incomes in a number of ways. The culture of the people along the study area does not prohibit women from participating in the road construction although the extent of their involvement is limited because of their roles in domestic sphere and activities. Nonetheless both women and men who have no access to formal employment will accumulation of capital for future investment, employed during the construction phase and later during the maintenance phase. This in itself will increase family and individual level incomes. During road construction women and others will also establish small scale business such as food vendor services popularly known as Mama Lishe. This again will lead to increases in the incomes of women and families in general and elevate women status in the community. The involvement of the local population including women will lead to capacity building in terms of new skills. Previous studies show that participation of women in leadership is limited due to lack of confidence and skills.

Accessibility to social services in the project area is relatively good, as almost all the villages have a primary school or two depending on the population of the village. Every ward has a secondary school; therefore children are not working long distances to reach education facilities. The accessibility to medical services is equally good, not every village has a medical facility, but

the services are available to the nearby villages in case the village does not have one, none of the affected village work than seven kilometres to reach medical facilities.

Regarding transport, there are many small and minibuses operating along the road throughout the day. Therefore movement from one point to the other is very easy. “Bodaboda” are operating along the road as well as big buses operate from Kigoma to Kasulu, Kibondo to Kakonko to Dares salaam.

Accessibility to water services is also not bad; in the project area there many surface water sources such as rivers and springs which are used by women to get domestic water.

4.4 CULTURAL ENVIRONMENT

4.4.1 Family Structure

The typical family system in the road impact area is both nuclear and extended families which are traditionally male-headed but matrilineal in structure.

4.4.2 Ethnicity

There are several tribes along the road with more or less similar and shared cultural traditions and customs as well as spoken languages. Ethnic groups include Waha, Wasubi, Washubi Wanyambo, Wahaya, Wasukuma, Wajaluo and Wajita. The major ones are the Wahangaza, Wanyambo, Wahaya, Waha and Wasubi. Waha are the majority among all tribes and even the majority of people speak Kiha and Kiswahili, which is the national language. Due to close relationship and interaction and cooperation existing among tribes, there are minimal cultural differences despite the existing tribal diversity in the project area.

4.4.3 Religion

Christianity and Islamic are the major religious groups found in the project areas. Under the Christianity, there are dominant denominations namely Evangelical Lutheran Church of Tanzania (ELCT), Roman Catholic, and Anglican. The followers of these religious groups and respective denominations cooperate and participate in different (both informal and formal) socio-economic and development activities and villages leaders reported that religious contributed to maintain harmony and peace in their project areas and are also useful to channel information to people.

4.4.4 Cultural Sites

Manyovu – Kasulu Roundabout and Eastern bypass

The survey did not notice any cultural site of significant importance in the DIZ of the road section.

Kasulu Southern Link

Two Christians and Muslims grave yards have been noted on the RHS along the road, between Km 6+100 and 6+600. Some of the graves are located as close as 9m from the edge of the road.

4.4.5 Archaeological, Historical or Heritage

There are no known archaeological, historical or heritage site along the project road.

4.5 ECONOMIC ENVIRONMENT

4.5.1 Agriculture

Buhigwe has a total arable land is 1,277.796 square km or 84.9% of the total District area. Out of that, only 50% of the land is actually cultivated, therefore there is a wide room for expansion.

The major farming mechanism in Buhigwe District is based on coffee-maize-bean-banana system in the highlands, maize-tobacco in the low lands and sugar cane and paddy along the river and water streams. Cash crops include Coffee, palm, Cotton, Tobacco, Ginger and Sugar cane while Maize, Cassava, Beans, Banana, Paddy are food crops. Coffee is the major source of income in the highlands and rolling hills area while maize and tobacco are the major sources of income in the lowland areas.

Farming activities are done by using traditional implements such as hand hoes and it is family labour based which results into low yield per area thus a need to invest in this sector.

4.5.2 Livestock

Livestock keeping is one of main economic activity in the project villages. Livestock kept are cattle; goats; sheep; and chicken.

Livestock keeping practiced in Buhigwe District is both traditional and commercial in nature. A large proportion of cattle, goats, and sheep are indigenous dominated by pastoralists and agro-pastoralists. The District has about 29,665 cattle, 17,506 goats, 3,893 sheep, 852 pigs, and 123,517 chicken and 9,220 ducks, though the number and quality of the livestock kept has remained low compared to the high population growth of the District and demand.

4.5.3 Source of Income for the Family Members

The study wanted to know main source of income of people living in the project area. This will help to understand how the project will affect either positively or negatively the socio- economic development of people. Regarding this issue it was observed and confirmed from the interview that people in the project area depend on agriculture (36%) as the main source of income, followed by small businesses (16.9%) the third group are those who do livestock rearing (13.2%). Of those interviewed 10% of people reported that they are engaged in business activities only. Other households reported to have been doing more than one activity at once; agriculture and livestock rearing (7.8%), agriculture and business (7.8%) and agriculture and small business (6.8%). Few (5.2%) of the interviewees reported that they are formally employed by either government (district councils) or the private institutions or non-governmental organizations while 3.9 % of the respondents were informally employed

4.6 INFRASTRUCTURE AND SOCIAL SERVICES

Social services delivery and provision is undertaken mainly by governmental institutions and few by religious institutions. The services examined include the provision of education, health, water, energy and travel and transport.

4.6.1 Energy

The major source of energy for households within the road impact area is fuel wood and liquefied petroleum gas for cooking, fossil fuel (diesel, oil, and petrol) for motorised transport, and electricity, kerosene, and to a small extent solar for lighting. The use of solar energy is limited to a few individuals and government and private institution because of its high initial cost.

The main source of energy for cooking in the project area is firewood (34%). This is followed by those who use charcoal 28%. 23 percent reported to use both charcoal and firewood. Only 11 percent of the respondents use gas as the main source of cooking. Only 4 percent said they use electricity for cooking. Dependency on these sources of energy is/will affect the existence of forest in the project area, as trees are/ will be cut to make charcoal and firewood. To have sustainable environment, people should be encouraged to establish wood lots at a household level to serve the existing of forests in the project area.

The main source of lighting the house at night is kerosene (49.4%) followed by electricity (27.2%) from national grid. Only 23.4% reported to get power through solar energy. Those connected to the national electrical grid use it for lighting and operating radio and TV. Cooking energies remain to be firewood and charcoal

Kasulu is yet to be connected to the national transmission grid. It has however a dedicated thermal power generation plant. There is also a private hydropower generating plant which is owned by Kabanga missionary. The use of the power plant is limited to Kabanga missionary hospital. A feasibility study for the establishment of a Mini-hydro power station across Mwoga falls at Herujuu ward, about 9 Km from Kasulu town through Rural Energy Agency is on-going.

While only Munanila is supplied with electric power from Kigoma, Buhigwe, Songambe, Kirunga, and Herujuu villages are with electric power from Kasulu thermal power plant.

4.6.2 Water Supply

While about 62.7 per cent of the total population in Buhigwe District has access to clean water within the required walking distance of 400 meters, while 64 per cent of the population in Kasulu District has access to clean water within the required walking distance.

Kasulu has 26 gravity piped schemes, 57 bore holes, 34 diesel pump, 3 spring water scheme, and 47 rain water harvesting tanks. There are 20 source of water not yet utilized this comprises 5 shallow wells, 12 bore holes, and 3 rain water,

The Coverage of the population by rural water supplies for the year 2014 is 64.01% while the total number of people covered with safe water supplies is 286,294.

Water sector in the project area is favourable because all respondents' access water within their own village, water quality is not good. Majority of them (32.5%) access the water from the traditional well while 13% and 9.1% get water from protected pumps both off the site and on the site respectively. 19.5 % of the respondents get water from shallow well, 7.8% get water from rain water tank and only 7.8% from house connection. 6.5% use surface water from springs while 3.9% reported to buy water from water vendors.

The majority (41.6%) of those interviewed pointed out that they use less than 1 bucket of 20 litres of water per day, 6.5 % survive on 1 -2 buckets of water, 29.5% use 3 – 4 buckets of water

a day while only 22.1% use more than 4 buckets of water a day. The use of the water is directly proportional to the size of the household and availability of water in the village vicinity

The main sources of domestic water supply for villages along the project road are pipe water from pumping scheme and shallow wells. Some of the pipe lines that supply domestic water to some of the villages along the project road either run along the road within the RoW or cross the project road. In addition, there are domestic points that are located within the RoW.

The following table (Table 14) describes domestic water supply profile for villages along the project road.

Table 14: Water Supply Profile for Villages along the Project Road

No.	Village	Source of Water Supply	Remarks
1.	Munanila	Pipe water from pumping scheme.	Pipe lines and Domestic Points are located far from the road
2.	Mkatanga	Pipe water from a pumping scheme	Several distribution lines run along and across the project road. In addition 2 Domestic Points are located near the road (Photo 6).
3.	Musagara	- Do -	Km 2+900, 8m RHS: Domestic Point (Photo 9)
4.	Kibwigwa	- Do -	- Do -
5.	Bwelanka	Improved springs and open traditional shallow wells	None of the utilities is located near the project road
6.	Mulera	Pipe water from a pumping scheme, with a source located at Herujuu village group scheme	Several distribution lines run along and across the project road. In addition, a number of Domestic Points are located close to the road as follows: <ul style="list-style-type: none"> • Km 20+400, 15m LHS: Domestic Point • Km 21+200, 18m LHS: Domestic Point
7.	Buhigwe	- Ditto -	Several distribution lines run along and across the project road. In addition, a number of Domestic Points and valve chambers are close to the road: <ul style="list-style-type: none"> • Km 22+900, 15m LHS: Domestic Point
8.	Songambele	Pipe water from a pumping scheme, with a source located at Nyafisi village	The following utilities are located within the DIZ of the project: <ul style="list-style-type: none"> • Km 23+400: main distribution line cross the project road • Km 23+400: a man hole is located 7m on the RHS of the road • Km 23+400, 22m LHS: Water storage tank • Km 23+900: A 4" Galvanised Steel (GS) pipeline across the the road • Km 27+800, 20m LHS: Domestic Point • Km 28+100, 16m LHD: Domestic Point • Km 28+500, 16m LHS: Domestic Point • Km 28+700, 25m LHS: 2 Nos 4" distribution pipes • Km 28+800, 17m LHS: Domestic Point • Km 29+400, 15m LHS: Domestic Point • Km 29+700, 15m RHS: Water storage tank
9.	Karunga	Pipe water from a pumping scheme, with	Several distribution lines run along and across

No.	Village	Source of Water Supply	Remarks
		a source located at Chogo village	the project road. In addition, a number of Domestic Points are located close to the road
10.	Herujuu	- Ditto -	Several distribution lines along and across the project road as well as 3 Domestic Points.
11.	Kasulu	Pipe water from a pumping scheme, with a sources located at Miseno, Nyanka, Nyakatoke villages gravity scheme	Several distribution pipe lines along and across the project road as follows: <ul style="list-style-type: none"> • 8" GS pipe cross the road just after the bridge for R. Lusungwe at Km 46+900 • 3" poly pipes run on both sides of the bridge for R.Lusungwe

Source: Interview with DWE for Kasulu, Field Survey, and Interview with Local People

4.6.3 Health Services and HIV/ AIDs

Buhigwe District

The district has two hospitals one owned by faith based organization and one under government control. The district also has four health centres, of which two are owned by private, and two by government. In addition there are thirty dispensaries.

The presence of this service in rural and urban has decreased mother to Infant Mortality Rate (IMR) from 116/100,000 to 56/100,000 in year 2005 and 2010 respectively. HIV infection has decreased from 2% since last year. This is a positive improvement but still more efforts are highly needed to increase efficient service especially in this sector.

Kasulu District

The District has two hospitals, owned by a Faith Based Organization (Roman Catholic) and the other Mlimani district hospital under government. Both hospitals are located at Kasulu town. There are eight Health Centres, 1 privately owned and 7 owned by the government/public. In addition there are 46 dispensaries, of which 41 are owned by public and 5 are owned by private sectors.

The presence of this services in rural and urban has decreased the Mother to Child mortality rate from 116/100,000 to 56/100,000 in year 2005 and 2010 respectively. HIV infection has decreased from 2% in 2005 to 1.3% in year 2014. This is a positive improvement but still more efforts are highly needed to increase efficient service especially in this sector. IMR in the district is 5/1,000 and Mother Mortality Rate (MMR) is 58/100,000 for the year 2013. If healthy facilities and service delivery will be improved IMR and MMR will decline sharply.

HIV/AIDS Programmes and Activities within the Immediate Road Impacted Area

Within the immediate road impact area a number of HIV/AIDS activities are undertaken. In most of the villages these activities include information, Education and Communication (IEC) and behaviours Change Communication (BCC) activities: posters, brochures, seminars, counselling and meetings. Education and information regarding HIV/AIDS is also provided in most of the schools. HIV/AIDS committees at village and sub-village levels have been formed. It was observed that HIV/AIDS is a standing agenda item in all village meetings. In most of the villages although statistics on the prevalence of the disease is lacking yet there is a recognition that the disease is of major health concern.

It was reported that the major means of creating awareness on the disease is through village meetings. In some villages, groups have been formed to provide HIV/AIDS information these groups included traditional dance groups, church (youth groups) and peer groups. In most villages condoms are available and condom use was reported to be on the increase.

Major challenges that were reported in the war against HIV/AIDS in the immediate road impact area include: alcoholism, lack of knowledge on how to use condoms, limited information on HIV/AIDS and culture, norms and traditions that increase the probability of involvement in unprotected sex.

Data at village levels revealed that most of the HIV/AIDS activities implemented in the road impact areas were undertaken outside the road sector and by a variety of other stakeholders. However, it is worth noting that these activities and programmes could not be efficiently implemented without upgrading of this road. Therefore the road can positively affect the flow of HIV/AIDS information and provision of services such as access to clinics for testing.

4.6.4 Education Services

Kasulu has 134 governments registered pre-primary schools, 138 primary schools of which 134 are government owned and 4 are privately owned, 37 Secondary schools of which are 27 Government, 10 private secondary schools, 7 colleges as follows 2 vocational training colleges, 2 teachers' colleges, 1 agricultural training college, 1 nursing college and 1 Utalii College. The District is currently establishing modern Library facility at Kasulu town.

The level of education of the inhabitants in the impacted villages is relatively high. Households with high education normally have better income than families with low education. Poverty levels are strongly correlated with the education levels achieved by the heads of household. The education levels in the project area is relatively good, as 44.2. % of the interviewed household members have standard seven education and above, while 26 % have reached ordinary level and advanced level as well some have attended technical colleges. Only 26% members of the interviewed households reported not to have formal education, among these group include children under five years and old people. The figure also shows that 3.8% of them have reached college level of training. A similar pattern of comparatively high levels of education among people in the community is reflected through ability to read and write. The following table (Table 15) list schools that are located along the project road

Table 15: List of Schools Located along the Project Road

No	Chainage	Name of Black Spot	Village
1.	Km 2+900 RHS	Mkatanga Primary School	Mkatanga
2.	Km 7+000 LHS	Muhululo secondary school	Kibwigwa
3.	Km 9+200 LHS	Church and dispensary	
4.	Km 9+700 LHS	Church	
5.	Km 12+800 LHS	Kibwigwa secondary school	Kibwigwa
6.	Km 13+500 RHS	Liange primary school	Kibwigwa
7.	Km 18+400 RHS	Buyenzi secondary school	
8.	Km 20+800 LHS	Mulera primary school	Mulera
9.	Km 21+700 LHS	Buhigwe primary school	
10.	Km 36+800 LHS	Kasange secondary school	Karunga

Source: ESIA expert field Survey and Consultation with local people

4.6.5 Travel and Transportation

4.6.5.1 Road Transport

Road is the major means of transport and transportation in the project area as it accounts for more than 90% of goods and passenger transport in the study area. Lorries, buses, and light duty vehicles (small cars), are the main means of transport in the project area. Other means of transport and travel between these points on the road are bicycles, motor cycles, and head loading for short distances.

Buhigwe District is a junction that link roads to Kigoma, Kasulu District, and Republic of Buhigwe has a total of 574 Km of road, out of which 30 km are trunk roads, 60 km are Regional Roads, 282 Km are District Roads, and the remaining 202 Km are feeder roads. Of these 48 Km are tarmac roads and 526 are earth/ gravel roads. Generally main regional road and truck road are passable throughout the year but feeder roads and District roads are traversed with difficulty during rainy season.

4.6.5.2 Air Transport

Apart from road transport, Buhigwe has one air strip, which is located at Biharu. The airstrip is mainly used and maintained by missionaries' flight.

4.6.6 Communication

Generally communication network in the District has been improved over the past years. The following mobile phone networks operate in the District: VODACOM, Airtel, TIGO, and Halotel. In addition, the following media are accessible by the district: Radio KWIZERA, TBC, ITV, Star TV, and Print media from IPP media and other publishers.

4.6.7 Waste Management

4.6.8.1 Solid Waste Management

Most of the households do not have safety/adequate solid and liquid waste disposal. The solid and liquid wastes are disposed haphazardly. 41 percent bury the waste while 33 percent indicated to throw their waste in the farm and 26percent burn their waste. People urinate just anywhere within house compound, in bushes along roads where there are trees or vegetation to hide. Result of poor sanitation is one of causes of some of the water-borne diseases including diarrhoea

4.6.8.2 Liquid waste Handling and Treatment Systems

From data collected it shows that 62% of the households have pit latrines while only 36% of the respondents use septic tanks. None of the households is using the sewer system because sewer system is not available and 2% of the surveyed households had no sanitation facilities at all.

Poor sanitation and improper disposal of waste has led to water stagnation and poor hygiene, which are the leading causes of malaria and diarrhoea. Malaria is the most prevalent disease with 57% of the respondents reporting to have at least one member who has suffered from the disease. This is followed by diarrhoea with 23.4%. Skin flash is 15.6% followed by HIV/AIDS and TB with only 2.6% and 1.3% respectively

4.7 LAND USE AND OWNERSHIP PATTERNS

4.7.1 Land Use

There are three main types of land use along the project corridor. The majority land use are farming activities; followed by grazing; and a small percentage of land is used for residential settlements as well as infrastructure such as roads, social services like schools, medical facilities and etc.

Land use categories within the road impact area can be divided into six categories:

- (i) Settlement (residential and institutional)
- (ii) Agriculture (farmland)
- (iii) Transport corridor
- (iv) Undisturbed areas [undeveloped or covered by woodland, scrubland and grassland], the latter being a relative term]
- (v) Open land.
- (vi) Exotic tree forest

Settlements areas are concentrated mainly at Munanila, Mkatanga, Musagara, and Herujuu villages, and Kasulu town. There is however no clear distinction between settlement and agriculture land use because settlements are found within farmland. Commonly grown food crops include maize, banana, beans, coffee, paddy, and coffee, and avocado.

The following table (Table 16) describe significant land use along the project road

Table 16: Significant Land Uses along the Project Road

No.	Road Section	Land Use
Manyovu – Kasulu roundabout		
1.	Munanila - Musagara	Mixed farmland and settlements, with no clear distinction between settlements and farmland. The settlements have continuous pattern.
2.	Musagara - Belanka	<ul style="list-style-type: none"> Farmland and settlements, with no clear distinction between settlements and farmland Exotic tree forest
4.	Belanka - Buhigwe	<ul style="list-style-type: none"> Scattered settlements mixed with farmland. Open land between Km 16+400 and 19+800 both sides of the road
5.	Buhigwe - Songambebe	<ul style="list-style-type: none"> Mixed farmland and settlements, with no clear distinction between settlements and farmland. The settlements have continuous pattern. Exotic tree forest Open undeveloped land (without any settlements) between Km 23+800 – 27+100 Open marginalized land, without any, with few but scattered eucalyptus trees between Km 29+500 and 36+800
6.	Songambebe - Karunga	<ul style="list-style-type: none"> Mixed farmland and settlements. The settlements are scattered settlements between Km 37+100 – 38+500. Social services infrastructures, e.g. schools, domestic water storage tanks Exotic tree forests: Km 28+200 – 28+700 both sides Undeveloped open land: K m 32+200 – 36+300

No.	Road Section	Land Use
7.	Karunga - Herujuu	<ul style="list-style-type: none"> Mixed farmland and settlements. The settlements have continuous pattern Exotic tree forest: Km 39+200 – 40+000 both sides
8.	Herujuu - Kasulu	<ul style="list-style-type: none"> Mosaics of mixed farmland and settlements. The settlements have continuous pattern, and much concentrated in Tunduru town. Exotic tree forests: Km 40+300 to 40+500 both sides, Km 43+300 – 44+600 both sides, Km 45+400 – 45+600 RHS
Kasulu Southern Link		
1.	Nyumbigwa - Kasulu	<ul style="list-style-type: none"> Km 0+000 – 3+600: undisturbed area, agricultural, and exotic tree forest Km 3+600 – 6+100: Agricultural and residential settlements, Km 6+600 – Kasulu roundabout: Settlements
Eastern Bypass		
1.	Start of Lot 2 — Start of Western bypass	<ul style="list-style-type: none"> Km 1+600 – 2+800: undeveloped land with grassland and miombo scrubland, with a few but scattered large trees on both sides of the road Km 2+800 – 4+200: Miombo woodland, with a few but scattered yellow cassia, fig, acacia, Christmas, on both sides of the road
2.	Start of western bypass– Kigondo road crossing	Undisturbed land, exotic tree farming
3.	Kigondo Rd crossing – R.Mgandazi	Farmland and undisturbed land
4.	R.Mgandazi – end of bypass	Farmland and residential settlements
Western Bypass		
1.	Kidiama - Kabanga	Subsistence agriculture and exotic tree farming land use. A small section of land at Kabanga is used for settlements
2.	Kabanga - Herujuu	Subsistence farming and exotic trees farming

Source: ESIA expert field Survey and Consultation with local people

4.7.2 Land Ownership and Tenure

Dominant family or household owned lands are either distributed by village governments or inherited through customary arrangements is the dominant form of land ownership. The family/household land is normally under the custodianship of the head of the family who is often a man. And according to most customs in the road impact area only male offspring have the right to inherit family land. Second is community or village owned land. These are pieces of land that are owned by communities and villages for building schools, health centre, recreational facilities, grazing land etc. Traditional communal land rights for grazing are also common in the area. Most pastureland is community and forestland are central government, district, village and few individually owned.

Majority of the interviewed people reported that most of the villagers own between two and four acres of land while only few have over ten acres of cultivatable land. Majority of farmers use simple farm implements cannot cultivate big farm land

Most of respondents said the most practical land tenure system in the project area is buying land from those who have land to sell. Land closer to the road is more costly than land located hinterland. The village government does not have more land to allocate to people.

4.7.3 Settlement Pattern

There are settlements along the proposed project area that have urban and semi urban characteristics. The settlements, which are located on almost both sides of the project road, are used as residential, commercial, or administrative centres. Administrative centres include government offices like ward executive or village offices. Institutional centres include schools and dispensaries

Major villages and settlement present along the project road are Munanila, Buhigwe, Herujuu, and Kasulu. The following table (Table 17) describe settlement pattern along the project road.

Table 17: Significant Settlements along the Project Road

No.	Road Section	Land Use
1.	Munanila - Musagara	Continuous settlements close to the project road Grevillea and cypress trees, coffee, banana, avocado, on both sides of the cypress both sides of the road (Photo 5)
2.	Musagara - Balanka	<ul style="list-style-type: none"> Km 4+600 – 16+900: Coffee, banana, avocado, and grevillea on both sides of the road Km 4+700 – 6+900: Strip of large cypress trees on the LHS (Photo 6) and eucalyptus trees on both sides of the road (Photo 7)
3.	Belanka - Belanka	<ul style="list-style-type: none"> As above
4.	Belanka - Buhigwe	<ul style="list-style-type: none"> Km 21+21+700: Banana, palm, avocado, grevillea, mango, and eucalyptus trees on both sides of the road
5.	Buhigwe - Songambebe	<ul style="list-style-type: none"> Banana, avocado, eucalyptus, and coffee Km 21+800 – 21+900: large eucalyptus trees within 10m on the LHS of the road (Photo 8.) Km 28+200: Strip of eucalyptus trees on both sides of the road
6.	Songambebe - Karunga	<ul style="list-style-type: none"> Banana, avocado, and eucalyptus Km 29+000 – 29+100 RHS: Cypress trees located 20m on the RHS of the road Km 33+200 – 37+100: Open, undeveloped land
7.	Karunga - Herujuu	<ul style="list-style-type: none"> Large cypress and eucalyptus trees, banana, avocado Km 39+200 – 40+000 (Karunga): eucalyptus trees on both sides of the road, located between 8 – 10m from the road
8.	Herujuu - Kasulu	<ul style="list-style-type: none"> Banana, cypress and eucalyptus trees Km 40+300 – 40+500: eucalyptus trees on both sides of the road close to the road Km 43+300 – 44+600: Large eucalyptus tree on both sides of the road Km 44+600 – 45+400: Shrubs on both sides Km 45+400 – 45+600: Large eucalyptus tree on the RHS of the road Km 46+200 – 46+700: Large eucalyptus tree on both sides of the road

4.7.4 Housing

Shelter is one of most important human basic needs. Good housing has a close correlation with good health and other aspects of human dignity and well-being. Though there is lack of clear-cut on which is proper and good housing facility but enough and well-ventilated rooms, kitchen, and toilets provision were used to determine the quality of the shelter in the study area. Moreover

type of structures and materials used in construction were also primarily used to determine the quality of the houses in the study area.

The study has found out that 98.6% of the houses are roofed by iron sheets, only 1.4 % are thatched grass, while 79% of the structures walls are made of clay burnt bricks 17.3% are made of mud bricks and plastered with cement, only 3.7% were made with cement blocks. With Regard with flooring structures, 68.7% of houses are made of mud and earth, 29% of the surveyed houses are made of concrete cement floor, and only 2.3% are made of tiles. The high prices of construct materials is hindering factor for people to afford the use of modern materials for house construction.

4.8 BIOLOGICAL ENVIRONMENT

4.8.1 Flora

The flora along the project road is characterised by varied mosaics of shade trees, street strip trees in settlements areas, grassland, acacia woodland, and miombo woodland, and scrublands in the outskirts of villages. Street strip trees consist of exotic trees, mainly yellow cassia, and fruit trees mainly mango and avocado. In addition, there are eucalyptus and cypress forests along the project road. The following table (Table 18) describes significant vegetation cover along the project road.

Table 18: Significant Vegetation Cover Characteristics along the Project Road

No.	Road Village	Vegetation Characteristics
Manyovu – Kasulu roundabout		
1.	Munanila - Musagara	<ul style="list-style-type: none"> Km 0+000 – 4+600: Grevillea and cypress trees, coffee, banana, avocado, on both sides of the road (Photo 5) At Km 2+400, LHS there a strip of exotic tree forest, located about 10 from the edge of the road
2.	Musagara - Belanka	<ul style="list-style-type: none"> Km 4+600 – 16+900: Coffee, banana, avocado, and grevillea on both sides of the road Km 4+700 – 4+800: Strip of large cypress trees on the LHS (Photo 6) and eucalyptus trees on both sides of the road (Photo 7) Km 6+000 - 6+500 on both sides: eucalyptus trees Km 6+500 - 7+000 on RHS: Large eucalyptus trees
3.	Belanka - Buhigwe	<ul style="list-style-type: none"> Km 21+21+700: Banana, palm, avocado, grevillea, mango, and eucalyptus trees on both sides of the road
4.	Buhigwe - Songambe	<ul style="list-style-type: none"> Banana, avocado, eucalyptus, and coffee Km 21+800 – 21+900: large eucalyptus trees within 10m on the LHS of the road (Photo 8) Km 28+200: Strip of eucalyptus trees on both sides of the road
5.	Songambe - Karunga	<ul style="list-style-type: none"> Banana, avocado, and eucalyptus Km 29+000 – 29+100 RHS: Cypress trees located 20m on the RHS of the road Km 33+200 – 37+100: Open, undeveloped land
6.	Karunga - Herujuu	<ul style="list-style-type: none"> Large cypress and eucalyptus trees, banana, avocado Km 39+200 – 40+000 (Karunga): eucalyptus trees on both sides of the road, located between 8 – 10m from the road
7.	Herujuu - Kasulu	<ul style="list-style-type: none"> Banana, cypress and eucalyptus trees Km 40+300 – 40+500: eucalyptus trees on both sides of the road close to the

No.	Road Village	Vegetation Characteristics
		road <ul style="list-style-type: none"> Km 43+300 – 44+600: Large eucalyptus tree on both sides of the road Km 44+600 – 45+400: Shrubs on both sides Km 45+400 – 45+600: Large eucalyptus tree on the RHS of the road Km 46+200 – 46+700: Large eucalyptus tree on both sides of the road
Kasulu Southern Link		
1.	Nyumbigwa - Nyansha	<ul style="list-style-type: none"> Km 0+000 – 2+900: Miombo woodland on both sides of the road that are located about 5m from the edge of the road Km 2+900 – 4+100: grassland with acacia trees on both sides of the road (Photo 16)
2.	Nyansha - Kasulu	<ul style="list-style-type: none"> Km 4+100 – 4+800: Exotic strip trees, consisting of eucalyptus, yellow cassia, and mango Km 4+800 – Kasulu roundabout: very few but scattered exotic tree strip
Eastern Bypass		
1.	Start of Lot 2 – Start of western bypass	<ul style="list-style-type: none"> Km 1+600 – 2+800: undeveloped land with grassland and miombo scrubland, with a few but scattered large trees on both sides of the road Km 2+800 – 4+200: Miombo woodland, with a few but scattered yellow cassia, fig, acacia, Christmas, , on both sides of the road
2.	Start of bypass –Kigondo road crossing	Miombo woodland and large eucalyptus trees
3.	Kigondo Rd crossing – R.Mgandazi	<ul style="list-style-type: none"> Miombo woodland immediately after crossing Kasulu – Kigondo road Private farmland with large number of mango trees as one approaches R.Hwazi Exotic shade tree at settlements. A one area there is a strip of relatively large eucalyptus trees along the alignment (Plate 23) Scattered groups of miombo woodland trees
4.	R.Mgandazi – end of bypass	<ul style="list-style-type: none"> Miombo scrubland, scattered exotic shade trees consisting of yellow cassia, neem, etc.
Western Bypass		
1.	Kidiama - Kabanga	For about the first 1.5km the proposed road traverses a flood plain which is characterised by grassland, in particular elephant grass. The flood plain is mainly used for seasonal subsistence farming, although perennial crops in particular mango trees are also seen. The road section between Kidiama and Kabanga after the first 1.5km is characterised by subsistence farmlands and scattered exotic tree forest that are privately owned. Common trees in the forest are eucalyptus, pines, and Cyprus.
2.	Kabanga - Herujuu	The proposed road section between Kabanga and Herujuu is mainly covered by exotic tree forests, while the last 400km is dominated by settlements and private institutions.

Source of Data: Consultant's field survey

The importance of the green vegetation along the road underlies in the fact that it creates not only micro climate, but also reduces air and noise pollution as well as addresses the global warming problem. Vegetation creates micro climate by correcting summer over heating due to its screening effect through shading, reflection of solar radiation, and absorption of solar energy, and convective exchanges. Vegetation also creates habitats for fauna, in particular wildlife

Vegetation is able to reduce from air carbon monoxide, lead, dust and other air pollutants by absorbing them. Vegetation also serves to sequester carbon, which gives a major contribution to

greenhouse gases. Vegetation controls surface run offs and so reduce soil erosion to adjacent lands. Other important roles vegetation play are creating aesthetics, property value appreciation.

4.8.2 Fauna

The main fauna along the project is domesticated animals, which include cows, pigs, goats, sheep, pets, dogs, and poultry. Wild animals include mainly different species of reptiles, rodents, and different species of birds,

4.8.3 Fish and Aquatic Habitats

Major aquatic habitats across the project road are rivers Lusungwe, Bogwe, Mgandazi. Cat fish are common fauna in these rivers. Others habitats are rivers that have been discussed in Table 11.

4.8.4 Protected, Ecologically Sensitive Area, Rare and endangered Species

There is neither wildlife nor forestry protected area in the DIZ of the project area.

4.9 ENVIRONMENTAL PROBLEMS

The major environmental problem noted along the project road is farming on water course, in particular vegetable farming along R.Bogwe.

4.10 OTHER RELEVANT DEVELOPMENT INITIATIVES

There numerous on-going or proposed development initiatives within the project's area of influence or impact zone. Of relevance here are those likely to affect or to be affected by the proposed road upgrading as follows:

- On-going upgrading of Kidahwe - Nyumbigwa road section (50Km) to bitumen standard
- On-going upgrading of Nyakanazi – Kabingo road section (50Km) to bitumen standard
- Proposed upgrading of Kabingo – Kibondo - Kasulu road section (220Km) to bitumen standard
- The proposed construction of One Stop Border Post (OSBP) facilities for Tanzania and Burundi at Manyovu/ Mugina
- The works contracts for the upgrading of Mugina – Mabanda road section (21Km) and rehabilitation of Mabanda –Nyanza Lac road section (45Km) have been signed. The projects are being financed by AfDB.
- Upgrading of Nyanza Lac – Rumonge road section (42Km) is underway
- Plans are underway to upgrade Rumonge – Bujumbura road section (42Km)

SECTION 5: PRESENTATION OF ALTERNATIVES CONSIDERED

Identification of alternatives is one of the key aspects of a success of the ESIA. All feasible alternatives have to be fully addressed and their advantages and disadvantages compared in order to determine the best alternative. There are however some significant constraints that have to be taken into account when identifying alternatives for a project of this scope. Such constraints include financial, social, and environmentally related issues that will be discussed in the evaluation of the alternatives. Alternatives can be identified according to:

- (i) The No-Action alternative (Zero Alternative)
- (ii) Activity alternatives (alternative undertakings)
- (iii) Process alternatives (or Alternative technologies)
- (iv) Scheduling alternatives;
- (v) Input alternatives (Alternative sources of construction materials)
- (vi) Location alternatives (alternative sites)
- (vii) Alternative Design

For any alternative to be considered feasible such an alternative must meet the need and purposes of the development proposal without presenting significantly high associated impacts. Alternatives are typically distinguished into discrete or incremental alternatives. Discrete alternatives are overall development options, which are typically identified during the pre-feasibility, feasibility and or scoping phases of the ESIA process. Incremental alternatives typically arise during the ESIA process and are usually suggested as a means of addressing identified impacts. These alternatives are closely linked to the identification of mitigation measures and therefore are not specifically identified as distinct alternatives. Three alternatives have been identified as follows:

5.1 NO GO, ZERO OR BASE (ALT0) ALTERNATIVE

The “No Go “Alternative” refers to the alternative of not embarking the proposed road rehabilitation at all. This alternative would imply that the current status quo without the proposed road construction would continue. It is important to note that the No Go Alternative is the baseline (Base Alternative or ALT0) against which all other alternatives and the development proposal are assessed.

When considering the Zero alternative the impacts (both positive and negative) associated with any specific alternative or the development proposal would not occur and in effect the impacts of the Zero Alternative are therefore inadvertently assessed by assessing the other alternatives. In addition to the direct implications of retaining the status quo there are certain other indirect impacts, which may occur should the Zero alternative be followed.

Overall, the impact of “No Go” alternative impact is considered to be significant in hampering development in terms of local, regional, and national wise transport. The consideration of “No Go” was dismissed as an alternative due to the need and desirability of upgrading this road in order to cope with rapid increase in demand for transit of goods and services into other regions.

5.2 DESIGN ALTERNATIVES

Design alternatives have considered pavement materials in terms of sub-base, base course, and wearing course. Two pavement alternatives have been considered as follows:

- Alternative 1 (ALT1): Upgrading to AC surface, with paved shoulder, Dense Bituminous Macadam (DBM) base layer, and Cemented Material (CM) sub-base material
- Alternative 2 (ALT2): Upgrading to AC surface, with paved shoulder, Crushed Rock (CRR) base layer, and Cemented Material (C1) sub-base material

Economic analysis shows that ALT1 [Upgrading to AC surface, with paved shoulder, Dense Bituminous Macadam (DBM) base layer, and Cemented Material (CM) sub-base material] is a more most feasible option for implementation. It is therefore recommended to upgrade the road to AC surface, with paved shoulder, DBM base layer, and CM sub-base material.

SECTION 6: POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

6.1 INTRODUCTION

This chapter presents analysis of impacts of various components of the project. Several techniques and methods are available for the prediction and analysis of impacts. Examples of such methods include Mathematical Models, Mass Balance Models, Statistical Models, Physical, Image, or Architectural Models, Field and Laboratory Experimental Methods, and Analogues Models.

The methods that were used in this study were mainly Field Method and Analogue Model. The field method used existing data inventories, which was supplemented by field surveys to predict impacts on receptors.

The Analogue Model make predictions based on analogue situations, including comparing the impacts of the proposed project with a similar existing projects, comparing environmental conditions at one site with those at similar sites elsewhere, comparing an unknown impact (e.g. concrete on human skin) with a known environmental impact. The model was developed from site visits, literature searches, expert opinion, and on expert's previous experience.

The impacts are either positive (beneficiary) or negative (adverse). Whether positive or negative, the impacts are classified into direct short term, direct long term, and indirect impacts, reversible or irreversible. Negative impacts need to be abated, while those identified as positive will need to be strengthened so that the objective of the project is enhanced.

6.1.1 Direct Impact

Direct impacts are caused by the road itself that is to say, by road building processes such as land consumption, removal of vegetation, and severance of farmland. For example, the removal of gravel material from a borrow pit, for use in surfacing the road, is an obvious direct impact of road construction. In this case, the land area in which the pit site is located has been directly affected by activities associated with the road project. Direct impacts are generally easier to identify, assess, and control than indirect impacts, since the cause-effect relationship is usually obvious.

6.1.1.1 Direct Short-Term impacts

Direct short term impacts are direct impacts that may be apparent only during the construction stage of the project. Such impacts include impacts that are related to construction works.

6.1.1.2 Direct Long-Term impacts

These are direct impacts that will appear after the construction has been completed, and include impacts related to both construction works and the use of the road.

6.1.2 Indirect Impacts

Indirect impacts are sometimes called secondary, tertiary or chain impacts, depending on how many steps there are between the original source and its impact. They are not a direct result of the strategic action, but occur away from the original source of impact or as a result of a complex pathway. They are linked closely with development projects and may have more profound consequences on the environment than direct impacts.

Indirect impacts are not easier to identify, assess, and control due to difficulties in understanding the cause-effects relationships, but can ultimately be more important. Over time they can affect larger geographical areas of the environment than anticipated.

Examples of indirect impacts include degradation of surface water quality by the erosion of land cleared as a result of a new road and urban growth near a new road.

A subset of indirect impacts is **generated impacts**: where one type or phase of development attracts or facilitates another. An example of a generated impact is a new transport link to a remote area which triggers new housing and employment development.

Indirect impacts are identified by using a causal chain diagram (or causal network diagram).

6.1.3 Cumulative Impacts

Cumulative impacts are caused by combined results of past, current and future activities. Over time, direct and indirect human activities combine to collectively impact the environment.

The impacts may differ from the original, individual activities. For example, ecosystems can be damaged by the combined effects of human activities, such as air, land, and/or water pollution, improper handling of industrial waste, and other human development activities. Global warming is the cumulative effect caused by too much greenhouse gas, and it may then cause a loss in biodiversity and acid rain.

The process of cumulative environmental change can arise from any of the four following types of events:

- Single large events, i.e. a large project
- Multiple interrelated events, i.e. road projects within a region
- Catastrophic sudden events, i.e. a major landslide into a river system; and
- Incremental, widespread, slow change, such as a poorly designed culvert or drainage system along a long road extending through a watershed.

These can generate additive, multiplicative or synergetic effects, which can then result in damage to the function of one or several ecosystems (such as the impairment of the water regulation and filtering capacity of a wetland system by construction of a road across it), or the structure of an ecosystem (such as placement of a new road through a forest, leading to m-migration or land clearing which results in severe structural loss to the forest).

A cumulative impact, in the context of road development, might be the de-vegetation and eventual erosion of a roadside pull-out. The scenario might unfold as follows: a road cutting through a mountain range offers some spectacular views, and in the absence of designated rest areas, motorists stop indiscriminately. Roadside vegetation is damaged by vehicle and foot traffic, and the soil is left unprotected. Subsequent rainfall causes erosion and siltation of nearby watercourses. The vegetation never has enough time to recover (because of high traffic volume on the road), and the problem is exacerbated over time.

6.1.4 Residual Impacts

Residual impacts are those impacts that remain following the implementation of the mitigation measures proposed for each project phase, taking into account the background environmental conditions and the impacts from existing, committed, and planned projects.

The impacts considered in this study pertain not only to the road right-of-way but also to sites associated with the road. These will include:

- Deposit and quarry and borrow sites
- Construction equipment and materials storage yards;
- Materials processing areas (e.g. concrete batch plant and bitumen heating area)
- Detours and access roads
- Construction camps

In order to identify the impacts easily and effectively, each phase of the project has been broken down into main activities, from which possible impacts have been delivered. The identified potential environmental and social impacts have been classified in accordance with activities causing them. The Prediction and evaluation of environmental impacts of the proposed roads project has been done using the matrix in Table 20. The likely interactions between the development actions/activity and the impact subjects are described (rated) in terms of magnitude and importance on a common scale of between -3 through +3 for both positive and negative impacts as follows:

+3 = Major Positive, +2 = Moderate Positive, +1 = Minor Positive, 0 = No Impact,
-3 = Major Negative -2 = Moderate Negative, +1 = Minor Negative,

It is important to note that the impacts discussed below are presented as worst-case scenarios, in the absence of any best management practices (e.g. proper waste disposal) or mitigation measures, such as horizontal realignment to avoid excessive clearing of trees or improvement of sight distance and so road safety, etc.

6.2 MOBILIZATION PHASE

As noted earlier, the main activities during mobilization phase of the project will be the transportation of construction equipment to the site, establishment of camps, and establishment of sources of naturally occurring construction materials.

The camp will be required for the storage of construction materials and equipment, material processing, carpentry workshop, steel workshop, mechanical workshop, and pre-cast yard. The camp will also be required to provide site office and accommodation for Supervising Consultant and a few senior staff of the Contractors. Accommodation may not be necessary for workers coming from the project area. Mobilization activities are expected to bring about the following impacts.

6.2.1 Creation of Employment

Establishment of construction camp site will create direct and indirect employment to the local as well as people from other places. Direct employment will be in the form of skilled labour as well as non-skilled labour. Indirect employment will include employment of food vendors (especially women) and other small businesses like soft drinks. The Impact is estimated to be positive, direct, short term, and moderate.

6.2.2 Loss of Vegetation

Clearing works during establishment of camps and material borrow areas will involve removal of vegetation, including trees. Clearing of vegetation apart from exposing soil to water erosion, it will remove fertile top soil which is good for supporting plant growth. The negative impact is gauged to be a direct long terms and moderate, and irreversible.

6.2.3 Deterioration of Scenic and Visual Quality

Loss of aesthetic quality will result from accumulation of top soil cleared from camp sites, construction material wastes such as concrete, nails, timber, steel, iron sheets etc., and material packing such as cement bags etc. This will create eye-sore to the by passers. The negative impact will be direct, short term, minor, and reversible.

6.2.4 Generation of Noise and Vibrations

Pollution due to noise and vibrations will result from operations of construction equipment and trucks during transportation and delivery of construction materials, and works at the camps. Increased traffic movement across and along settlements is likely to cause considerable noise and vibrations. This is likely to interfere with audio communication.

The impact is likely to be eminent if the equipment and trucks are poorly maintained. Since there are no settlements in the neighbourhood of potential sources of construction materials, the impact due to noise and vibrations due to material extraction activities is only likely to be felt by construction workers. The negative impact due to noise and vibrations will be direct, moderate, but short term. The impact is residual since it cannot be mitigated fully.

6.2.5 Deterioration of Ambient Air Quality by Dust

Deterioration of ambient air quality will be due to generation of dusts at the campsite, during site preparation, construction activities especially those involving the use of cement and extraction of materials at material borrow sites. Deterioration of ambient air quality will also arise from transportation and stockpiling of construction materials at camp site. In addition, the transport trucks may generate clouds of dust as they move across settlements. The impact is estimated to be direct, moderate, short term, and reversible. The impact will be residual since dust cannot be mitigated fully.

6.2.6 Risk of Road Traffic Accidents

Project activities during mobilization phase will increase the traffic volume and movements. This is likely to increase the likelihood of accidents, especially along materials stock/ source routes discussed in borrow pits) and road crossings, especially settlement centres. Settlements that are likely to be affected most are the relatively high populated ones such as Munanila, Buhigwe, Herujuu, and Kasulu. The impacts due to pressure on traffic and road safety are gauged to be direct, moderate, short term, and irreversible.

6.2.2 Soil Erosion

Clearing of vegetation during establishment of camps and material borrow areas will remove fertile top soil which is good for supporting plant growth as well as expose soil to water and wind erosion. The negative impact will be direct, short term, moderate, and irreversible.

6.3 CONSTRUCTION PHASE

6.3.1 Creation of Employment

Construction phase of the project will create both direct and indirect employment for both women and men. Direct employed people will be those working in the direct construction of the road and will include skilled labour (engineers, surveyors, technicians, machinery and equipment operators, drivers, artisans etc.) and unskilled labour. Indirect employed people will include food vendors (especially women) and other small businesses like soft drinks, which are likely to be concentrated at village centres, active construction sites as well as in the neighbourhood of campsites.

This will be a direct, moderate, and short term impact, since it will only occur during the construction period of the project.

6.3.2 Extraction, Processing, and Delivery of naturally-occurring Construction

Materials

Environmental and social impacts due to borrowing of materials from borrow pits, sand pits as well quarrying activities will include loss of vegetation, waste disposal, deterioration of aesthetics, and generation of noise and vibrations. Extractions of construction materials from the pits and quarries identified in sub-section 2.4.6 are likely to cause the following negative environmental impacts:

6.3.2.1 Loss of Vegetation and Farmland

As indicated earlier in sub-section 4.8, the majority of the project road traverses along varied mosaics of shade trees, and street strip trees in settlements areas, grassland, acacia woodland, and miombo woodland, and scrublands in the outskirts of villages. Street strip trees consist of exotic trees, mainly yellow cassia, and fruit trees mainly mango and avocado. In addition, there are sections with eucalyptus and cypress forests.

Borrowing of natural gravel and quarrying from the identified potential sites will obviously involve excavation and so clearance of this tree vegetation. Clearance of vegetation is likely to result into degradation of the production value of farmlands and forestry due to loss of fertile top soil. Removal of vegetation will amount to further degradation of land and landscape, making the area susceptible to water and wind erosion. In addition, quarrying and excavation will destroy the economic and aesthetic value of the quarry site. The impact is gauged to be direct negative moderate, reversible, and long term because once the vegetation has been cleared; it will take substantial time for the cleared vegetation to regenerate.

6.3.2.2 Generation of Noise and Vibrations

Generation of noise and vibrations will result from the blasting of rocks at quarry site discussed in sub-section 2.4.6. In addition, noise and vibrations will be generated by construction equipment and trucks during extraction (borrowing), transport, and delivery of construction materials to the project site. The problem is likely to be worse if the equipment and trucks are poorly maintained. However, since there are no settlements in the neighbourhood of the identified quarry and borrow sites, the impact due to noise and vibrations will only be felt by construction workers. However, increased traffic movement across settlements and material

routes during transport of materials will cause increased noise and vibrations. Increased generation of noise and vibration will in turn interfere with audio communication.

The negative impact is gauged to be direct, moderate, reversible, and short term, since it will only be felt during the construction phase of the project. The impact will be residual since it cannot be mitigated fully.

6.3.2.3 Deterioration of Ambient air Quality

Air quality deterioration will be the major direct negative impact during the construction phase of the project. Pollution of ambient air by dust will arise from transportation and stockpiling of construction materials.

Gravel and fill materials will generate dust as they are being transported in uncovered trucks or being off loaded at the site. In addition, the transport trucks may generate clouds of dust as they move across village settlements whose road is not paved.

Although dust is a permanent feature along the unpaved road, especially during dry season, it is likely to increase beyond the current levels, causing alarming effect to the locals.

Further to that, dust will be generated by stone crusher at the quarry sites. Production of dust by transport trucks near settlements along the road is likely to affect human health. The dust is likely to cause bronchial problems, including URTI (Upper Respiratory Tract Infection) to the villagers and workers, let alone being a nuisance to the environment.

Pollution of ambient air will also occur at materials borrow and quarry sites. This will be due to emission of SO₂, NO_x, CO, and CO₂ from exhaust fumes from material extraction equipment and stone crusher at quarry site. The impact is estimated to be direct, major, reversible, and short term since it will only occur during the construction phase of the project.

The impact will be direct, of moderate significance for short periods in close proximity to material borrow areas, and dwellings during the day and evening.

The impact due to pollution of ambient air by dust and fumes will be residual impact because it cannot be avoided or abated fully.

6.3.2.4 Deterioration of Scenic and Visual Quality

A common source of deterioration of scenic and visual quality during extraction of materials is the presence of borrow pits after materials have been extracted. The ESIA Expert's past experience has shown that most Contractors prefer to borrow materials very close to the edge of the road in order to minimize haulage distance. This is exactly what was observed during this study, whereby some of the borrow pits were located as close as 10m from the edge of the road and some of them were located in settlements. The other thing is that, more often than not these borrow pits are not reinstated after completion of their use.

Borrow pits and access road left after extraction of construction materials will impair aesthetics, especially if located close to the road.

Dust generated by construction equipment, machinery, and vehicles will impair visibility making construction sites prone to traffic accidents. In addition, stockpiles of construction materials on road sides will impair scenic and visual quality.

Discolouration of buildings and vegetation along the construction site will occur due to the dust blown by wind. The impact due to deterioration of scenic and visual quality is weighed to be

direct, short term, moderate, reversible, and short term, since it will occur during the construction phase of the project.

6.3.2.5 Risk of Accidents to Livestock and Humans

If pits and quarries sites especially if located near settlements are left un-reinstated, they may become filled with rainwater and become dangerous to livestock and human, in particular children, due to possible drowning. They may also create breeding sites for vectors like mosquitoes and bilharzias, when filled with rainwater.

Past experience by the Environmental Expert during supervision of construction of roads has shown that although standard specifications for road works clearly specifies requirements by the Contractor to reinstate borrow pits before a Take Over Certificate (TOC) is issued, borrow pits are left unreinstated, creating environmental and safety hazards to nearby communities.

The impact due to accidents to human and animals due to un-reinstated borrow pits is estimated to be direct, moderate, reversible, and short term if mitigated as soon as they are no longer in use.

6.3.2.6 Soil erosion

Clearing of vegetation during extraction of construction materials is likely to cause soil erosion in pits and quarries. Soil erosion will occurs because vegetation and topsoil are either removed or disturbed, leaving behind loose soil, which is too poor to sustain good plant growth and resist erosion due to surface runoff. The impact is likely to be worse if borrow sites are located on steep slopes and near a water course, because higher velocity of runoff is likely to transport loose material to the water course causing serious sedimentation. The impact due to soil erosion will be direct, moderate, reversible, and long term.

6.3.2.7 Impact Related to Blasting, Drilling and Rock Excavation

Blasting is used to loosen or break up rocks for removal. Blasting will involve drilling of rock and loosening rock with the aid of explosives. Potential environmental impacts will include dust (air quality), contaminant spills, sedimentation, safety (workers, storage), fly rocks, and debris, noise, and explosive detonation effects on people, and structures. The negative impact will be direct and indirect, moderate and short term.

6.3.3 General Earthworks during Road and Culverts Construction

6.3.3.1 Loss of Vegetation

Manyovu – Kasulu roundabout

Widening of the existing road to accommodate carriage width and its shoulders, road side drain, horizontal realignment of the existing road to improve safety and extending the RoW from the current 45m to 60m will require more land beyond the existing RoW and so further clearing of vegetation as well as loss of farmlands. Sub-sections 4.2.8 (Table 13) describe sections of the existing road that will require realignment to improve road safety. The table also gives indications on how realignment of the existing road will affect properties along the road. Photo 11 through Photo 14 describe typical sections where realignment will be done.

Vegetation of particular importance is the private exotic trees, consisting of strips of grevillea, cypress, and eucalyptus forests that were discussed in sub-section 4.8.1 (refer to Table 18).

Kasulu Western Bypass

Clearing works along western bypass will cause substantial loss of exotic tree forest between Kidiamo and Kabanga and Kabanga and Herujuu that were discussed under sub-section (Table 18).

Kasulu Southern Link

Clearing works and borrowing of material along Kasulu Southern link will cause loss of miombo woodland, exotic trees, and strip trees that have been discussed under Table 18).

The negative impact due to loss of vegetation due to earthworks will be direct, moderate, irreversible, and long term, because once cleared, their shading and micro-climate effect will be lost for good.

6.3.3.2 Roadside Soil Erosion

Roadside soil erosion will occur because, vegetation will be cleared, and top soil will be removed/ disturbed, leaving behind infertile soil, which is too poor to sustain good plant growth and susceptible to wind and water erosion. Where earth works involve materials cuttings, or cut embankment (construction across a hill), in particular Kabanga – Herujuu section; the road sides will slope towards the road. But where earth works involve material filling (construction across a flood plain or a river), in particular construction of the western bypass between Kidiamo and Kabanga or construction of across Mgandazi, and Bogwe during construction of eastern bypass, Kasulu Southern link, and western bypass, the road sides slope away from the road. In both cases, the roadside slopes will be prone to shallow mass movements or development of gullies.

The negative impact will be direct, moderate, long term, and reversible if appropriate mitigation measures are not put in place.

6.3.3.3 Displacement and Loss of Properties

Manyovu – Kasulu roundabout

Most of the settlements along the project road are located outside the old 45m RoW. Nevertheless, there are a few settlements that are located within the RoW. Most of these settlements are located at Munanila, Musagara, Buhigwe, Herujuu villages, and Kasulu town. These buildings will have to be demolished to pave the way for construction works. In addition, realignment of the existing road to improve road safety at some village sections will call for demolitions of buildings that otherwise were outside the RoW. Typical sections of the existing road where realignment will cause loss of properties are described in sub-section 4.2.8 (Table 12). The unfortunate part of it is that even if people are compensated it may be difficult for them to get comparable sites. Some of the houses that will be demolished are within the prime business areas and it could be difficult for these people to obtain similar sites and if they manage to do so it might be at a high cost and customers might be difficult to get. Additionally, there are difficulties of adjusting to new areas and for older people who are uprooted it will result in increased stress and even early deaths. This issue of settlement is thus an area of potential conflict between the people and the government and has social, political, and legal implications. Other properties that will be affected apart from settlements are farmlands consisting of among others banana; coffee, avocado, and mango (refer to Table 18)

Kasulu Western Bypass

Clearing works will cause permanent loss of agricultural land throughout the section. In addition clearing of about the last 400m of Kabanga – Herujuu section is likely to cause loss of residential and a number of private and institutional buildings.

Kasulu Southern Link

Clearing works along this section is not likely to cause permanent loss of land which is used for farming. It is however not likely to cause loss of building because most of the buildings are out the right of way.

The negative impact due to displacement will be direct, moderate, long term, and irreversible.

6.3.3.4 Disruption/Destruction of Public Utilities and Service

Sub-section 4.6 has given details of public utilities that are likely to be affected by the road upgrading as electric power lines, domestic water supply pipe lines and water storage tanks, and Fibre optic cable.

Disruption of Domestic water supply Systems

As noted in sub-section 4.6 (Table 14), a number of domestic water supply pipelines either run very close or cross the project road at Mkatanga, Mulera, Buhigwe, Songambebe, Karunga, and Herujuu villages as well as Kasulu town. In addition substantial numbers of domestic points are located within the RoW at Mkatanga, Musagara, Kibwigwa, Mulera, Buhigwe, Karunga, and Herujuu villages. Other utilities within Row include a water storage tank at Songambebe village and man holes and valve chambers at Buhigwe and Songambebe village. The pipe lines, domestic points, valve chambers, and tank are likely to be disrupted by earthworks during the road upgrading. The impacts will be direct, moderate, short term, and reversible.

6.3.3.5 Generation of Noise and Vibrations by Construction Equipment

Earth moving, compaction, and other construction activities will generate noise and vibrations due to reactions between earth and the equipment. In addition, movement of the machinery, equipment, and dump trucks will also generate noise and vibrations. The noise and vibrations generated will agitate and impair audio communications at settlements along road. The noise impact will also be felt by construction workers and locals.

The impact will be direct, reversible, of moderate significance, for short periods in close proximity to dwellings areas during the day and evening. It is a residual impact since it cannot be mitigated fully.

6.3.3.6 Deterioration of Ambient Air Quality by Dust and Fumes

Deterioration of ambient air quality will be due to production of fumes from exhaust from stationery as well as or moving construction machinery and equipment will emit SO₂ NO_x, CO, and CO₂. The impacts due to fumes will affect residents along the project road as well as construction workers. In addition, moving of earth as well as movement of construction machinery and vehicles will generate clouds of dust. Although dust is a permanent feature along the current road during the dry season, it is likely to increase beyond the current levels due to increased traffic volume and movements. Apart from nuisance, excessive dust level can negatively affect human health. Dust can cause several bronchial problems, including URTI (Upper Respiratory Tract Infection).

In addition, dust particles can affect the growth the crops and other vegetation. Dust abrading leaf surfaces, dust blocking stomata (clogging of pores) of plants, dust increasing the amount of absorbed incident radiation. These are just a number of different impacts dust can have on vegetation and plants. But overall, the effects seem to be a reduction in photosynthetic abilities, the result of which can be stunting their growth due to shading effect, and clogging of the plant's pores.

The negative impact will be direct, of moderate significance for short periods in close proximity to active construction sites and dwellings during the day and evening. The impact will be residual as it cannot be mitigated fully.

6.3.3.7 Generation of Solid and Liquid Wastes

Among the wastes that will be generated during construction are:

- Top soil and cleared greens from along rivers, existing road and general clearing works
- Excess (spoil) material, excavated from the road
- Demolition materials from existing buildings and road structures (from demolished buildings), corrugated steel culverts), concrete (from demolished concrete culverts), and steel reinforcements (from demolished culverts), etc.
- Material wastes such as sand, fill material, aggregates, gravel, concrete, bitumen, etc.
- Sanitary wastes from project staff working outside the campsite

Apart from impairing the scenic and visual quality of the project site, the wastes generated are likely to cause the following impacts:

- Pollute surface water resources if exposed to surface runoff
- Cause waterborne or airborne diseases (sanitary wastes) if improperly disposed of

The negative impact will be direct, moderate, reversible, and short term as disposal of solid and liquid wastes shall be part and parcel of the construction activities of the project.

6.3.3.8 Road Traffic Congestion and Accidents

During construction phase, increased project activities will increase traffic volume as well as movements. These activities will cause traffic congestion and disruption; and possibly accidents. Moreover, along materials stock routes, and specifically at road crossings, especially village/settlements centres, road accidents may occur during construction phase. Other accident black spot areas are where school pupils and students have to cross the project road. Typical accident black spots are those listed in Table 15.

The negative impact due to pressure on traffic and road safety are will be direct, moderate, reversible and long term since they will span over construction as well as operation phase of the project.

6.3.3.9 Increased Consumption of Energy and Natural Resources

Energy will be consumed to operate construction machinery and equipment as well as other transportation facilities. More energy in the form of fuel and lubricants will be consumed during the construction stage of the project. The energy will be used in the operations of construction equipment. In addition, pressure on natural resources will increase due to increased consumption of natural resources in the form of fuel wood and charcoal. Past experience by the Environmental Expert in the supervision of road construction projects has shown that some Contractors have

tendencies of cutting/ using fire wood as a source of energy for boiling bitumen or cooking. In addition, Contractors cut trees to make road markers pegs, claiming that the pegs have been made from trees cleared from road side or borrow pits. If not prevented to do so by the Engineer, it is likely that Contractors will cut trees from the forest protected areas discussed in sub-section 4.8.4 as well as other unprotected miombo woodland forests to make marker pegs. The impact will be indirect, moderate, short term, and reversible.

6.3.3.10 Resources Use Conflict

Presence of worker's camps is potentially a source of social and environmental problems as a result of interaction of local people and workers in the project area. Conflicts between the two groups of people may result due to sharing of social services, like water resources for domestic and construction activities, especially when it is considered that drinking water is scarce in the project area. The negative impact will be direct, moderate, and short term.

6.3.3.11 Reduction in Rivers Flows

Abstraction of water from the Bogwe seasonal river discussed earlier in Sub-Section 4.2.4 for construction works, including dust suppression is likely to reduce the discharge of the river and so affecting the flow rate for other users in the downstream, in particular gardening. This is likely to create conflicts between the contractors and the local communities. The impact will be indirect, moderate, short term, and reversible.

6.3.3.12 Impact to Cultural Sites

The survey did not identify any burial areas along Manyovu – Kasulu roundabout, Western bypass, and Eastern bypass. The survey however identified two burial sites around Km 6+100 and 6+600 on the RHS along Southern Link road. Some of the graves are located as close as 9m from the edge of the existing road. Clearing works and earthworks; if not done carefully are likely to cause damages to the graves. The impact will be direct, moderate, short term, and reversible.

6.3.3.13 Deterioration of Visual and Scenic Quality

Increased traffic movement and speeds will increase the generation of dust. Clouds of dust generated by construction equipment will impair visual quality, making the site prone to traffic accident. The generated dust will impair visual quality due to discolouration of vegetation and buildings along the road.

Another source of deterioration of visual and scenic quality will be cuts across hills. The cuts will impair visual and scenic quality if the cuts are located across settlements. The impact will be direct, moderate, reversible, and short term.

6.3.4 Construction of Cross Drainage Structures

Construction across water courses will encompass among others demolition of existing and construction of new culverts. The following impacts are anticipated:

6.3.4.1 River Bank Erosion during Riparian zone Construction

Works across rivers, drainages, and in the riparian zones during construction of culverts is likely to disturb or cause losses of vegetation along their banks and riparian zone, consisting of mainly exotic riverine trees discussed in sub-sections 4.2.4.1. Since all the existing bridges and culverts

will be replaced with new ones, all the water courses across the project road will be substantially affected because significant earthworks will be carried out along their riparians.

Since there is only one river of significant importance across the project road the impact due to river bank erosion and sedimentation of river systems due to work across rivers and in the riparian zone will be direct, minor, reversible, and long term.

6.3.4.2 Surface Water and Soil pollution

During construction of culverts, pollution of river systems and soil may occur due to sedimentation, accidental spillage of hazardous material such as concrete, fuel, and oils from construction equipment. Spillage of hazardous material to water courses is potentially very detrimental to aquatic fauna such as fishes. Though one cannot predict the location or type of spillage, any spillage to water will be local in nature. This is an unwelcome possibility.

Deposition of concrete and fine sediments during construction across the permanent rivers and other semi-permanent rivers discussed in sub-section is likely to affect fish (though very few) and their habitat. Works in the river systems, such as excavation and compaction may cause fish mortalities due to entrainment in excavator's buckets etc.

Since there is only one river system across the project road, the negative impact due to water and soil pollution is will be direct, minor, long term, and reversible since once it has occurred; it will take long term for the ecosystem system to regenerate itself.

6.3.4.3 Generation wastes

Apart from spoil material, other types that will be generated during construction of cross drainage structures will include demolition material such as concrete and reinforcements bars (from old pipe culverts), old culverts, and hard stones (from protection works). These wastes if not properly disposed of will create eye sore to by passers. The impact will be direct, moderate, long term, and reversible.

6.3.5 Construction of Roadside drainage Systems

6.3.5.1 Increased Risk of Roadside Soil Erosion

Where the road traverses through hilly topography with steeper slopes, in particular sections between Munanila – Musagara, Buhigwe – Songambe, and Herujuu – Kasulu (refer to Table 11) gullies may easily be formed along ditches, drainage channels, as well as culverts. Formation of such gullies may, apart from destroying farmland and crops beyond the drainage, will undermine the road itself. In contrary, where the road traverses in more or less flat topography, drainage may appear to be difficult. Depending on the adjoining terrain, there may be a need to extend the drainage to longer distance or creating soak pits. This will result into not only increasing construction costs but also clearing vegetation cover. The negative impact due to increased risk of roadside erosion will be indirect, moderate, irreversible, and long term.

6.3.5.2 Disruption of Community Access to their Dwellings and Business Areas

During construction, disruption of community access to their business activities and residential places at all settlements along the road will occur due to creation of barriers. One of the potential barriers is the construction of road side drainages. The impact of these barriers would be an increase in travel time for local residents to their business and residential areas. This will be indirect, moderate, reversible, and short term negative impact.

6.3.6 Concrete Works and Construction of Cement-stabilized Layers

6.3.6.1 Health Problems Associated with Handling of Cement and Wet-cement Products

Construction of road pavement (lying of cement stabilized sub-base layer), culverts, and lined roadside drains will expose workers to cement and wet-cement products (mortar and concrete). Construction workers working with cement and wet-cement products are likely to be affected by URTI due to inhaling cement dust and dermatitis infection due to prolonged contact with cement and wet-cement concrete.

Cement has constituents that produce both Irritant Contact Dermatitis (ICD) and corrosive effects (from alkaline ingredients such as lime) and sensitization, leading to Allergic Contact Dermatitis (ACD) [from ingredients such as chromium IV].

Allergic Contact Dermatitis is inflammation of the skin typically manifested by erythema, mild edema, and scaling. ICD (Photo 10) is a nonspecific response of the skin to direct chemical damage that releases mediators of inflammation predominantly from epidermal cells. A corrosive agent causes immediate death of epidermal cells, manifested by chemical burns and cutaneous ulcers

Allergic Contact Dermatitis is an allergic response (immunological response) of the skin as a result of exposure to a chemical. Chemical exposures that may result in allergic contact dermatitis include epoxy resins, chromates, rubber chemicals, amine hardeners, and phenol-formaldehyde resins.

Findings indicate that cement and wet-cement products (e.g. concrete and mortar) should be treated as hazardous materials, and that workers handling such products should reduce exposure wherever possible. OPC contains varying amounts of hexavalent chromium (Chromium IV), a known carcinogenic, and toxin hazardous to skin, eyes and lungs (Winder, C et al (2009).

Skin contact

The hazards of wet cement are due to its caustic, abrasive, and drying properties. Wet concrete contacting the skin for a short period and then thoroughly washed off causes little irritation. But continuous contact between skin and wet concrete allows alkaline compounds to penetrate and burn the skin.

When wet concrete or mortar is trapped against the skin may cause skin burn or skin ulcer. Cement dust released during bag dumping can also irritate the skin. Moisture from sweat or wet clothing reacts with the cement dust to form a caustic solution, which has a burning effect to the skin.

Allergic skin reaction

Some workers become allergic to the hexavalent chromium in cement. A small yet significant percentage of all workers using cement will develop an allergy to chromium, with symptoms ranging from a mild rash to severe skin ulcers.

In addition to skin reactions, hexavalent chromium can cause a respiratory allergy called occupational asthma. Symptoms include wheezing and difficulty breathing. Workers may develop both skin and respiratory allergies to hexavalent chromium.

Studies have shown that it is possible to work with cement for years without any allergic skin reaction and then to suddenly develop such a reaction. The condition gets worse until exposure

to even minute quantities triggers a severe reaction. The allergy usually lasts a lifetime and prevents any future work with wet concrete or powder cement (Dru Sahai, 2001)

Eye contact

Exposure to airborne dust may cause immediate or delayed irritation of the eyes. Depending on the level of exposure, effects may range from redness to chemical burns and blindness.

Inhalation

Inhaling high levels of dust may occur when workers empty bags of cement. In the short term, such exposure irritates the nose and throat and causes choking and difficult breathing. Prolonged or repeated exposure can lead to a disabling and often fatal lung disease called “silicosis”. There is a link between crystalline silica exposure and lung cancer (ibid).

6.3.6.2 Soil and Water Pollution by Concrete Slurry and Concrete Wastewater

Concrete works during construction of culverts, and lining of roadside drains is likely to cause leakage of concrete slurry to road sides. Concrete slurry will pollute soil and affect the growth of young trees. In addition, there is a likelihood of the concrete slurry to find their way to rivers either directly during construction of culverts or through storm water system, especially when concreting is done when raining.

Lime is a major component of cement and is found in all concrete products. It dissolves in water to produce an alkaline solution that will burn and kill fish, insects, and plants. Water that comes into contact with unset concrete or concrete dust quickly increases in alkalinity and will be highly toxic to aquatic life. Notably, concrete wastewater has a pH of 12 -13 and is as toxic as bleach, while the pH of freshwater is between 6 and 7. Concrete wastewater causes burns in a similar way to a strong acid. A single bucket of concrete wastewater will easily kill hundreds of fishes.

In addition, leakage of concrete slurry to road sides is likely to cause soil pollution and so killing or stunting the growth of young trees, especially regenerating ones. The negative impact due to soil and water pollution is weighed to be direct, moderate, reversible, long term.

6.3.7 Construction of Road Pavement

6.3.7.1 Health Problems Associated with Handling of Cement and Wet-cement Products

The impact associated with handling of cement and wet cement products has already been discussed in sub-section 6.3.6.1

6.3.7.2 Deterioration of Ambient Air Quality by Bituminous Fumes

Apart from dust exhaust fumes from construction equipment, deterioration of ambient air quality will be due to generation of bitumen fumes from bitumen processing plant, pre-coating of chippings with bitumen as well as during spraying of bitumen. The impacts due to bitumen fumes will affect construction workers as well as residents along the project road. The impact due to deterioration of ambient air quality by bituminous fumes will be direct, moderate, reversible, and short term.

6.3.7.3 Health Problems Associated with Hydrated Lime

During construction, naturally occurring materials that have high plasticity index (very plastic) are likely to be stabilized with hydrated lime. Hydrated lime if not handled properly, can cause the following health problems:

- Eye contact with lime can cause severe irritation or burning of eyes, including permanent damage.
- Skin contact with lime can cause irritation of skin.
- Ingestion of lime can cause severe irritation of gastrointestinal tract if swallowed.
- Inhalation of lime can cause severe irritation of the respiratory system. Long-term exposure may cause permanent damage.

Although hydrated lime is not listed as a carcinogenetic, it may contain trace amounts of crystalline silica in the form of quartz or cristallite, which has been classified carcinogen to humans when inhaled. Inhalation of silica can also cause a chronic lung disorder, silicosis

6.3.8 Operations of a Construction Camp

Operations of site office, mechanical workshops, site stores, medical clinic, as well as pre-cast yards are likely to have a number of impacts as narrated in the following sub-sections.

6.3.8.1 Generation of Solid and Liquid Wastes

Operations of camps (offices, workshops, storage yards, and kitchens) will generate the following wastes:

- Solid wastes such as plastic and glass containers, steel and aluminium cans, used tyres, used lead-acid batteries, used oil and fuel filters, litter, used printer cartridges, used metal plastic parts, food wastes
- Liquid wastes such as used motor oils and grease, battery acid, grey and black waters
- Biohazard wastes such as syringes, needles, pharmaceutical products packing material

The concern here is their management. If they are not properly managed, treated, or disposed of, they will impair aesthetic quality of the campsite, cause soil, and/ or ground water. Unsafe disposal of biomedical wastes will pose health hazard to any person coming into contact with it. The impact will be direct, moderate, reversible, and short as well as long-term.

6.3.8.2 Fire and Explosion Risks

Activities at mechanical workshops during repair and maintenance of construction equipment poses a risk of fire or explosion, although minor. Small quantities of flammable liquids and compressed gases will be stored and used. Liquids will include fuels (petrol, diesel and, paints, and cleaning solvents). Compressed gases will include oxy-acetylene (for welding and cutting). The impact will be direct, moderate, irreversible, and short term.

6.3.8.3 Risks of Leakage of Hazardous Materials

The project will utilize a number of chemicals during construction and maintenance of construction equipment. Some of the materials will have to be transported from outside the project area, and will therefore require special attention in their transport, handling, and storage. Such materials will include different grades of lubricants (oils, grease etc.), fuels, and bitumen (all hydrocarbons compounds), paints and solvents, brake fluids, battery acid.

Leakage of such chemicals poses a risk of soil contamination as well as surface and groundwater pollution. The impact will be direct, moderate, irreversible, and long term since when it occurs, clean-up of chemicals, apart from being very expensive, will take long time.

6.3.8.4 Generation of Human Sanitary Wastes

Among the wastes that will be generated at the construction camps will be sanitary wastes from construction workers. If sanitation facility is not provided for, they are likely to relieve themselves in the bush causing outbreak of waterborne diseases such as dysentery and diarrhoea. The impact will be direct, moderate, short term, and reversible.

6.3.9 Marital and Social Conflicts

Road project will lead to increased marital and social conflicts because of increased interaction. Project workers with extra earnings could be the sources of conflicts as they engage in extra-marital affairs. The impact will be indirect, moderate, and short term.

6.3.10 Increase in unwanted Pregnancies

Increased and unwanted pregnancies especially among school girls as project workers could easily entice school girls with money in return for sexual relationships. This will be an indirect, moderate, and short term negative impact.

6.3.11 Triggering of Child Labour and School Dropout

Availability of employment from construction activities is likely to tempt school children to abstain from school in search of unskilled job resulting into decline in the quality of education.

6.3.12 Occupational Health and Safety Hazards

Mobilization, construction, demobilization, and phase of the project activities will expose workers, visitors, and the general public to different hazards as follows:

6.3.12.1 Physical Hazards

6.3.12.1.1 Falling of people, objects or materials

Working at height during construction of camps (e.g. roofing and block work), construction of box culverts, working above excavation will expose workers to fall hazards resulting into physical injury or fatal accident. In addition, the public will be exposed to excavation fall hazard, especially if the worksite is not physically separated from the surrounding. Similarly, workers working below height (during construction of camp and culverts) and by passers will be exposed to physical injury due to possible fall of object or material from height.

6.3.12.1.2 Stepping on or striking against objects

Hazards associated with stepping on objects will result from mainly poor housing keeping at work sites and lack of personal protective gears. Hazards will include being punctured by sharp objects (e.g. nails or any other metallic material) left on the ground and tripping/ tumbling on object.

6.3.12.1.3 Manual Handling Injury -- Overexertion

Physical hazard associated with lifting and over-exertion is discussed under sub-section 6.3.11.2.2

6.3.12.1.4 Workers being struck or Crushed by Mobile Equipment

Project workers working near mobile equipment such as overhead crane, excavator, articulated crusher, concrete mixer, dozer, grader, wheeled loader, dump truck, etc. or members of the community near such equipment will be exposed to physical hazards due to the possibility of being hit, entangled, or crushed by the equipment during their operations.

6.3.12.1.5 Transport

Operations of equipment transporting materials etc. will expose workers and members of the community to traffic accidents.

6.3.12.1.6 Electrical Shock Hazard

A number of stationery construction and workshop equipment will be operated by electricity. Examples of such equipment include stone crusher plant, concrete batch plant, cement-stabilized material mixing plant (pug mill), bitumen heater, steel reinforcement workshops machines (bar bender, bar cutter, etc.), and workshop metals machines. When control panels of this equipment are not well insulated, exposed, or not earthed or their cables are poorly insulated, will expose workers to electrocution hazard.

6.3.12.1.7 Fire and Explosion

The impact associated with fire and explosion has already been discussed in sub-section 6.3.8.2.

6.3.12.2 Health Hazards

Construction activities, involving the use of different construction materials will expose workers and the public to health hazards. Health hazards can be categorized into chemical health hazard (due to liquids, dusts, gases, and fumes), physical health hazards to (due to heat, noise and vibrations, compressed air, and manual handling), and biological health hazards.

6.3.12.2.1 Chemical Health Hazards

Contact with Skin

Dermatitis is the most occupational skin disease. This will result from exposure to wet cement or cement product

Inhalation of harmful Chemicals

Inhalation of harmful chemicals causes the following respiratory diseases:

- Silicosis (lung scarring) due to inhaling silica dust and commonly found in many rocks, granite rock, aggregates, sand. Inhalation of dust (including cement dust) also causes asthma
- Headache, nausea, dizziness, and loss of co-ordination due to inhalation of carbon dioxide from internal combustion engines exhaust, carbon dioxide welding, especially when working in highly confined space). Headache, dizziness, and vomiting can also be caused by inhalation of solvent vapours. Solvents are used in a wide range of products,

which are likely to be used in the construction activities such as adhesives, sealers, paints, solvents, lubricants, and lacquers.

- Drowsiness, vomiting, loss of muscular control, including death due to cadmium poisoning through breathing of cadmium fumes, released during cutting, welding, or brazing operations of cadmium plated steel (especially in confined space). Fatigue, anaemia, colic or wrist-drop due to lead poisoning through breathing lead dust or lead fumes lead poisoning, resulting from demolition of (cutting and burning) old structures covered in lead-based paint.
- Metal-fume fever – a flu-like illness due to inhalation of complex welding fumes from the welding parent metal and its coatings. In addition, zinc fumes are evolved from the welding, brazing, and flame cutting of galvanized steel. Breathing them may cause zinc-fume fever

6.3.12.2.2 Physical Health Hazards

Physical hazards are hazards resulting from general environment that will be experienced by the workers or from their particular occupation. Physical health hazards include the following:

Noise

Prolonged exposure to high noise levels from plant and machinery on site or in workshops likely to cause irreversible damage to hearing. The general acceptable sound level upper limit is 85dB (A), where the sound is reasonably steady and exposure is continuous for 8 hours.

Vibration

Continuous exposure of the hands to high frequencies of vibrations from tools such as pneumatic hammers, concrete breakers, drills, and chipping hammers cause most common injuries (called vibration white fingers). It starts with a slight tingling or numbness in the fingers and eventually causes whiteness to the tips. The attack may last for about an hour and end with a sudden rush of blood to the affected tip, often causing considerable pain.

Manual Handling Injury

While handling construction materials manually (e.g. lifting concrete block, cement bags, etc.), workers are likely to be affected through spraining and strains due to over exertion. The effect of which may be to have musculoskeletal injury (total, back injury, upper and lower limb disorders).

6.3.12.2.3 Biological Health Hazards

The likely biological hazard during construction will be drinking of unsafe water, eating contaminated water or food contaminated with rat urine. The diseases that are related with unsafe water are water borne diseases such as diarrhoea, cholera, and amoebic dysentery

Another health hazard will be due to exposure to ionizing radiation. Exposure to ionizing radiation will result from the use of a nuclear gauge, which contain radioactive materials and therefore emits ionizing radiation.

6.3.12.3 Increased Transmission of STIs/HIV

Construction of the road will increase mobility, migration, and interaction. This is likely to increase transmission of communicable diseases such as HIV/AIDS and other STIs. Increased spread of transmission of HIV/AIDS from construction workers to the local people during and

after the construction is one big potential challenge that has to be taken into consideration during and after the construction of the road. The negative impact is likely to be moderate, long term, and irreversible.

6.4 DEMOBILIZATION PHASE

6.4.1 Generation of Solid Wastes

Wastes from site office, mechanical workshop, pre-cast yard, and stores at the end of the construction phase are likely to cause scenic degradation, pollution and become an eye sore. The wastes likely be generated will include demolition materials from temporary structures, storage facilities (pallets), packing (plastic bags, paper and timber boxes), wastes from pre-cast yard (concrete wastes, metal reinforcements etc. The impact will be indirect, minor, short term, and reversible since it disposal of solid and liquid wastes shall be part and parcel of the construction activities of the project.

6.4.2 Deterioration of Ambient air Quality

Demobilization; demolition, collection, and transport of demolition wastes will generate dust. The dust generated will affect workers at the site as well as residents as the trucks move across settlements. The impact is gauged to be direct, moderate, reversible, and short term.

6.4.3 Loss of Employment and Economic Activities at the End of the Project

Completion of road rehabilitation activities nearly all workers will be declared redundant and will therefore be laid off. This will automatically result into loss of income. In addition, traders that had established along the road during construction of the road will no longer be able to trade, this will affect livelihood of the traders. The impact will be indirect, moderate, short term, and reversible.

6.5 OPERATION AND MAINTENANCE PHASE

6.5.1 Positive Impacts

6.5.1.1 Improved Ambient Air Quality

The upgraded road will have very minimum pollution of ambient air due to particulate matter, since dust generation will be very low. The only source of deterioration of ambient air quality will be emission due to exhaust fumes from traffic.

A number of studies that have been carried out in Tanzania on vehicular air pollution due to nitrogen oxides, carbon monoxide, sulphur dioxide, and ammonia for areas with even higher traffic volume and concentration than the project area have shown that the levels are insignificant if they are compared to international standards.

It can therefore be concluded that during the operation phase of the project, there will be very significant improvement of air quality due to reduced dust generation and insignificant level of air pollution by exhaust gases from traffic.

The positive impact due to reduction in dust generation along the road will be major and long term, while the impact due to reduced air pollution from exhaust gases is gauged to moderate and long term.

6.5.1.2 Improved Hydrology and Drainage

Upgrading of the road will improve the drainage, due construction new culverts, as well as road side drainage with adequate hydraulic capacities. Sedimentation of culverts and road side drains will be reduced due to provision control devices and cover vegetation. Sediment carrying storm water runoff from the road will be discharged away from the road by drainage channels. Water stagnation within and on roadsides will be eliminated. Given the fact that during rainy season the existing road was either impassable or passable with lots of difficulties and proper operation of the facilities, the operation of the road will have a major positive, direct, and long term impact on the hydrology and drainage of the project road.

6.5.1.3 Reduction in Vehicle Operating Costs

Lower speeds due to poor road imparts extra stress on motor vehicles' engines (higher engine revolution per unit time) and so faster engine wear as compared to when a vehicle travels at higher speeds (lower engine revolutions per unit time). In addition, improvement of the existing road will result into serving in mileage per litre of fuel as vehicles will be able to travel at relatively higher speeds. Improvement of travel speeds due to upgrading of the road will therefore reduce operating and maintenance costs of vehicles. This will be direct, major, and long term positive impact.

6.5.1.4 Reduced Rate of Energy Consumption

Energy consumption rates for vehicles operating on the roadway can be differentiated by comparing changes in traffic operations, as measured by vehicle kilometres travelled and changes in traffic speed throughout the study area. Fuel consumption is proportional to distance travelled, and decreases as speed increases up to about 100 Km per hour (on average). Fuel consumption increases as speed increases above that point. It is anticipated that vehicles will be able to travel at even higher speeds (above 60 Km/hr). This will consequently lead to decreased consumption of energy per unit distance in the form of fuel. This will be a direct, major, and long term positive impact.

6.5.1.5 Reduced Traffic Accidents

Improvement of the road will involve widening of the existing road as well as change in the road geometry. Increased road width and change of geometry, including increasing in radii of curves and provision of speed restraining humps especially at accident black spots, will significantly improve the safety of the road, the result of which will be reduction in accident rates.

In addition, reduced generation of dust will improved visibility and so reduce driving hazards. The result of which will be reduced traffic accidents involving motorists as well as pedestrians. The impact will be direct, major, and long term, and irreversible.

6.5.1.6 Reduced Travel Time, and Comfort to Passengers

Upgrading of the road to bitumen standard will significantly reduce travel time, since vehicles will be able to travel at higher speeds. It is estimated that the travel time will be reduced to almost one third of the present travel time. The served travel time could be used to other productive ventures. In addition, though cannot be quantified, upgrading of the road will

improve comfort to passengers, due to the absence of corrugations. It is most likely that better passengers' buses will be plying the routes.

The impact will be direct, major, positive, and long term since it will be felt throughout the operation phase of the project.

6.5.1.7 Diversification of the Local Economy

Upgrading of the project road will attract more investors in the area. The increased investment will bring in more employment opportunities to the local people including diversification of economic activities hence, reduce dependence on agriculture. Existence of improved and reliable road will influence business activities in the area through increasing population and enhancement of income of the people. The improved road will also bring to the area customers from other regions increasing money circulation and improving household income. During consultative meetings, some of the villagers cited out that diversification of the economy as one of the anticipated positive result of the improved road. The positive impact is gauged to be major, and long-term.

6.5.1.8 Improve Access to Social Services

The road will enable easy access to social services like modern health facilities, which will be beneficial for women and children who are the groups that deploy these facilities for a considerable extent. Also, school children will benefit since they can reach their school in time. This is apparent to secondary school students who many of them travel from distant villages where there are no secondary schools and easy access to Government administrative offices.

The social services such as schools and hospitals are understaffed because technocrats are not enthusiastic to live in the project area due to unreliable transport. Improved road will attract technocrats to service the project area. This is very true as the data from the district shows that the ratio between teachers and pupils does not much the national required standard of 1:45 per class. With the improved road, there will be reliable and cheap transport services that will link villages to the main road and to the small emerging semi-urban areas to the urban town areas of Kasulu, where there are more social services. The positive impact is gauged to be indirect, major and long term.

6.5.1.9 Increased interaction of people drive for social change

The project area is inhabited by mainly indigenous people, unlike in urban centres where there is a mixed group of people from all over Tanzania. In migrants are either business people or employees by government or in informal sector. In such situation it is difficult for people to be innovative since no new ideas and experience can easily penetrate in the community. Upgrading of the road will encourage people from other parts of the country to live in the area. In migrants will come with new ideas into the project area. Such opportunity will create room for social transformation for both groups, share values, and adopt new cultures and diffusion of cultural values suitable for development. The positive impact will be indirect, moderate, and long term.

6.5.1.10 Increased investment

The project area has potentials for agriculture and forestry. It is anticipated that the improved road will attract many investors to invest in the above mentioned areas; this will have a multiplier effect on the availability of other services such as hotels, schools and medical services. This will be an indirect, moderate long term positive impact.

6.5.1.11 Reduced Transport and Transportation Costs

The costs of transport and transportation between villages along the project road are high due to poor road. Bus fares double or triple during rainy season as road condition deteriorate. With the improved road the fares are expected to be low. The operating cost of bus operators will also be reduced resulting into reduced bus fares. The impact will be direct, major, and long term.

6.5.1.12 Increased household income due to increased trading activities

Increased household income is expected due to improved road conditions and improved traffic. It is thus expected that there will be a positive impact on businesses and trading activities adjacent to the road, thereby increasing the income of households along the road. The impact will be indirect, moderate, and long-term.

6.5.1.13 Access to and increased Farm Produce to the Markets

All the villages along the project road are known for the production of rice. Other crops produced are tobacco, sorghum, maize, legumes, vegetable, cassava, etc. Unreliable market is one of the hindering factors that limit production. The main buyers of farm outputs are the middlemen from Bukoba, Mwanza, Shinyanga, and Mwanza. Prices are determined by the buyer, while the seller has no bargaining powers to influence the prices.

Upgrading of the road will have positive impact on paddy production and productivity. This will lead to increased profit margins for both farmers and traders further contributing to food security in the area and beyond. In addition, upgrading of the road will enhance the transportation hence enable local people to find more paying markets outside the area. For this reason they can sell agricultural produce at better prices and increase household income and therefore increase their capability to afford other basic needs. Apart from agriculture and tourism, the project road passes through an area with such opportunities forestry and mining. The impact will be direct, major, and long term.

6.5.1.14 Improved Road conditions

Repair and maintenance will focus on activities that ensure the long-term serviceability of the road. Repair and maintenance activities will pertain to the road pavement and its embankments, hydraulic and drainage structures and road furniture and where necessary, re-surfacing. All repair and maintenance works will virtually have positive impacts that will enhance the intended functions of the road and lengthening its life time, especially when it is considered that the number and scope of routine maintenance of the road will be greatly reduced.

6.5.1.15 Improved growth of vegetation due to Reduced Generation of Dust

In sub-section 4.2.4 it was clearly explained how the generation of dust causes stunted growth of vegetation along the project road. It was explained how photosynthesis of vegetation is impaired by dust through abrading of leaf surfaces, blocking of stomata, increasing the amount of absorbed incident radiation.

Upgrading of the road to bitumen standard will significantly improve the growth of vegetation along the road. The impact will be indirect, moderate, long term, and irreversible.

6.5.1.16 Complementation of other Development Initiatives

Upgrading of Kasulu – Manyovu road to bitumen standard will augment numerous on-going or proposed development initiatives within the project's area of influence or impact zone as follows:

- On-going upgrading of Kidahwe - Nyumbigwa road section (50Km) to bitumen standard
- On-going upgrading of Nyakanazi – Kabingo road section to bitumen standard
- Upgrading of Kabingo – Kasulu road section to bitumen standard
- The proposed construction of OSBP facilities for Tanzania and Burundi at Manyovu/Mugina, which will minimize the time waste for clearance and delivering services and so enhance trade between the two countries
- Upgrading of Mugina – Mabanda road section (21Km) and rehabilitation of Mabanda – Nyanza Lac road section are being financed by AfDB.
- Upgrading of Nyanza Lac – Rumonge road section (42Km) is underway
- Upgrading Rumonge – Bujumbura road section (42Km)

6.5.2 Negative Impacts

6.5.2.1 Increased Traffic Accidents

At present road traffic accidents are minimal because of the poor road conditions. With poor road conditions even reckless drivers are forced to drive slowly. Upgrading of the road is likely to increase traffic volume and travel speeds. Invariably, improved road conditions will attract more bus services to the road project. This could in turn lead to an increase in the number of accidents especially at school crossings and settlements. Specific black spots are crossings for school children listed in Table 15. Other black spots are settlements in all the village centres in Table 1. The impacts will be direct, moderate, short term, and irreversible. The impact will be residual because accident cannot be prevented fully.

6.5.2.2 Increased Pressure on Natural Resource

Improved road transport due to road upgrading is likely to increase the influx of people to the project area, which will result into more demand for timber and land, as people tend to establish new settlement and agricultural lands. The resultant effect will be increased clearing of vegetation. The negative impact is will be indirect, moderate, reversible, and long term.

6.5.2.3 Increased Noise and Vibrations Pollution

Improvements of the road will definitely results into higher utilization of the roads and so higher traffic volume by generated (additional vehicles travel that results from the road improvement). Since bitumen road propagates noise and vibrations much more effectively compared to gravel and loose soil, upgrading of the road will increase noise and vibrations will increase. Ultimately, the increased traffic volume will result into increased noise and vibrations. The increase in noise and vibration impacts due to operation of the road is anticipated to be direct, long term, irreversible, and minor. The impact due to noise and vibrations cannot be mitigated at the project level and therefore a residual impact.

6.5.2.4 Increased Cost of Living

At present prices of food crops in the project area are relatively low compared to other places in Tanzania. The upgrading of the road will increase prices of cereal crops and might not be affordable to some of the local population, although for the sellers it will be an advantage for their crops to fetch a good price. The impact is gauged to be indirect, minor, and long term.

6.5.2.5 Increased Rate of Crimes

Improved road is more likely to attract more advanced criminal activities in the project area. Criminals will be able to move faster across the project area. The life of residents will be more in danger than now. Advanced weapons are more likely to increase. Influx of job seekers of all ages and subsequent crime poses a threat to security in the project area. The negative impact will be indirect, moderate, long term, and irreversible.

6.5.2.6 Abuse of Road Corridor

Past experience has shown that local communities along the road have a tendency of carrying out activities other than those intended for the road reserve. Normally any road has a road reserve, which is utilised for other infrastructure including water supply system, installation of electric, and telephone poles, though the area is under TANROADS. Other users have to get permission from TANROADS to be able to utilise the road reserve. However, communities have the tendency of using the road reserve for farming and other economic activities resulting into soil erosion and eroding the road. These have a negative impact on the sustainability of the road. The negative impact will be indirect, moderate, and long term.

6.5.2.8 Reduced Economic Activities at Closure of the Project

Traders will establish trading activities points along the route during construction of the road, but as construction activities come to halt, the traders will not be able to trade, this will affect livelihood of the traders. The impact will be indirect, moderate, and short term.

6.5.2.9 Interference with smooth Traffic Flow

Maintenance activities will interfere with smooth traffic flow. The negative impacts gauged to be insignificantly small will include interference with smooth flow of traffic and effects related to acquisition, storage, processing, and application of construction materials and their equipment. The impact is gauged to be direct, insignificantly minor, and short term.

6.5.2.10 Deterioration of ambient air quality due to Emission from Vehicle

Motor vehicles are significant sources of pollution that can damage the environment and pose public health issues. Carbon monoxide, nitrogen oxides, and hydrocarbons are released when fuel is burned in an internal combustion engine and when air/fuel residuals are emitted through the vehicle exhaust pipe. Gasoline vapours also escape into the atmosphere during refuelling and when fuel vaporizes from engines and fuel systems caused by vehicle operation or hot weather.

The pollutants in vehicle emissions are known to damage lung tissue, and can lead to and aggravate respiratory diseases, such as asthma. Motor vehicle pollution also contributes to the formation of acid rain and adds to the greenhouse gases that cause climate change.

Pollutants emitted directly from vehicles are not the only cause for concern. On warm, sunny days, hydrocarbons react with oxides of nitrogen to create a secondary pollutant, ozone. In many urban areas, motor vehicles are the single largest contributor to ground-level ozone which is a

common component of smog. Ozone causes coughing; wheezing and shortness of breath, and can bring on permanent lung damage, making it a cause of crucial public health problems. The impact will be direct, moderate, long term, and reversible.

6.5.2.11 Contribution to climate change effect due to emission of Green House Gases

Increased traffic volume during the operation phase of the road will increase the generation of Green Houses Gases (GHGs), particularly CO₂ and N₂O exhaust gases, the result of which will be contribution to greenhouse effect, global warming, and so climate change. This is because C₂O and N₂O are among the six greenhouse gases (others are methane, hydro fluorocarbons, per fluorocarbons, sulphur hexafluoride, and water vapour).

Global warming and climate change refer to an increase in average global temperatures. This is caused by increases in GHGs.

A warming planet thus leads to a change in climate which can affect weather in various ways.

The term greenhouse is used in conjunction with the phenomenon known as the greenhouse effect as narrated hereunder.

- Energy from the sun drives the earth's weather and climate, and heats the earth's surface;
- In turn, the earth radiates energy back into space;
- GHGs trap some of the outgoing energy, retaining heat somewhat like the glass panels of a greenhouse

Based on the method described in sub-section 4.2.5, the contribution of carbon dioxide due to the increased volume of traffic (projected traffic volume), 1 year after the road upgrading has been upgraded to bitumen standard has been estimated as shown in Table 19..

Based on Table 12 and Table 19, it is clear that the road upgrading of the road will double of amount of CO₂ that is currently generated by road traffic.

Table 19: Estimated Amount of CO₂ Likely to be generated in Kg/day by Road Traffic by 2020 after Road Upgrading

No.	Type of vehicle	No of vehicles [a]	Type of fuel	Average fuel consumption (Km/litre) [b]	Estimate of Fuel consumption in 77km = (77/b) x a [c]	Amount of CO ₂ Currently generated in kg: [c] X [d] where d= 2.3 (for gasoline engines) and 2.7 (for diesel engines)
1.	Motor cycle	2,339	Gasoline	20	9,005.1	20,712
2.	Medium car/ Station wagon	1,137	Gasoline	9	9,727.7	22,374
3.	4WD vehicle	147	Diesel	8	1,414.9	3,820
4.	Pickup	31	Diesel	8	298.4	806
5.	Daladala	89	Diesel	8	856.6	2,313
6.	Medium bus (30 – 35 passengers)	1	Diesel	6	12.8	35
7.	Large bus (40 seater capacity)	4	Diesel	2	154.0	416
8.	Light Truck (LGV) – Rigid 2-axles (3-6 tons)	8	Diesel	5	123.2	333
9.	Medium Truck	21	Diesel	2	808.5	2,183

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No.	Type of vehicle	No of vehicles [a]	Type of fuel	Average fuel consumption (Km/litre) [b]	Estimate of Fuel consumption in 77km = (77/b) x a [c]	Amount of CO ₂ Currently generated in kg: [c] X [d] where d= 2.3 (for gasoline engines) and 2.7 (for diesel engines)
	(MGV) – Rigid 2-axles (7-10 tons)					
10	Heavy Truck (Rigid 3 or 4 axles), typically 12-15 tons capacity,	72	Diesel	2	2,772.0	7,484
11.	Articulated Truck (4 -7 axles), typically 25-32 tons capacity,	244	Diesel	1.5	12,525.3	33,818
Total Current daily emissions of CO2 (Kg)						94,294

Global warming has several effects on earth. The following effects of the global warming are relevant to the proposed project:

1. Global warming effects on animals: A large number of animal species will disappear from the planet, owing to the loss of habitat triggered by global warming.
2. Global warming effects on plants: Drastic changes in temperature levels will cause various plant species to experiencing difficulties in adapting to the new climate. The growing season of some plant species will be altered, which in turn will disturb their reproduction cycles, thus giving a drastic blow to the plant population. Even the changes in precipitation patterns can lead to hazardous effects on various plants species. A global warming effect on agriculture is the best possible example one can give to explain the effects of global warming on plants. Frequent rains will lead to flooding, whereas less rain will result in drought, both of which will only lead to the destruction of agricultural fields.
3. Global warming effects on weather: Increasing temperatures will lead to adverse effects on weather as well. Even minor alterations in global temperatures will trigger a series of weather extremities, and alter the climatic patterns of the planet. On one hand, heating of the ocean due to global warming gives rise to ferocious hurricanes, while more than the normal temperature on land gives rise to intense heat waves. Higher temperature leads to faster evaporation of water and leads to drought in one part, and brings in heavy rain falls and causes flooding in other part of the world.
4. Global warming effects on sea levels: One of the most grievous among the various global warming effects on earth is the rise in sea levels, which are threatening to encroach up on land. If the sea levels rise it will result in a watery grave to several low laying areas. Rising global temperatures are causing the water bodies to heat, expand, and thus encroach on land.
5. Global warming effects on humans: Human will be the worst affected beings because directly or indirectly we are dependent on all the above mentioned components of the environment. Animals and plants are related to each other, extinction of either will put tremendous pressure on other, eventually leading to its extinction. Humans, in turn, are dependent on both for many purposes, so extinction of animals or plants will also affect humans to a great extent.
6. Global warming effects on economy: Global warming will affect the economy of various countries. The most affected would be the countries with agriculture-led economy. Global warming will trigger a series of changes in weather conditions which will take a toll on agriculture and allied activities. Owing to unnatural precipitation pattern, crop failure will become a very common phenomenon. Economies dependent on tourism will also bear the brunt of global warming.

The impact due to contribution of the project to global warming during the operation phase cannot be mitigated at the project level. Like anywhere else, an effort by the government by enforcing relevant legislation are enforced to ensure that only road worth vehicles are allowed to operate on the road will be required.

6.5.2.12 Contribution to depletion of ozone layer

Increased traffic volume will contribute to increased depletion of ozone layer due to increased emissions of GHGs.

The Earth's atmosphere is divided into five layers - stratosphere being one of them. Within the stratosphere, there lays a layer, made of a specialized form of oxygen, known as the ozone layer. The layer is made up of three oxygen atoms, contradictory to the usual two oxygen atoms. With no demarcated boundary, the ozone layer is found between 10 to 20 miles above the surface of the Earth. This layer traps the harmful ultraviolet-B (UV-B) radiation emitted by the Sun, and hence plays a crucial role in supporting life on the Earth.

The ozone layer is threatened by a global warming because the fall of its temperature increases the rate of its depletion. This is because GHGs trap the Sun's radiation which in turn makes the planet warmer. This actually means that the heat which is supposed to be reflected back to the space is trapped within the troposphere. When this heat is trapped, it does cause the temperature in the troposphere to increase, but at the same time, it also causes the temperature of the stratosphere to decrease. As the temperature in the stratosphere falls, the ozone molecules in this layer become vulnerable to destruction by the harmful emissions. The impact will be indirect, moderate, trans-boundary, and long term. The effect to increased depletion of ozone layer cannot be mitigated at the project level and therefore a residual impact.

6.5.2.13 Reduced life span of the road due to climate change

As stated earlier, the design life time of the road (with double Asphalt Concrete) is 20 years. Variation or increase in temperatures resulting from global warming is likely to affect the life span of the road. Excessive temperatures are likely to cause bleeding of bitumen if mitigation measures are not in place. Similarly, during preparation of sub-base layer, cracking of cement-stabilized sub-base layer is likely to occur if curing is not done properly. High temperatures are likely to cause damages of concrete hydraulic structures, especially culverts due to expansion. In addition, flooding resulting from global warming is likely to cause serious damages to or overtopping of hydraulic structures (culverts). The impact will be indirect, moderate, trans-boundary, and long term.

6.5.2.14 Fragmentation of Settlements and impaired Safety of pedestrians

Cuts across hills tend to cause fragmentation of two sides of the road. The impact will be even significant if the cuts are located across settlements as they create barriers. The impact of these barriers would be an increase in travel time for local residents to their business and residential areas. Another impact of cuts would be to jeopardise the safety of the communities, in particular pedestrians. Exact locations of these cuts will be known after detailed engineering design has been done. The impact is estimated to be direct, moderate, long term, and irreversible.

Table 20: Environmental and Social Impact Assessment Matrix

PROJECT PHASE	M	C						D		O & M	
Impact	Construction of a camp	Extraction, processing and delivery of construction materials	General earthworks	Construction cross drainage structures	Construction of roadside drainage systems	Concrete and bituminous works	Operation of construction camps	Demolition of temporary structures	Disposal of demolition material	Operation of the road	Repair and maintenance of the road
Creation of employment	+2	+2	+2	+2	+2	+2	+1	+1	+1	0	+1
Loss of vegetation and farmlands	-1	-2	-2	-2	-1	-2	0	0	0	-2	0
Deterioration of aesthetics as related to discolouration of vegetation and buildings, unreinstated borrow pits	0	-2	-2	0	0	0	0	0	0	0	0
Impacts related to generation of solid wastes	0	-1	-2	0	-1	-1	-2	-1	0	-1	-1
Generation of noise and vibrations	-1	-2	-2	-2	-2	-2	-2	-2	-1	-2	-1
Deterioration of ambient air quality by particulate (dust)	-2	-3	-3	-1	-2	-2	0	0	-2	+3	-1
Deterioration of ambient air quality exhaust: fumes (SO ₂ , NO _x , CO)	-1	-2	-2	-1	-1	-1	-1	-1	-1	-2	-1
Deterioration of ambient air quality by bituminous fumes	0	0	0	0	0	-2	0	0	0	0	0
Risk of accidents to livestock and human due to borrow pits	-1	-2	0	0	0	0	0	0	0	-2	-2
Road traffic accidents to human and animals	-1	-2	-2	-2	0	0	-2	-1	-1	-2	-1
Accidents related to blasting, drilling, and rock excavation	0	-2	0	0	0	0	0	0	0	0	0
Soil erosion	1-	-1	-2	0	-2	0	0	0	0	-2	0
Displacement and loss of properties	0	0	-3	0	0	0	0	0	0	0	0

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PROJECT PHASE	M	C						D		O & M	
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Disruption of domestic water supply systems	0	0	-2	0	-1	0	0	0	0	0	0
Increased consumption of energy in the form of fuel and lubricants	-1	-2	-2	-2	-1	-2	-2	-1	-1	+2	-1
Increased consumption of forestry products	-1	-1	-1	-1	-1-	--1	-1	-1	-1	-2	-2
Resource use conflict	0	0	-2	0	0	-2	-2	0	0	0	0
Reduction in river flows	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0
River banks erosion during riparian zone construction	0	0	-2	-1	-1	0	0	0	0	0	0
Surface water and soil pollution by oil, concrete/concrete slurry	0	0	0	-1	-1	-1	0	0	0	0	0
Surface water and soil due to possible of leakage of hazardous wastes	-1	-1	-1	-1	-1	-1	-1	0	0	-1	-1
Disruption of community access to dwellings and business areas	0	0	-2	0	-2	0	0	0	0	0	0
Impact to cultural sites	0	0	-2	0	0	0	0	0	0	0	0
Health problems associated with handling of cement and wet cement products	-2	0	0	-2	-2	-2	-2	0	0	0	0
Fire and explosion risks	0	0	0	0	0	0	-2	0	0	0	0
Reduction in domestic water supply for local people	-1	0	-1	-1	0	-1	0	0	0	0	0
Occupational health and safety related impacts	-2	-2	-2	-2	-2	-2	-2	-2	-2	0	-2
Risks of leakage of hazardous	-1	-1	-2	-2	-1	-2	-2	-1	-1	-1	-1

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materials											
Marital and social conflicts	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Increase in unwanted pregnancies	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
Physical hazard due to fall from height or being hit by falling object	-2	-1	0	-2	-1	0	-2	0	0	0	0
Physical hazard due to stepping on sharp object or striking/ stumbling on objects	-2	0	0	-2	-2	0	-2	-1	0	0	0
Physical hazard due to manual handling (over-exertion)	-2	0	0	-2	-2	0	-2	0	0	0	0
Physical hazard due to workers being struck or crushed by mobile equipment	0	-2	-2	-2	-2	0	-1	0	0	0	0
Physical hazard due to electrocution	-1	-2	0	0	0	-2	0	0	0	0	0
Chemical health hazard due to chemical contact with skin			-1	-2	-2	-2	-2	0	0	0	0
Chemical health hazard due to inhalation of harmful chemicals	-1	-2		-2	-2	-2	-2	0	0	0	0
Physical health hazard due to noise and vibrations	-1	-2	-2	-1	-1	-1	-1	-1	-1	-2	-1
Biological health hazard due to drinking unsafe water or eating contaminated food	-2	-2	-2	-2	-2	-2	-1	-2	-2	0	0
Biological health hazard due to exposure to ionizing radiation	0	0	-2	0	0	0	0	0	0	0	0
Increased infection of	-1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2

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HIV/AIDS											
Improved hydrology and drainage	0	0	0	0	-2	0	0	0	0	+3	0
Reduction in vehicle operating costs	0	0	+1	+1	+1	+1	+1	+1	+1	+3	+3
Reduced travel time and comfort to passengers	+1	+1	+1	+1	+1	+1	+1	+1	+1	+3	+3
Diversification of local economy	0	0	0	0	0	0	0	0	0	+3	+3
Improved access to social services	0	0	0	0	0	0	0	0	0	+3	+3
Increased interaction of people drive for social change	0	0	0	0	0	0	0	0	0	+2	+3
Increased investment	0	0	0	0	0	0	0	0	0	+2	+3
Reduced transport and transportation costs	0	0	0	0	0	0	0	0	0	+3	+3
Increased household income due to increased trading activities	0	0	0	0	0	0	0	0	0	+2	+2
Access to and increased farm produce to the markets	0	0	0	0	0	0	0	0	0	+2	+2
Improved growth of vegetation due to reduced generation of dust	0	0	0	0	0	0	0	0	0	+2	+2
Improved quality of water courses across the road	0	0	0	0	0	0	0	0	0	+2	+2
Complementation of other development initiatives	0	0	0	0	0	0	0	0	0	+2	+2

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Increased costs of living	-1	-1	-1	-1	-1	-1	-1	-1	-1	-2	-2
Increased rate of crimes	-1	-1	-1	-1	-1	-1	-1	-1	-1	-2	-2
Abuse of road corridor	0	0	0	0	0	0	0	-1	-1	-2	-2
Reduced economic activities after closure of the project	0	0	0	0	0	0	0	-2	-2	-2	0
Contribution to climate change effect due to emission of GHGs	0	0	0	0	0	0	0	0	0	-1	-1
Contribution to depletion of ozone layer	0	0	0	0	0	0	0	0	0	-1	-1
Reduced life span of the road due to climate change	0	0	0	0	0	0	0	0	0	-1	-1

Impact Rating:

+3 = Major Positive, +2 = Moderate Positive, +1 = Minor Positive, 0 = No Impact,
-3 = Major Negative, -2 = Moderate Negative, +1 = Minor Negative,

6.6 CUMULATIVE IMPACTS

6.6.1 Creation of Employment

It was noted in sub-section 4.10 that apart from upgrading this road section, the following roads are either being upgraded or plans for their upgrading are underway:

- (i) The upgrading of upgrading of Kidahwe – Nyumbigwa Road (50km) to bitumen standard is on-going
- (ii) The upgrading of upgrading of Nyakanazi – Kabingo Road (50km) to bitumen standard is on-going
- (iii) Plans are underway to upgrade Kabingo – Kibondo – Kasulu Road (223km) Section, including Kibondo bypass roads to bitumen standard
- (iv) Plans are underway to upgrade Nyanza Lac – Rumonge Road (45km) Section and Rumonge – Bujumbura Road (78km) Section to bitumen standard are underway

If one or more of the above road projects, especially sections that are linked with this project are concurrently upgraded with this project, the number of jobs that will be created would be higher than if only this project was to be implemented at a time.

6.6.2 Deterioration of Ambient Air Quality

During construction, if upgrading of the project road is done in parallel with Kabingo – Kasulu Road section, deterioration of ambient air quality due to particulate matter especially at adjoining sections is likely to be higher, and the area affected (the whole section between Kasulu and Nyakanazi) would be higher than if the two roads were constructed at different times.

6.6.3 Transportation Related Issues

As noted earlier, during construction of this road the following impacts are anticipated:

- Traffic delays, changes in traffic circulation, and congestion.
- Business and residents access would be rerouted or restricted during construction activities.
- Temporary displacement of bus stops during construction may interfere with transit service.
- Construction activities of the road near local business could result into temporary loss customers for affected businesses due to potential access difficulties.

If construction of this road is done concurrently with one or more of the above road sections stated sub-section 6.6.1 project (upgrading of Kabingo – Kibondo – Kasulu Road Section and Kidahwe – [Nyumbigwa] Kasulu Road Section), that are directly linked with this road, the above impacts are likely to be higher than if each of the above projects was to be constructed at a time.

6.6.4 Borrowing of Materials

Construction of the roads will require extensive borrowing of such construction materials as sand, gravel, fill material, and hard stone. These are likely to result into contribution to cumulative impacts to ecosystem due to loss of vegetation and soil erosion.

In addition, given the fact that already there is substantial number of unreinstated borrow pits along the road that were opened during periodic routine maintenance of the existing gravel road, further opening of borrow pits during construction will result into cumulative impacts on health and safety (malaria, safety – due to possible fall or drowning or traffic accidents). The impact will be more profound if the borrow pits are located within the ROW, near or at settlements, or within forestry or wildlife protected areas.

6.6.5 Pollution of water courses

It was noted under sub-section 4.9 that farming along and across water courses is one of the present environmental problems along the project road. This practice causes significant sedimentation of river and drainage systems. This is because agricultural activities make soil loose to be easily carried away by storm water. Apart from reducing hydraulic capacities of cross drainage structures, sedimentation raises river beds to the extent of causing overtopping of storm water after downpour.

Clearing and earthworks along and across water courses during construction of drainage structures as well as accidental or deliberate disposal of excess or spoil materials on water courses are likely to exacerbate the present impact of sedimentation of water courses.

SECTION 7: MITIGATION/ ENHANCEMENT MEASURES AND COMPLEMENTARY INITIATIVES

The following sections describe measures that shall be followed by the contractor to ensure that the anticipated environmental and social impacts are avoided, abated, or remediated. Since most of the proposed mitigation measures will be contractual obligations of the contractor (some will not be mitigated by the contractor), they are also included in the Tender Document (Technical Specifications and Bill of Quantities). The Sections under which the proposed measures are found in the Technical Specifications are indicated in bracket after the proposed mitigation measure.

7.1 MOBILIZATION PHASE

7.1.1 Creation of Employment

The impact shall be enhanced by ensuring that:

- Priority of employment is given to the local people
- Contractor Complies with Labour Relations Act
- Wages paid to workers are in accordance with Government Notice No. 196 of June 2013
- Contractor does not employ workers who are below the age of 18 years.

7.1.2 Loss of Vegetation

To mitigate the impact due to loss of vegetation, the following shall be done:

- The contractor shall avoid unnecessary removal of the vegetation, especially trees
- When removal of vegetation is not avoidable, they shall be replaced by original species soon after completion of construction works/ closure of the camp, and its facilities (pre-cast yard, workshop, bitumen processing area, concrete batch plant, etc.)
- During site clearing for the camps, top soil shall be stockpiled so that it is used for vegetation during site reinstatement
- Cleared trees should be stockpiled and left on the road side for the local people to collect as firewood.
- Under any circumstance the Contractor shall not use the cleared trees for other purposes such as firewood or making marker pegs as past experience has shown
- Owners of exotic strip tree forests within the RoW shall be advised to harvest them prior to commencement of the road construction.

7.1.3 Deterioration of Scenic and Visual Quality

The impact due to deterioration of scenic and visual quality shall be mitigated as follows:

- Top soil shall be stockpiled aside to be used for vegetation during reinstatement of camps.

- Material wastes such as concrete and cement blocks wastes will be stockpiled so that it is used in the reinstatement of pits
- Metal wastes such as GS pipes, nails, and reinforcement bars shall be disposed of by recycling. The Contractor shall be transported for recycling in foundry factories in Dar es Salaam by NEMC certified company. To achieve this, the Contractor shall enter into an agreement with NEMC certified metal collecting company. The metal collecting company shall be approved by the Engineer.
- Cement paper bags and paper boxes (biodegradable) shall be treated on site by either burying or controlled burning
- Non usable timber wastes will be given to the local people to be used as fire wood
- Plastic and hessian bags will be treated on site by controlled burning
- The Contractor shall have a written agreement with NEMC certified company for the collection and transport of PVC pipes, plastic and glass bottles (non-biodegradable) to plastic and glass recycling factories in Dar es salaam

7.1.4 Generation of Noise and Vibrations

To reduce the impact due to noise and vibrations, the contractor shall adhere to Occupational Health and safety Act No. 5 of 2003 by ensuring that equipment, including trucks are well maintained and properly fitted with exhaust mufflers to minimize noise and vibrations. In addition, workers exposed to severe noise level shall be equipped with earplugs to protect them against prolonged and excessive exposure to noise.

7.1.5 Deterioration of Ambient Air Quality by Dust

The impact due to pollution of ambient air at the construction camps and material borrow sites shall be mitigated by sprinkling water on access roads to materials and across settlements areas. Workers exposed to severe dust level shall be equipped with dust masks.

7.1.6 Risk of Road Traffic Accidents

The impact due to accidents shall be mitigated by limiting speeds of project vehicles as well as third party vehicles to 60 km/hr by among others installing speed limiting systems in all project cars, providing warning signs at junctions to material stocks routes to warn other road users, speed humps across material stock routes.

7.2 CONSTRUCTION PHASE

7.2.1 Creation of Employment

To enhance the impact due to employment, the measures proposed in Sub-Section 7.1.1 shall apply

7.2.2 Extraction, Processing, and Delivery of naturally-occurring Construction Materials

7.2.2.1 Loss of Vegetation and Farmland

To mitigate the impact of loss of vegetation due to extraction of construction materials, the following measures are proposed:

- Existing borrow sites shall be used prior to trucking in materials from new sites
- In excavating new or expanding existing pits, relatively fertile/organic top soils shall be well stripped and stockpiled so that it is used to cover the pits after restoration for vegetation growth.
- Site clearing shall be minimised but will permit safe and efficient movement of personnel, materials and equipment, while allowing for excavation of materials
- Cleared trees should be left for the local people to collect as firewood
- Immediately after construction, all the borrow pits and quarries shall be rehabilitated by trimming at a maximum slope of 1:3 (vertical: horizontal), backfilling with top soil to promote re-vegetating.
- Before opening a borrow pit or quarry, the Contractor shall submit to the Engineer a request for review and approval. The request among others shall include a sketch showing its location, coverage (area), adjoining features, and management and closure plan. To comply with Clause 1214 of Standard Specifications for Road Works (2000), the request shall also include a written consent of land owners that he/she is prepared to release his land for borrowing material.
- Borrowing of materials shall not be allowed near water courses. The minimum distance from a borrow pit or quarry from any water course shall be 100m.
- Before a borrow pit or quarry is opened, runoff control measures in the form of catch water drain, berms, etc. shall be put in place re-direct surface runoff away from access route and pit and quarry walls
- Where materials have to be extracted from agricultural land, the land owner shall be compensated after the land has been evaluated by a Valuer. After completion of construction of the project, the compensated borrow sites shall be the property of TANROADS.
- All borrow pits shall be reinstated to the satisfaction of the Engineer and management of protected areas (whichever is applicable) before a takeover certificate (TOC) is issued to the Contractors.

7.2.2.2 Generation of Noise and Vibrations

To reduce the impact due to noise and vibrations, the contractor shall:

- Adhere to Occupational Health and safety Act (2003) by ensuring that construction equipment are properly maintained (including proper tuning of engines) and properly fitted with exhaust mufflers to minimize noise and vibrations due to materials transport trucks

- Adhere to Section 62 of Occupational Health and safety Act (2003) and Section 126 of Factories (Building Operations and Works of Engineering Construction) Rules, 1985, by ensuring that workers exposed to noise level above the limit of 85dB are equipped with ear plugs to protect them against excessive noise level
- Under any circumstance, blasting of rocks at quarry sites shall not be allowed during the night. A day before blasting, the local community surrounding the quarry area shall be informed of the intention to carry out blasting. In addition, 30 minutes prior to blasting, a siren shall be sounded to warn the public
- Where applicable and possible work face of the pit and quarry shall be oriented away from nearby settlements. This practice will direct noise away from settlements and minimize aesthetics impacts

7.2.2.3 Deterioration of ambient air quality

The impact due to pollution of ambient air by dust and exhaust fumes shall be mitigated as follows:

- The project road, material haul/ access roads and diversion roads across settlements and active construction sites shall be sprayed with water at least twice a day to suppress the generation of dust
- Haulage trucks carrying dusty material shall be covered with tarpaulin to prevent escape of dust from material being transported
- When equipment are not in use, they shall be switched off to minimize the concentration of exhaust fume from equipment and so protect the workers at material borrow sites
- The Contractor shall properly tune engine of equipment to ensure complete combustion of fuel and so minimize exhaust fumes
- In accordance with Section 62 of Occupational Health and safety Act (2003) and Section 126 of Factories (Building Operations and Works of Engineering Construction) Rules, 1985, the Contractor shall provide workers with dust masks and ensure that they are used properly to prevent them from inhaling polluted air

7.2.2.4 Deterioration of Scenic and Visual Quality

To mitigate the impact of loss of scenic and visual quality due to borrow pits the following measures shall be applied:

- The minimum distance from the road and new borrow pits shall be 100m
- The contractor shall regularly sprinkle water on the project road, diversion roads across settlements, active construction sites, as well as access to roads to materials borrow sites in order to minimize deterioration of visual and scenic quality due to dust.
- Access roads to material borrow areas shall be reinstated by ripping and scarifying to allow natural generation of grass and trees.

7.2.2.5 Risk of Accidents to Livestock and Humans

To minimize the risk of accidents to animals and humans

- The depth of borrow pit shall not exceed 3m

- To prevent ponding of borrow pit from rainwater, the Contractor shall ensure that all borrow pits are self-draining throughout (when operational and after being reinstated).
- As much as possible, spoil material shall be spoiled in borrow pits when no longer in use. The Engineer, prior to approving a new spoil area, shall make sure that there is no exhausted borrow pit nearby the proposed spoil areas or there is no possibility of using a nearby borrow pit
- All borrow pits shall rehabilitated by trimming their side slopes to at least 1:3, properly landscaped, their beds flattened to the satisfaction of the Engineer, before a TOC is issued to the Contractor, as required by Clause 1703(e) of the Standard Specifications for Road Works, 2000.
- The minimum distance from the road from any borrow pits shall be 100m. The minimum distance from borrow pits to a dwellings area shall be 500m
- Maximum depth of quarry face shall be 10 m as specified by Mining regulations and the quarry face shall be benched to 4m high and at least 4m wide

7.2.2.6 Soil erosion

The following measures shall be applied to mitigate the impact due to soil erosion:

- Minimize soil disturbance by avoiding unnecessary clearing of vegetation
- Control measures for runoff, such as the use of catch water drain, cut off drains, berms and drainage swales in the upper slope of the borrow sites shall be put in place to redirect surface runoff away from access routes and pit walls
- The Contractor shall not be allowed to borrow construction materials within a buffer of 60m from any water course as stipulated by Water Resources Management Act (2009) and Environmental Management Act (2004). The minimum distance from a borrow pit or quarry to water course shall be 100m. In addition, as much as it is practical, the Contractor shall not be allowed to borrow material from an area established by the Engineer to have a likelihood of causing serious soil erosion and siltation of a water course.

7.2.1.7 Impact Related to Blasting, Drilling and Rock Excavation

To mitigate impacts related to blasting and rock excavation, the following practices shall be followed:

- The Contractor shall acquire, transport, store, use, and manage explosives in accordance with Explosive Act: Explosives shall be stored in a magazine licenced by Commissioner of Mines, explosives shall be handled and blasting done by a person holding a blasting certificate issued by Commissioner of Mines
- Drilling sites for blasting shall clearly be marked with flags
- Whenever possible, large charges shall be divided into smaller multiple time delayed charges
- Vehicles and, machinery and equipment shall be kept in good working condition and free of fuel leaks
- Blasting shall be done between 08:00 hrs and 16:00 hrs. Under any circumstance, the Contractor shall not carryout blasting during the night

7.2.3 General Earthworks in Road and Culverts Construction

7.2.3.1 Loss of Vegetation

To mitigate the impact due to loss of vegetation, the following shall be implemented:

- During construction of the project road, and diversion road, and access roads, fertile top soils shall be well stockpiled so that it is used for top soiling back slopes and other cleared sites as well as reinstatement of borrow pits to promote the growth of grass as discussed in sub-section 7.2.3.2
- As much as possible, the contractor shall avoid unnecessary removal of vegetation; especially riparian and riverine trees by confining clearing works to within the working a corridor of 12m - 15m wide.
- All the construction affected surfaces shall be rehabilitated by filling and grading. The affected surfaces will be reinstated by re-vegetating with natural species and forestry species appropriate to the area as instructed by the Engineer.
- Cleared trees shall be left along the road for the local people to use as firewood. Under any circumstance the Contractor shall not be allowed to use cleared trees either firewood or any other construction activity such as making marker pegs. ESIA expert's past experience has shown that in their effort to cut down costs, some Contractor tend cut trees to make marker pegs. It becomes very difficult to establish whether the pegs are made from trees cleared from the road side or trees are cut purposely to make marker pegs.

7.2.3.2 Roadside Soil Erosion

The following measures shall be implemented to prevent and control soil erosion:

By controlling erosion as follows:

- All high fills (above 2.5m) and cuts not paved or covered by permanent structures shall be grassed after placing at least 10cm of top soil immediately after construction. The Engineer shall determine sections that require grassing and instruct the Contractor accordingly
- Top soil of at least 10cm shall be placed on all sections with shallow fills and cuts (less than 2.5m) not paved or covered by permanent structures to promote the growth grass immediately after construction. The Engineer shall determine sections that require top soiling and instruct the Contractor accordingly
- The extent of disturbance shall be limited and the soil surface shall be stabilized immediately
- Existing vegetation shall be preserved to the extent possible, by confining construction activities to road alignment

By controlling surface run off by:

- Diverting storm water from undisturbed area to avoid disturbed areas: Catch water drains shall be excavated on upper sides of slopes to collect and direct runoff water away from cut slopes
- Long slopes shall be broken with temporary diversion to reduce the velocity of runoff

- As much as it is practical grades (slopes) shall be maintained to minimize the velocity of sheet flow over disturbed area and promote evaporation and infiltration of storm water directly into the ground
- Barriers such as check dams, sediment traps, or silt fence¹ shall be installed to control erosion on long steep slopes adjoining water courses. Gabions will be installed to prevent formation of erosion gully along drainage channel in steep slopes.
- On high fill sections, kerb stones shall be installed on the edges of carriageway to direct runoff from pavement to down chutes which shall be installed at determined intervals
- River systems shall be protected
- As much as possible, areas adjoining water course shall be left undisturbed as buffers

7.2.3.3 Displacement and Loss of Properties

To mitigate the impact due to loss of properties, pursuant to Land Act (1999), Land Acquisition act, 1967 (RE 2002), Road Act (2007), Road Management Regulations (2009), and Land Regulations (compensation claims and Assessment of the value of land for compensations), 2001, all the affected properties between 22.5m and 30m (both sides) from the centreline of the road existing road shall be compensated before commencement of construction works. In addition, properties that are located outside the old RoW of 45m, but will be affected due to alignment of the road shall be compensated accordingly as they are entitled for compensation. The buildings and other properties, including exotic tree forests along the road that are entitled for compensation will be identified and their values established by a Land Valuer in accordance with the Law. After valuation, the PAPs shall be compensated within 6 months after values of their properties have been established.

In addition, affected people shall be given advance notice on demolition and be given time to salvage useful materials from their buildings.

7.2.3.4 Disruption/Destruction of Public Utilities and Service

Disruption of Domestic water supply Systems

To mitigate the impact on water supply utilities:

- The Contractor shall consult water supply authorities from respective road section to establish exact locations of water supply utilities within the RoW
- The contractors shall work carefully not to damage domestic water utilities along and across the road.
- Where is necessary to excavate the road beyond the pipe lines depth, the contractor shall carefully remove pipe lines which cross the road before commencement construction works. The utilities shall be reinstated immediately after completion of earth works in respective road section. The costs of relocating pipe water supply utilities and installing service ducts shall be borne by the project
- The contractor shall provide ducts for domestic water pipe line crossing for future expansion/ extension of the existing pipe lines networks or new project as instructed by

¹ A silt fence is a temporary barrier designed to retain sediment on the construction site or wherever there is bare disturbed earth. It is designed to filters out sediment from construction run-off, yet allows clean water to pass through.

the Engineer. The Engineer shall work closely with District Water Engineer to establish locations of service ducts.

7.2.3.5 Generation of Noise and Vibrations by construction Equipment and Vehicles

To mitigate the impact due to noise and vibrations, the measures proposed in Sub-Section 7.2.2.2 shall be applied here as well. In addition, as much as possible, sitting of stationery equipment near sensitive area such settlements shall be avoided.

7.2.3.6 Deterioration of Ambient Air Quality by Dust and Fumes

To mitigate the impact due to air quality deterioration due to dust, the measures proposed in Sub-Section 7.2.2.3 shall apply.

7.2.3.7 Generation of Solid and Liquid Wastes

The following measures will be applied to mitigate the impacts due to deterioration of visual and scenic by solid wastes:

- Top soil shall be stockpiles so that it is used for top soiling to promote regeneration of vegetation as specified by Clause 3102(d) of Standard Specifications
- Excess (spoil) material, excavated from the road shall be spoiled in areas only approved by the Engineer outside the RoW as specified by Clause 2102 of Standard Specifications. The height of spoil shall not exceed 2.5m
- Spoil areas shall be vegetated with indigenous tree species as approved by the Engineer
- Prior to demolishing buildings in the RoW, owners of the properties shall be allowed to salvage valuable materials such roofing iron, windows, doors, and timber.
- Non degradable demolition and material wastes such as concrete, sand, earth, blocks, stones, gravel, and aggregates shall be used to fill pits during their reinstatement. During site reinstatement, the contractor shall add soil to any area backfilled with blocks to fill large voids and top prevent future settlement. The backfilled areas shall be capped with at least 60cm of soil, contoured to match the surrounding grade, covered with top soil, and re-vegetated.
- Reinforcement bars from the demolition of hydraulic structures (culverts) shall be disposed of as described earlier in sub-section 2.4.2.5.
- Degradable wastes such as cement paper bags and boxes, and wooden boxes shall be disposed of by controlled burning or buried on site.
- Cleared trees shall be left on the road side for the local people to collect them for fire wood or other uses. The Contractor shall not be allowed to use cleared trees as a source of energy.
- Hessian bags will be disposed of by controlled burning.
- Liquid wastes, such as grey water (domestic liquid wastes) shall be directed to onsite sanitary treatment system (septic tanks and soak away pits). Mobile sanitation facilities or pits latrines shall be provided by the contractor at all work sites other than the camp that last for at least a month.

7.2.3.8 Road Traffic Congestion and Accidents

The impact due road traffic congestion and accidents shall be mitigated as follows:

- Where a new cross drainage structure (culvert and bridge) has to be constructed at the same location as the existing structure then the Contractor shall avail a suitable temporary crossing structure to accommodate traffic and flow of water prior to demolishing the existing crossing.
- The Contractor shall devise proper traffic management, including deploying traffic management personals at all active construction sites.
- The Contractor shall appropriately post night-reflective traffic warning signs (speed limit, speed humps, works ahead), affixed with reflective hazard warning tape, to notify the public from distant about potential dangers
- The Contractor shall separate working area from public traffic by providing physical barriers such as reflective barricade blocks (affixed with reflective hazard warning tape), guardrails, reflective hazard warning tape, and diversion roads or walkways) and the Contractor shall use guards to protect employees and the communities from physical hazards.
- All moving plants and machinery will be shielded for safety reasons. In addition, warning signs [stating “**HATARI**” (**DANGER**), “**TAHADHARI**” (**WARNING**)] shall be installed to give warning on potential dangers.
- The Contractor shall design and implement a training programme to create road safety awareness for all the schools (refer to Table 15) along the project road
- Temporary speed restraining humps shall be installed near settlements

The barriers and guards shall be used to:

- Reroute pedestrian and vehicular traffic to completely avoid a construction site.
- Guard any permanent ground openings, deep excavation, or pits into which a person or vehicles could fall
- Guard moving or parked construction machinery
- Protect work immediately at the end of the activity or at the end of each day.

7.2.3.9 Increased Consumption of Energy and Natural Resources

Measures to reduce energy consumption during construction stage of the project will include:

- Limiting unnecessary idling of construction equipment as well as adequately tuning of engines of the construction equipment and vehicles to minimize fuel consumption).
- Encourage carpooling (sharing of vehicles – although this cannot be imposed to the Contractor) among construction workers.
- The Contractor shall not be allowed to use firewood and charcoal for boiling of bitumen. In addition, the Contractor shall not be allowed to use firewood (including trees cleared from borrow pits and road side) and charcoal as sources of energy for cooking.
- The Contractor shall not be allowed to cut trees or use trees cleared from road side or borrow pits to make markers pegs

7.2.3.10 Resources Use Conflict

To mitigate the impact due to resource use conflict, the Engineer shall not approve sitting of construction camp site in the neighbourhood of village settlements and the camp shall be totally

catered by the contractor. The camp shall be furnished with all the necessary social services to minimize interactions of the workers with the local people.

7.2.3.11 Reduction in Rivers Flows

To mitigate the impact due to reduction of water flow for domestic purposes:

- The Contractor shall not abstract water from R.Bogwe which is used for gardening by the local people (refer to sub-section 4.2.4)
- The Contractor shall obtain permits to abstract water for any river he intend to use for construction activities in accordance with Section 43 of Water resources Management Act, 2009.

7.2.3.12 Impact to Cultural Sites

To mitigate the impact, in the event that the Contractor identify graves within the RoW, the graves shall be deconsecrated in accordance to Graves (Removal) Act of 1969 as well as UNESCO's code of conduct, i.e. according to the rights of traditional of the people claiming ownership. The graves shall be relocated by excavation to a place selected by the village governments. This shall be done right before commencement of the construction work, and shall be done in consultation with affected people/owners of the graves through village and religious leaders (where applicable) to avoid friction.

7.2.3.13 Deterioration of Visual and Scenic Quality

To mitigate the impact of deterioration of scenic and visual quality due to dust generation, the Contractor shall regularly sprinkle water on the diversion roads across settlements, active construction sites, as well as access to roads to materials borrow sites. To minimize the impact due to deterioration of scenic quality due to cuts, the design has specified that all back slopes shall be well trimmed to at least 1:2.

7.2.4 Construction of Cross Drainage Structures

7.2.4.1 River Bank Erosion during Riparian zone Construction

To mitigate the impacts, the measures proposed in sub-sections 7.2.3.2 shall be applied. In addition, disturbed river banks, and heads in the neighbourhood of culverts shall be stabilized by planting grass.

7.2.4.2 Surface Water and Soil pollution

The impact due to pollution of water course and soil shall be mitigated by good working practice. The contractors' construction activities shall be performed by methods that will prevent entrance, or accidental spillage of solid matter, contaminants, debris and other pollutants and wastes into surface and ground water bodies.

The following other measures shall be implemented by the Contractor to mitigate the impact due to pollution of soil and water courses:

- In accordance with Clause 1706(a) and (b) of Standard Specifications the Contractor shall comply with all applicable Tanzanian laws, orders, regulations (Sections 34 and 39 of Water Resources Management Act and sections 6, 106, 109, and 110 of Environment Management Act), and water quality standards concerning the control and abatement of water pollution.

- In accordance with Clause 1706(b) of Standard specifications, if wells or other water sources, nevertheless, are polluted, it is the responsibility of the Contractor to compensate for this and provide the consumers with clean drinking water transported through pipes from an unpolluted source if required in the opinion of the Engineer.
- Whenever practical, the Contractors shall isolate concrete works from watercourses
- Concrete handling equipment and vehicles shall be washed down in an area that is isolated from the watercourses so that the toxic leachate is not allowed to enter the watercourse
- As much as it is practical, servicing and/or re-fuelling of equipment shall be restricted at the contractor's yard.
- Oil containers shall be kept properly on concrete containment (secondary containment) built in such a way that spilled oils can be easily recovered
- All construction equipment like excavators working near the riverbanks shall be well serviced to ensure that there is no oil leakage
- Excavated materials and other construction materials shall not be stockpiled or deposited near or on stream banks, or other water course perimeters where they can be washed away by high water or storm run offs or can in any way encroach upon the water course itself

7.2.4.3 Generation wastes

The impact shall be mitigated by disposing the wastes as follows:

- Concrete wastes and steel reinforcement bars shall be disposed of as described in sub-section 2.4.2.5
- Hard stone shall be disposed of by reuse by the Contractor, either for protection works or rock fill works
- Old culverts shall be transported to Kigoma TANROADS regional office for future reuse.

7.2.5 Construction of Roadside drainage Systems

7.2.5.1 Increased Risk of Roadside Soil Erosion

To mitigate the impact, measures proposed in sub-section 7.2.3.2 shall be applied. In addition:

- All line drain sections with slopes steeper than 4% shall be lined with concrete or stone masonry material.
- Areas of ground surface clearance (exposed soil) will be minimised by re-vegetating with natural vegetation. In addition, during excavation and grading, top soils will be stored for reuse on slopes to form top soil
- Unnecessary disturbance of sensitive areas like steep slopes shall be avoided
- To prevent formation of erosion gullies along drainage channels areas with steep slopes along the road, especially, the drains shall be extended far from the road and protected by gabions
- Speeds of storm water flows, especially for side drains will be reduced by constructing erosion checks, along all steep slopes

- As much as it is practical, existing vegetation shall be preserved to the extent possible, by confining construction activities to road alignment

7.2.5.2 Disruption of Community Access to their Dwellings and Business Areas

To abate the impact due to disruption of community access:

- The contractor shall provide temporary/ permanent concrete slabs across line drain to enable pedestrians gain access to their business and residential premises at areas that shall be approved by the Engineer.
- The road design has provided permanent access culverts to enable motorists gain access to their feeder roads

7.2.6 Concrete Works and Construction of Cement-stabilized Layers

7.2.6.1 Health Problems Associated with Handling of Cement and Concrete

The following measures will be followed in handling and using cement and concrete safely:

Personal protection

To protect skin from cement and cement mixtures, workers working in severe cement/concrete environment shall be equipped with:

- Alkali-resistant gloves
- Coveralls with long sleeves and full-length trousers (pull sleeves down over gloves and tuck pants inside boots and duct-tape at the top to keep mortar and concrete out)
- Waterproof boots high enough to prevent concrete from flowing in when workers must stand in fresh concrete
- Suitable dust/respiratory protective gear (dust masks) when cement dust can't be avoided
- Suitable eye protection gears where mixing, pouring, or other activities may endanger eyes (minimum - safety glasses with side shields or goggles, under extremely dusty conditions, tight-fitting unvented or indirectly vented goggles).

Work practices

The contractor shall ensure that workers:

- Work in ways that minimize the amount of cement dust released
- Mix dry cement in well ventilated areas
- Make sure to work upwind from dust sources
- Where possible, use ready-mixed concrete (mixing by concrete batch plant) instead of mixing on site
- When kneeling on fresh concrete, use a dry board or waterproof kneepads to protect knees from water that can soak through fabric
- Remove jewellery such as rings and watches because wet cement can collect under them

Hygiene

The contractor shall ensure that construction workers adhere to the following:

- Clothing contaminated by wet cement is quickly removed. Skin in contact with wet cement is washed immediately with large amounts of cool clean water
- Do not wash hands with water from buckets used for cleaning tools
- Provide adequate hygiene facilities on site for workers to wash hands and face at the end of a job and before eating, drinking, smoking, or using the toilet. Facilities for cleaning boots and changing clothes should also be available at the campsite

7.2.6.2 Soil and Water Pollution by Concrete Slurry and Concrete Wastewater

To mitigate the impact due to possible leakage of concrete wastewater the contractor shall make sure that:

- Concrete slurry or wastewater is not allowed to enter the storm water system
- Concrete slurry and wastewater are collected or diverted to grass or bare soil.
- Slurry control is put in place before concreting is started
- To divert run-off using sandbags, soil or other materials, to a grassed area, pit or bare ground to soak in.
- The area of grass/soil is big enough to deal with the volume of wastewater produced.

7.2.7 Construction of Road Pavement

7.2.7.1 Health Problems Associated with Handling of Cement and Wet-cement Products

Mitigation measures for health problems associated with handling of cement and wet cement products have already been discussed in sub-section 7.2.6.1

7.2.7.2 Deterioration of Ambient Air Quality by Bituminous Fumes

To mitigate the impact due to deterioration of ambient air quality due to bituminous fumes the following shall be observed:

- Bitumen processing facilities (bitumen heater and chipping pre-coating) shall be located in an open, well-ventilated area to minimize the concentration of bitumen fumes
- During bitumen spraying, apart from coveralls, workers shall be equipped with appropriate respirators

7.2.7.3 Health Problems Associated with Hydrated Lime

The impact shall be mitigated by:

Safe handling/ storage of material:

- Handling: Keep in tightly closed plastic or non-aluminium metal containers. Protect containers from physical damage. Avoid direct skin contact with the material.
- Storage: Store in a cool, dry, and well-ventilated location. Do not store near acids or other incompatible materials. Keep away from moisture. Do not store or ship in aluminium containers

Exposure control/ personal protection:

- Provide ventilation adequate to maintain Permissible Exposure Limits (PELs).

- Respiratory protection: Use NIOSH/MSHA approved respirators if airborne concentration exceeds PELs.
- Skin protection: Use appropriate gloves and footwear to prevent skin contact. Clothing should fully cover arms and legs. Should lime get inside clothing or gloves, remove the clothing and the lime promptly.
- Eye Protection: Use safety glasses with side shields or safety goggles. Contact lenses should not be worn when working with lime products.
- Other: Eye wash fountain/stations and emergency showers should be available

The following first aid measures should be followed:

- Eyes: Immediately flush eyes with generous amounts of water or eye wash solution if water is unavailable. Pull back eyelid while flushing to ensure that all lime dust has been washed out. Seek medical attention promptly if the initial flushing of the eyes does not remove the irritant. Do not rub eyes.
- Skin: Brush off or remove as much dry lime as possible. Wash exposed area with large amounts of water. If irritation persists, seek medical attention promptly.
- Inhalation: Move victim to fresh air. Seek medical attention. If breathing has stopped, give artificial respiration.
- Ingestion: Do not induce vomiting. Seek medical attention immediately. Never give anything by mouth unless instructed to do so by medical personnel

7.2.8 Operations of a Construction Camp

7.2.8.1 Generation of Solid and Liquid Wastes

To mitigate the impacts due to generation of wastes, the generated wastes shall be treated and disposed as describe in sub-section 2.4.2.5.

In addition the Contractor shall comply with section 32 of Environmental Management (Hazardous Wastes Regulations, 2008) which requires that all biomedical waste be managed and handled in a manner that will not adversely affect public health and the environment. The Contractor shall handle the medical wastes in a safe manner before transporting it to a nearby medical waste incineration facility.

7.2.8.2 Fire and Explosion Risks

To mitigate impact due to possible fire and explosion, safe working environment shall be exercised. This shall include, but not limited to:

- The Contractors shall maintain appropriate fire extinguishers within easy access at all work areas
- The Contractors shall recruits Safety Officers who will be responsible for training of all workers how to use fire extinguishers
- The Contractors shall prohibit smoking in hot work areas (welding, cutting, and grinding)

7.2.8.3 Risks of Leakage of Hazardous Materials

The following measures shall be implemented to mitigate the potential impact due to leakage of hazardous chemicals:

- Fuel (petrol and diesel) shall be transported by special fuel transport tankers and stored in onsite tanks.
- Lubricating oils, paints, solvents, grease shall be packed in barrel and tins and will be transported by fire extinguisher equipped trucks.
- Underground fuel storage tanks shall not be allowed
- Fuel storage tank(s) at the campsite will be installed in a concrete containment.
- Fuelling stations, equipment service bays and pits shall be concrete paved and provide with drains and oil-water separators
- Refuelling at campsite will be done by a pumps
- Refuelling of construction equipment shall be closely supervised to avoid leaks or releases. Should a spill occur during refuelling, it shall immediately be properly cleaned up.
- Liquids such as fuel, lubricants, and bituminous materials shall be properly handled to avoid leakages to the ground/soil. Lubricating oils stored onsite shall be contained in barrels. All power generators shall be kept a within secondary containment to contain any oil or fuel or leak. The barrels will be stored in a secondary containment area to contain any spillage, or in temporary warehouse
- When filling machinery and equipment with oils, the oil shall be pumped from a tank within a temporary secondary containment area to contain any spillage.
- Chemicals such as paint, solvents, and concrete additives shall be stored in a locked utility shed or secured in a fenced area.
- Paint and solvents containers shall be tightly sealed and properly stored to prevent leaks or spills. Unused paints shall be disposed of in accordance with applicable regulations. Spray painting shall not be done on windy days, and drop cloths shall be used to collect and dispose of drips and over-spray associated with all painting activities.
- In the event of spill or leak of hydraulic fluid, oil and other petroleum products, they will immediately be cleaned up to prevent discharge of these fluids into the ground or storm water runoff. Absorbent materials such as polypropylene boom and pads saw dust will be kept on hand for clean-up of spilled liquids on pavement, water, and soil. In the event that there is oil spill on the soil, the soil shall be excavated and treated by incineration.

7.2.7.4 Generation of Human Sanitary Wastes

The impact due to improper disposal of human sanitary wastes shall be mitigated by construction of sanitation facility at the camps. The type of facility will be of water closet (flush type). The sanitary waste water shall be treated and disposed of on-site by septic tank – soak away method.

7.2.9 Marital and Social Conflicts

The impact due to marital and social conflicts will be a residual impact as it cannot be mitigated at the project level.

7.2.10 Increase in unwanted Pregnancies

The mitigation the impact together with measures proposed in sub-section 7.2.12.2.4, there should be collaboration between parents, teachers, and village governments to reduce truancy of school children.

However, this will be a residual impact because it is impractical to prevent the increase in unwanted pregnancies completely.

7.2.11 Triggering of Child Labour and School Dropouts

To mitigate the impact, it is recommended that there should be close collaboration between parents, teachers, and village governments to reduce truancy of school children. The Contractor shall not employ people under the age of 18 years.

7.2.12 Occupational Health and Safety Hazards

7.2.12.1 Physical Hazards

7.2.12.1.1 Falling of People, Objects or materials

Measures to prevent workers fall from work platform will include:

- Providing toe boards and guard rails that will be fitted to the outer side and ends of the working platforms and so secured so as to prevent their outer ward movement. All scaffolds will be close boarded (boards placed with no space between adjacent boards).
- Areas that are slippery after spillage shall be immediately cleaned and sanded as necessary. Chipping from concrete and dust from materials shall be cleaned and not allowed to accumulate
- Materials deposited on the scaffold platform shall be neatly stacked and a clear passageway shall be maintained between the materials and the edge of the platform
- When people are likely to suffer fall of 1 m or more into an excavation, rigid guard rails or barriers of at least 0.9 m with a toe board and an intermediate rail to reduce any unprotected gap to 0.5 m or less shall be put in place. When people are likely to fall into a shallow trench of less than 1 m depth, warning tape shall be put in place to prevent trip and fall will be used

Measures to prevent workers fall from height due to scaffold collapse will include:

- Prevention of overloading including avoiding accumulation of materials and stacking materials
- Scaffold board shall be carefully examined before use to be free from unacceptable faults, such as large knots, knot clusters, large splits
- Scaffolding erection shall be done by an experienced scaffolders and competent supervision

Measures to prevent fall hazard while using ladders

- When used for access, ladders shall be securely tied at their upper ends
- It shall be made sure that they stand on a firm and level ground
- The rung and users footwear shall be kept clean and free from slippery mud, for example
- Along ladder shall be secured to prevent sway
- When works is to be performed from the ladder, when the ladder cannot be tied at the top or secured at the bottom, to prevent movement, the ladder shall be footed
- The ladder shall extend beyond the place of landing by at least 1 m unless adequate handhold is available

- Ladders with missing or defective rungs shall never be used
- Ladders shall always be inspected to identify defects and timber ladders shall not be painted since this may hide defects – transparent varnish or linseed oil will be used as a preservative

Measures to prevent accident due workers working below platform being struck by falling object/ material will include:

- Whenever there is any possibility of people below being struck by materials or tools falling through a gap in the working platform, on all scaffolds the boards will be laid close boarded (side by side) and end without space between the edges of adjacent boards.
- Workers under the platform shall wear safety helmet and shoes at all times

7.2.12.1.2 Stepping on or striking against Objects

Measures to prevent hazards resulting from stepping sharp objects or striking/ tumbling on objects shall include:

- Work areas shall maintain good housekeeping all the time to prevent possible accidents due to slipping, tumbling, or striking against an object
- The Contractor shall equip all the workers with steel-toe safety shoes

7.2.12.1.3 Manual Handling Injury -- Overexertion

To prevent manual handling injury, the Contractor shall ensure:

- Team handling e.g. using two or more persons
- The use of mechanical aid such as hydraulic crane, wheelbarrow that requires the use manual loading and unloading.
- Where applicable, breaking down the load into manageable components
- Using persons strong enough for the task to be undertaken

7.2.12.1.4 Workers being Struck or Crushed by Mobile Equipment

To prevent workers being struck by excavating machinery

- During excavation cycle, no person shall be allowed in the vicinity of the machine.
- People in the trench shall be well away from the face and those at ground level kept outside slewing radius of the machine.
- When the excavator operator cannot see all parts of the jib and bucket during the excavation cycle, or when the machine used as crane, to lower materials an experienced banks man shall be used to guide the operator and to ensure that other workers remain well clear of the operation being carried out
- All the workers on site shall be provided with on-site with training in site specific safety procedures and in hazards they may encounter at the site
- Barriers shall be used to separate workers, pedestrians, and vehicles from moving equipment
- Safety plans shall be continually to address changing conditions at the worksites

- Workers shall not be allowed to approach machinery without first signalling the operator to shut down the equipment and receiving acknowledgment from the operator
- Workers shall be provided and wear such as high visibility reflective vests and hard hats, to increase visibility

7.2.12.1.5 Transport

Measures to mitigate hazards associated with transport of materials will include limiting speeds of construction vehicles to 60km/hr and ensuring that construction vehicles are properly serviced.

7.2.12.1.6 Electrical Shock

The Contractor shall ensure that all electrical control panels and cable are properly insulated and earthed.

7.2.12.1.7 Fire and Explosion

Measures to prevent fire and explosion hazard have already been discussed in sub-section 7.2.8.2.

7.2.11.2 Health Hazards

7.2.11.2.1 Chemical Health Hazards

Contact with skin

Measures to prevent hazards associated with contact with hazardous materials have been discussed in sub-sections 7.2.6.1

Inhalation of harmful Chemicals

Measures to prevent inhalation of harmful chemicals will include personal protection and work practices that have been discussed in sub-section 7.2.6.1.

7.2.11.2.2 Physical Health Hazards

Noise

Measures to prevent physical health hazard due to noise have been presented in sub-section 7.2.2.2 and 7.2.3.5.

Manual Handling

Measure to prevent physical health hazard due to manual handling have been discussed in sub-section 7.2.11.1.3.

7.2.11.2.3 Biological Health Hazards

To prevent biological hazards related with sanitation and unavailability of safe drinking water, the Contractors shall:

- Provide adequate sanitation facilities at work site.
- Sanitary waste will disposed of by the use of toilets with septic tanks and soak away pits
- Provide adequate safe drinking water to his workers at all work sites

- Food waste collection bins with lids shall be provided at relevant locations at the camp. The bins shall be emptied on regular basis to pits

The waste management plan described in Environmental and Social Management Plan (ESMP) shall be followed in the management of different types of wastes

To mitigate the impact due to exposure to ionizing radiation, the Contractor shall comply with Occupational and health and safety Act (2003), Atomic Energy Act (2003) and Atomic Energy (Protection from ionizing radiation Regulation, 2004) by among others:

- Prior to using the gauge, obtaining a licence to own and use it
- Store, transport, and use the nuclear gauge in accordance with the law and regulations
- Ensure that only workers trained to use the gauge in accordance with law are allowed to use it
- Ensure that the gauge is used in manner that protect the public as specified by the law and regulations
- Appoint a radiation officer, whose duties and responsibilities are as specified by the law and regulations
- Ensure that records of exposure for users of the gauge are kept and available for inspection

7.2.11.2.4 Increased Transmission of STIs/HIV

To mitigate the impact due to increased transmission of STIs/ HIV, there shall be a HIV alleviation program. Each of the Contractors shall hire an organization (Sub-Contractor) experienced in the provision of HIV/AIDS awareness and prevention activities to prepare and implement HIV alleviation program on their behalf. The Sub-contractors shall work closely with various stakeholders (including communities and their leaders, schools and health centres, civil societies and CBOs) to have an educational awareness campaign during mobilization, construction, and demobilization phases of the project in order to prevent the further spread of HIV/AIDS as well as unplanned pregnancies due to road construction activities as well .

In addition, in accordance with sections 134, 135, and 136 of Factories (Building Operations and Works of Engineering Construction) Rules, 1985, the Contractor will have the obligations to:

- Provide first aid facility at every work site
- Provide and maintain in a good order and clean condition at or near the site of operation or work and conveniently easily accessible a properly constructed and suitable a first-aid room.
- Provide adequate number of trained and qualified first aiders for rendering the service to workers.

7.3 DEMOBILIZATION PHASE

7.3.1 Generation of Solid Wastes

The impact shall be mitigated as follows:

- The above wastes shall be treated and disposed of as described in sub-section 2.4.2.5

- Prior to demobilization, the Contractors shall submit to the Engineer for review and approval a closure plan for the camp (including fuel storage facility, workshop, pre-cast yard), bitumen storage and heating facilities. The plan shall outline steps that the Contractors shall adopt to reinstate the facilities, including disposal of old structures and all facilities that were used in the camp which would no longer be needed and are likely to be of environmental and health hazard.

7.3.2 Deterioration of Ambient air Quality

The impact due to pollution of ambient air by dust shall be mitigated by sprinkling water on the access roads to dump sites as well as covering transporting trucks to minimize escape of wastes from the trucks wastes. The workers at the demolition site shall be provided and ensure that they use dust masks to prevent them from inhaling polluted air.

7.3.3 Loss of Employment and Economic Activities at the End of the Project

The impact due to loss of employment at the closure of the project will be a residual impact as cannot be mitigated at the project level. To manage the impact, while recruiting workers the Contractors shall inform the expected duration of their employment. In addition, employment and labour relations act shall be adhered to by the Contractors during termination of redundant workers

7.4 OPERATION AND MAINTENANCE PHASE

7.4.1 Positive Impacts

7.4.1.1 Improved Ambient Air Quality

To enhance the positive impact due to improvement of ambient air quality people along the project roads shall be encouraged to plant strip street trees on road sides which will provide cleaning effect, alleviating air quality deterioration effects.

7.4.1.2 Improved Hydrology and Drainage

The impact due to improved hydrology and drainage shall be enhanced by ensuring proper and timely maintenance of the road furniture facility, including de-silting of culverts and side drain.

7.4.1.3 Reduction in Vehicle Operating Costs

The impact due to reduced rate of consumption of energy consumption shall be enhanced by ensuring proper repair and timely repair of the project road.

7.4.1.4 Reduced Rate of Energy Consumption

The impact due to reduced rate of consumption of energy consumption shall be enhanced by ensuring proper repair and timely repair of the project road.

7.4.1.5 Reduced Traffic Accidents

The impact due to improved safety shall be enhanced by ensuring that repair and maintenance of the road, including its furniture such as road safety signs are done properly and on timely.

7.4.1.6 Reduced Travel Time, and Comfort to Passengers

The impact due to reduction in travel and cost shall also be enhanced by ensuring that repair and maintenance of the road is done timely and properly.

7.4.1.7 Improved road conditions

Repair and maintenance will focus on activities that ensure the long-term serviceability of the road. The activities will pertain to the road pavement and its embankments, hydraulic and drainage structures and road furniture and where necessary, re-surfacing. All repair and maintenance works will virtually have positive impacts that will enhance the intended functions of the road and lengthening its life time, especially when it is considered that the number and scope of routine maintenance of the road will be greatly reduced.

7.6.1.8 Improved growth of vegetation due to Reduced Generation of Dust

The impact due to improved growth of vegetation due to upgrading of the road will be enhanced by ensuring that repair and maintenance of the road is done timely and properly.

7.6.1.9 Complementation of other Development Initiatives

The impact will be enhanced by ensuring that repair and maintenance of the road is done timely and properly.

7.4.2 Negative Impacts

7.4.2.1 Increased Traffic Accidents

To mitigate possible impact due to possible traffic accident:

- “Zebra” crossings with appropriate warning signs shall be put up at all accident black spots. Accident black spots are approaches to settlements, school children, and livestock crossings.
- Warning signs, a series of rumble strips followed by speed restraining humps shall be constructed on both approaches to settlements, school children (refer to Table 15) and livestock crossings
- Cattle crossings shall be provided. The Engineer shall consult village government leaders in determining locations of convenient livestock crossings
- In addition TANROADS shall launch awareness campaign in the use and road safety

The cost of provision of speed restraining humps is covered under the main design report.

7.4.2.2 Increased Pressure on Natural Resources

The impact cannot be mitigated at road project level. However, although the impact cannot be easily mitigated at project level, the local relevant authorities can initiate environmental management measures. This may include proper land management, promotion of tree planting campaigns, proper enforcement of economic instruments charging fees or tax on forest products like charcoal, fuel wood, timber, etc.

Increased pressure on natural resources during the operation phase of the project will be a residual impact as cannot be mitigated at the project level.

7.4.2.3 Increased Noise and Vibrations Pollution

The impact due to noise and vibrations during the operation phase of the project cannot be mitigated at the project level and therefore a residual impact.

7.4.2.4 Increased Cost of Living

The impact due cannot be mitigated at the project level and therefore a residual impact.

7.4.2.5 Increased Rate of Crimes

The impact due cannot be mitigated at the project level and therefore a residual impact.

7.4.2.6 Abuse of Road Corridor

To minimize the tendency of local people to encroach the road reserve, the design has included installation of concrete markers for end of road reserve.

7.4.2.7 Reduced Economic Activities at Closure of the Project

This is a residual impact as it cannot be mitigated at the project level.

7.4.2.8 Interference with smooth Traffic Flow

The measures to mitigate the impact due to interference of traffic flow in sub-section 7.2.3.8 shall be applied here as well.

7.4.2.9 Deterioration of ambient air quality due to Emission from Vehicle

The impact due to deterioration of ambient air quality due to increase emissions from vehicles cannot be mitigated at the project level. This requires effort by the government to encourage and enforce measures to reduce vehicles pollution. This can be achieved:

Proper maintenance of vehicles: Proper maintenance of vehicles emission control systems not only limits harmful emissions, but also can improve fuel efficiency and vehicle performance extending the life of the vehicle. Care in storing and handling gasoline and other solvents also reduces evaporative losses to the atmosphere.

Use of low emission or fuel efficient vehicles: This includes the use of low carbon vehicles, use zero carbon vehicles (Battery-electric vehicles, plug-in hybrid-electric vehicles), and use of natural gas vehicles. These technologies can be used in passenger cars, trucks and transit buses.

Introduction of carbon tax: The government should consider introducing carbon tax for diesel vehicles, since diesel vehicles emit more carbon than gasoline vehicles.

7.4.2.10 Contribution to climate change effect due to emission of Green House Gases

The impact due to contribution of the project to global warming during the operation phase cannot be mitigated at the project level. At the government level, the mitigation measures proposed in sub-section 7.4.2.9 above will apply here as well.

7.4.2.11 Contribution to depletion of ozone layer

The effect to increased depletion of ozone layer cannot be mitigated at the project level and therefore a residual impact.

7.4.2.12 Reduced life span of the road due to climate change

To mitigate the effect of bleeding of bitumen during the operation phase of the road, the design of the pavement has considered climate zoning, which determines the type of pavement and treatment to be used. The project area is classified in the dry zone (high temperature zone).

To prevent damages to pavement, the design has specified “Superpave” mix design. The Superpave system ties asphalt binder and aggregate selection into the mix design process, and takes into traffic loading and environmental conditions.

To prevent damages to concrete hydraulic structures resulting from high temperatures to hydraulic structures, the design has provided expansion joints to all box culverts to allow for free expansion when temperatures increases.

To prevent overtopping and failures of hydraulic structures during flooding, the design is based on 50 years (for bridges) and 25 years (for bridges culverts) of flood return period². Adequate drainage openings are provided so that the road embankments are not exposed to floods. It is therefore expected that the hydraulic structures will last for at least 50 years.

7.4.2.13 Fragmentation of Settlements and impaired safety of pedestrians

The effect of fragmentation of settlements can be reduced by providing a series of access stairs. It will however remain as a residual impact as cannot be mitigated fully.

² A return period also known as a recurrence interval is an estimate of the interval of time between events like an earthquake, flood or river discharge flow of a certain intensity or size. It is a statistical measurement denoting the average recurrence interval over an extended period of time, and is usually required for risk analysis and also to dimension structures so that they are capable of withstanding an event of a certain return period (with its associated intensity).

SECTION 8: EXPECTED RESIDUAL EFFECTS AND ENVIRONMENTAL HAZARD MANAGEMENT

8.1 RESIDUAL IMPACTS

Sections 6 and 7 describe the potential impacts that would occur along the route as a result of different phases of the project road, and how the proposed mitigation measures would contribute to minimizing or eliminating the impacts. It is clear from the discussion that not all the impacts can be fully mitigated and residual effects will be experienced by the environmental and social receptors affected by the project.

This section discusses and summarizes the potentially significant environmental and social residual impacts of the road project, i.e. those described as major and moderate. Residual impacts are the effects that will, or may arise as a consequence of the project after implementation of the mitigation measures. Where necessary, this section also identifies activities that will determine the nature or extent of particular residual impacts that are not yet fully defined.

8.1.1 Generation of Noise and Vibrations

(Related with impact in sub-sections 6.2.4, 6.3.2.2, and 6.3.3.5)

Generation of noise and vibrations will result from construction equipment and trucks during extraction, transportation and delivery of construction materials, as well as due construction activities, particularly earthworks. The impact will be of moderate significance for short periods in close proximity to dwellings during the day and evening.

Excessive noise and vibrations mitigation measures are already proposed and noise will be monitored at sensitive locations (e.g. settlements at which the criteria are thought to be at risk). If noise is likely to cause a nuisance at sensitive locations, additional noise suppression techniques will be considered, but may not be practical. Further measures to control the effect of such noise levels would include close liaison with the residents.

8.1.2 Deterioration of Ambient Air Quality by Dust

(Related with impact in sub-sections 6.2.3, 6.3.2.3, 6.3.3.6, 6.3.6.1, and 6.3.7.1)

Deterioration of ambient air quality by dust will mainly result from the following activities:

- Extraction of natural materials, particularly borrowing of fill materials, quarrying and crushing/ screening of hard stones
- General earthworks: excavation, filling, and compactions works during the construction of the project, diversion, and access roads
- Movements of construction equipment, particularly trucks and other light duty vehicles, as well as public traffic.
- Concrete works and laying of cement-stabilized layers

The impact will be of moderate significance for short periods in close proximity to active construction sites (borrow, quarry, crusher, and road sites) and dwellings during the day and evening.

Mitigation measures due to generation dust have already been proposed and dust level will be monitored at work sites and dwellings (at which the criteria are thought to be at risk). If dust level is likely to cause a nuisance at sensitive locations, additional dust suppression techniques will be considered. Further measures to control the effect of deterioration of ambient air quality by dust would include use of higher quality dust masks by workers and increased the frequency of water spraying on the diversion roads, and use of advanced dust suppression technique at the crusher plant such as the use vacuum pump technology to suck dust from screens.

8.1.3 Deterioration of Ambient Air Quality by Bituminous Fumes

(Related with impact in sub-section 6.3.7.1)

Apart from dust, deterioration of ambient air quality will be due to generation of bitumen fumes from bitumen processing plant as well as during spraying of bitumen products. The impacts due to bitumen fumes will affect construction workers as well as residents along the project road.

Mitigation measures due to generation bitumen fumes have already been proposed. Nevertheless, the impact, particularly the pungent smell from freshly-sprayed bitumen-product will be felt by the residents in the neighbourhood of the road.

Further measures to control the effect of such noise levels would include avoiding spraying bitumen during the night when dwellers are at home.

8.1.4 Loss of Vegetation

(Related with impact in sub-sections 6.2.2, 6.3.2.1, and 6.3.3.1)

Loss of vegetation will result from extraction of natural materials from borrow pits, widening of and upgrading of the existing road to improve safety. The impact will be of moderate significance for a long term to for the only some of the trees to regenerate naturally (from reinstated trees). The impact will be of moderate significance for long time.

The proposed mitigation measures will not mitigate the impact fully because only a small percentage of the lost vegetation, particularly trees lost from materials borrow areas will be recovered by natural regeneration after over 20 years, and vegetation lost due to the widening and realignment of the existing road cannot be recovered. The mitigation measures proposed to minimize the loss of vegetation and reinstate the affected sites will be monitored.

8.1.5 Loss of Land and other Properties

(Related with impact in sub-sections 6.3.2.1, 6.3.3.1, and 6.3.3.3)

Displacement and loss of properties will result from acquisition of land and demolition of buildings in order to widen the existing road, increasing the RoW from the current 45 m to 60 m (based on Road Act, 2007), realignment of the existing road to improve safety, and borrowing of material. The impact will be of major significance and long term. The proposed mitigation measures will not mitigate the impact fully. This is because even if people are compensated it may be difficult for them to get comparable sites. Some of the houses that will be demolished are within the prime business areas and it could be difficult for these people to obtain similar sites and if they manage to do so it might be at a high cost. Additionally, there are difficulties of

adjusting to new areas and for older people who are uprooted it will result in increased stress and even early deaths.

8.1.6 Road Traffic Congestion

(Related with impact in sub-sections 6.2.6 and 6.3.3.8)

Traffic congestion due to increased movement of construction equipment and vehicles, diverting the already congested public traffic to narrow and relatively poor diversion roads will be a major and short term significant impact. The proposed mitigation measures are therefore not expected to mitigate the impact fully.

Further measures to minimize congestion would include minimizing the lengths of continuous diversions roads.

8.1.7 Soil Erosion

(Related with impact in sub-sections 6.3.3.2 and 6.3.4.1)

Clearing of vegetation, which play a great role is stabilizing soil against erosion and disturbance of soil during borrowing of construction materials, construction of culverts, particularly where the soil is more susceptible to erosion as well construction across fill and cut sections are likely to cause soil erosion . The impact is anticipated to be of moderate significance and long term. The mitigation measures proposed are expected to make the impact due to soil erosion low. However, certain areas are particularly prone to erosion and any soil disturbance in these areas could initiate a significance increase in present erosion rate. In these areas the significance of the residual impact can only reasonably be mitigated to a moderate level.

8.1.8 Surface Water and Soil Pollution

(Related with impact in sub-sections 6.3.3.7, 6.3.4.2, 6.3.6.2, and 6.3.8.1)

Water pollution of surface water will occur during the construction across water course. Water pollution may be caused by either deposition of fine sediments during the construction across the water courses or accidental spillage of hazardous materials such as concrete or hydrocarbons.

Soil pollution by oil or fuel will occur due to accidental spillage of oil, poor managed oil, or leakage of fuel or oil containers.

In the unlikely situation that unplanned event leads to spillage of concrete waste water or oil to a water course or ground, it is possible that water course/ ground could be affected. However, the project Incident Response Plan (IRP) shall include measures for clean-up of water course and soil.

8.1.9 Disruption/Destruction of Public Utilities and Services

(Related with impact in sub-sections 6.3.3.4)

The mitigation measures identified for public utilities and services will, if implemented correctly and in full, prevent any unplanned significant impacts. However, it is likely that there will be instances when unforeseen utilities or services are accidentally disrupted without notice or prior planning. Such disruption could affect large numbers of people living in extensive areas and, although temporary, there is a possibility that an unplanned disruption could hinder income generation (including subsistence activities) of those affected, for example by impeding

irrigation to crops or by accidental damage to an irrigation channel. This will also result in residual resentment towards the project. Such instances will be dealt with through the compensation procedure.

8.1.10 Accidents Involving Community Members

(Related with impact in sub-sections 6.2.6 and 6.3.3.8, and 6.6.2.1)

It is possible that accidents involving local community members along the project road could occur at some stage during both the construction and operation phases of the project. This could include traffic-related accidents or accidents involving falling in open excavations, or other accidents. Traffic related accidents during the construction phase of the project will be caused by increased traffic volume, while during the operation phase of the project; it will be caused by increased traffic volume as well as increased traffic speeds. Although all practical measures have been proposed to ensure that no accidents occur, any incident that harms a person will have a major residual impact in terms of diminishing the quality of life for the victim, negatively impacting them or their household livelihood, and potentially creating hostility towards the project and project team.

Successful implementation of the proposed mitigation measures, including safety training, traffic management, and driver training (during the construction phase), and high priority placed on safety should ensure that the risk of serious accidents during the construction phase of the project is low.

Mitigation measures have been developed to ensure safety close to residential areas, thereby avoiding the possibility of residual impacts occurring. During construction, the Contractor shall work with communities to manage issues or anxiety surrounding accidents and to give advice on the risks and dangers associated with the project.

8.1.11 Accidents on open trench or borrow pits involving livestock and Wild animals

(Related with impact in sub-sections 6.3.2.5, 6.3.2.7, and 6.3.11.1)

It is likely that there will be minor accidents involving livestock within and outside the RoW. Basic health and safety management measures are in place to minimize this, but as stock proof fence will not be used on all fences and borrow pits, there is a risk that animals could move beyond any marker fences, and on to borrow pits, which could result in accidents. Compensation measures via a grievance process will be established which will mitigate any losses incurred reducing the impact to a low level.

If pits and quarries sites are left un-reinstated after their use, they may become filled with rainwater and become dangerous to children and animals. They may also create breeding sites for vectors like mosquitoes and bilharzias, when filled with rainwater.

The impact due to accidents to human and animals due to un-reinstated borrow pits is estimated to be indirect, moderate, reversible, and short term since it can be mitigated as soon as the construction is completed.

8.1.12 Un-met employment expectations

(Related to the impact in Sections 6.2.1 and 6.3.1: Creation of Employment)

Because unemployment in the project area, residents in directly affected settlements that are unsuccessful in their job applications are likely to become frustrated when they do not gain

employment. All the villages along the project road will anticipate employment opportunities. This could create resentment and possibly hostility towards those who win job and could cause resentment towards the project.

Measures to manage expectations regarding employment opportunities will help to reduce this potential impact. However, it is likely to remain a key concern of communities and the public in general given the high interest in employment found during the consultations. Hence the impact could be Major.

It is also possible that there will be a short-term residual impact of discontent and perhaps resentment towards the project arising from perceptions of bias in recruitment process. Experience of large scale construction projects indicates that it will be extremely difficult to eliminate all bias from the recruitment process. This residual impact is therefore expected to be moderate.

8.1.13 Tension between communities, workers and the project

(Related to Impact in Section 6.3.3.10 and 6.3.3.10: Resources Use Conflict)

It is likely that there will be incidents and tensions between workers and communities at particular times and locations during the construction phase given the number and range of impacts that will affect communities. The mitigation measures proposed will minimize the project impacts but where any incidents are not completely resolved there could be a localized residual impact in loss of trust and increased discontent with the project and project team. The community relations plan and activities should be designed to address these situations and to minimize residual discontent or resentment among communities.

8.1.14 Transmission of STIs/HIV

(Related to Impact in Section 6.3.12.3)

There is a residual risk that interaction of the workforce with local communities will increase the transmission of communicable diseases such as HIV/AIDS and other STIs, despite health training on communicable diseases. The likelihood and severity will depend upon the health of the workforce and the level of interaction with the local settlements. This impact may include short term outbreaks of diseases (STDs), but also more serious communicable diseases with long term effect on community mortality levels (HIV/AIDs).

A rise in STIs/ HIV is likely to occur in relatively more developed and busier villages centres (Munanila, Buhigwe, Herujuu, and Kasulu) as compared to less busier communities, where prostitution is strongly discouraged because of stiffer social norms in small villages.

8.1.15 Grievance over Land and Properties Compensation

(Related with impact in sub-sections 6.3.2.1, 6.3.3.1, and 6.3.3.3)

Experience has shown that there will be dispute and dissatisfaction between the project and some land owners and users on the project route. This will be caused by perceived or actual instances of disagreement with regard to the compensation process and/or methodology, and associated impact on livelihoods. This could cause resentment and possibly hostility towards the project.

The nature and scale of these negative residual impacts will depend on the quality of implementation of the land acquisition and compensation process, community relations and the

grievance procedures. However, where grievances occur, it is expected that these will be of moderate significance until solved.

8.1.16 Additional Cash injected into communities

(Related to the impact in Sections 6.2.1 and 6.3.1: Creation of Employment)

Employment is the most significant positive social impact associated with the project, in the short-medium term. There will be a positive residual impact of the income obtained and spent by local workers in the community. This will be limited in each individual community by the short term nature of the employment of unskilled workers, but more prolonged in the case of semi-skilled or skilled labour. The result should be an increase in the standard of living for families and additional indirect employment for local business as a result of more cash in the local economy. The key issue in determining the scale of this impact will be the total number of Tanzanians employed in the construction works, and the duration of their employment.

There will also be a positive residual impact from money spent locally on goods and services by foreign construction workers in the local communities, which could also help create temporary indirect employment.

Additional cash will also be injected into local communities through the land compensation programme. This positive impact will depend on the extent of out-migration from the affected communities.

8.1.17 Wide distribution of economic benefits

(Related to the impact in Sections 6.2.1 and 6.3.1: Creation of Employment)

Management measures for the recruitment process should ensure that the distribution of jobs and therefore the distribution of economic benefits are spread out over the route. However, individual unskilled jobs will be relatively short. Skilled and semi-skilled workers may benefit from longer periods of employment.

8.1.18 Enhanced local experience and employability

(Related to the impact in Sections 6.2.1 and 6.3.1: Creation of Employment)

There will be benefits in terms of the additional experience and skills gained by the construction workers. This will apply to some extent to all workers, though mostly to skilled workers, who will be employed for longer periods. The future employment prospects of these workers will be enhanced. Hence, the indirect benefit to the families and communities could be significant.

The potential to realize this positive impact will depend on the training programmes developed by Contractor(s) and to some extent on the individual's willingness to learn. Employees are more likely to enhance employment prospects following construction, since they may also be eligible for positions in other industries. This will be a positive residual impact for the Contractor(s) and employees.

8.1.19 Economic benefit of indirect employment opportunities

(Related to the impact in Sections 6.2.1 and 6.3.1: Creation of Employment)

If local people remain living within the local communities much of the cash injected is likely to remain within the local economy beyond construction period, creating a positive residual impact.

8.1.20 Access to new culture and international attitudes

(Related with impact in sub-section 6.6.1.9)

There are some opportunities for the internationalization of local communities/ greater tolerance and awareness of other cultures which can be seen as a positive impact if communities welcome this. This is because it is most likely that some of the construction workers will be expatriates. The presence of expatriates will give expose the local people to new cultures and international attitudes.

8.1.21 Complains procedure

(Related with impact in sub-sections 6.3.2.1, 6.3.3.1, and 6.3.3.3)

A fair and effective complaints procedure will help to establish a legacy of trust and good relations with communities. The level of trust will be determined by the quality of implementation of all measures, not simply those related to community relations.

8.1.22 Fragmentation of Settlements and impaired safety of pedestrians

(Related with impact in sub-sections 6.6.2.15)

Cuts across settlements will create a barrier, increase travel time across the road. The cuts will also jeopardise the safety of pedestrians.

Measures to mitigate the impact will include installation of access stairs across cuts to enable pedestrians have access to their residents. However, given the attitude of reckless drivers, traffic accident hazard will not be mitigated by installation of access stairs. Further measure to manage the accident hazard will include installation of posting of speed limit, warning, and installation of speed humps.

8.2 ENVIRONMENTAL HAZARD MANAGEMENT AND CONTINGENCY PLAN

This section describes a general plan through which the Contractor shall prepare himself and response to an emergency environmental hazard.

An emergency is a sudden unforeseen event, which may arise from natural, environmental, physical, or personal unforeseen occurrences. Emergencies which are likely to occur during the construction of the road project may cover one of the following events:

- Worker injury at construction sites or workshops (mechanical, steel, or precast yard, carpentry), quarry, crusher plant, batch plant etc.
- Injuries to workers or member of the public due to collisions or run over
- Fires or explosions at camp sites
- Mishap spills of hazardous material such as large amount of concrete, bitumen, oil, fuel, or paint on the ground or in a river system;
- Outbreak of pandemic diseases such as cholera, diarrhoea, meningitis
- Serious pollution to the water source (by hydrocarbons) which is relied on by the local

people for living.

Accident and Emergency Response Plan (ERP) is a detailed program of action to control and/or minimize the effects of emergency requiring prompt corrective measures beyond normal procedures to protect human life, minimize injury, to optimize loss control, and to reduce the exposure of physical assets and the environment from an accident.

8.2.1 Purpose and Scope

The purpose of this ERP is to identify emergency personnel and the logical sequence of actions that should be taken in the event of an emergency during construction of the road project.

The ERP begins to establish written emergency procedures, communication coordination, and clean-up responsibility to minimize hazards resulting from construction and traffic accidents, leakage, mishap spill, fire, and explosion.

8.2.2 Emergency Response Team

The contractor shall form an Emergency Response Team (ERT) as outlined below. The ERT will report through the normal, internal management chain-of-command. Due to the diverse locations, and variety of field activities, which will be involved during construction, establishment of more than one ERT may be necessary. Under all circumstances, prompt and proper treatment of the employee injured employee or person, as well as response of hazardous spills, fires, or explosions, is of utmost importance.

8.2.3 Emergency Response Team during Construction

The team that will be used during construction listed in sub-section 8.2.4 with titles, functions, and reporting relationship.

8.2.4 Incident Notification

Prior to commencement of construction, the contractor will establish the ERT that may include the positions listed below.

- Project Manager: will be the Incident Commander and will have an overall management of emergencies, including the activation and deactivation of ERT
- Construction Manager: will be the Operation Manager and will be responsible for managing emergency' tactical activities as per ERP
- Environmental and Social (E & S) Manager and Health and Safety (H & S) Manager - responsible for managing emergency' tactical activities as per ERP
- Construction Supervisor/foreman: will be the Logistic Provider, whose responsibility will be to provide logistical support for operations during emergency.

First Responder: will be the first person receiving a call on emergency.

8.2.5 Emergency Communication Procedure

An important key to effective emergency response is a communication system which relays accurate information quickly. To do this, mobile telephone communication method will be used, and personnel trained. There will be alternative telephone numbers in case one fails by emergency (lack of signal or out of charge). In the event that there are sections of the project road where mobile signals are either weak or unavailable, the Contractor shall provide alternative mode of communications (say satellite phones or radio calls) as alternative means of communication. The list of emergency telephone numbers will be made accessible by all relevant personnel of the project. Where practical, the emergency mobile numbers shall be posted at all sites.

Other important emergency telephone numbers are:

- Police Emergency telephone number
- Police Station(s)
- Fire brigade for (Kasulu)
- District hospitals

The emergency response plan posted in a noticeable place on the project shall identify the designated equipment and the people to operate it.

The following steps shall be followed in communicating for an emergency situation: The person receiving the call (information) will be designated as the “First Responder.” First Responder is a member of ERT.

8.2.5.1 STEP 1: Incoming Calls to the First Responder

During road construction, the emergency calls will most likely be generated by Contractor’s or Engineer’s inspection personnel and will be received by a member of the ERT listed above in sub-section 8.2.4 from a workgroup supervisor/ foremen, worker, an outside agency, or the public. Each foreman/supervisor or lead person on each phase of the road construction (clearing, excavation, grading, etc.) will be equipped with a mobile telephone.

8.2.5.2 STEP 2: Classifying Incidents

The risks associated with road construction are generally related to environmental pollution and personal injury. Emergencies associated with camp site/workshop operations could include:

- Worker injury at construction sites or workshops (mechanical, steel, or precast yard, carpentry), quarry, crusher plant, batch plant etc.
- Injuries to workers or member of the public due to collisions or run over
- Fires or explosions at camp sites
- Mishap spills of hazardous material such as large amount of concrete, bitumen, oil, fuel, or paint on the ground or in a river system;
- Outbreak of pandemic diseases such as cholera, diarrhoea, meningitis disease
- Serious pollution to the water source (by hydrocarbons) which is relied on by the local

people for living

Level 1 Emergency

There is no potential danger to outside the project's right-of-way, no threat to the public, and project personnel can handle the situation. Notification to the Supervisors and other authorities should be within 12 hours.

Examples of Level 1 emergencies include:

- An oil, fluid, or fuel spill of any magnitude that is confined to the site and does not flow onto private, or enter a stream, or river
- An employee or Contractor injury accident resulting into minor injury that may require medical attention, but does not require hospitalization
- Minor property damage that does not compromise the safe operation of equipment or vehicles
- Small bush or structure fire that has been contained within the right-of-way

Level 2 Emergency

The potential exists for the emergency to extend beyond the right-of-way.

Examples of Level 2 emergencies include:

- An oil, fluid, or fuel spill of any magnitude that leaves the lease and flows onto private, or that may enter a stream, or river
- An employee or contractor injury accident resulting in hospitalization
- Property damage resulting from fires, explosions, impact, or contacts that exceeds the safety threshold of the equipment or the structure

Level 3 Emergency

Safe operating control has been lost, a fatality has occurred, the public safety is jeopardized, or there is a significant and on-going environmental impact.

Examples of Level 3 emergencies include:

- An oil, fluid, or fuel spill of any magnitude that enters a watercourse and threatens the intake of a local water supply
- Any leak or spill (controlled or uncontrolled) that causes significant environment damage
- A fire, explosion, impact, or contact resulting in the destruction of the project property, injury to the general public and/or damage to private or public structures
- An employee or contractor injury accident resulting in a human fatality

Level 2 and 3 require notification of the project management (Project manager) who will then notify outside the district council's services and NEMC and in certain situation the police authority so that they may be kept informed of the situation. Immediate notification to the supervisor is mandatory.

8.2.5.3 STEP 3 Classification of Emergency Level and Notification

The workgroup supervisor will determine whether or not the incident is an emergency. If an emergency exists, the Supervisor will classify the Emergency Level and determine the notification level as who has to be notified.

Level 1 emergency will be notified to Supervisors and E & S Manager

Level 2 and 3 emergencies require notification to the Project manager, who will then notify the district council's services and in certain situation NEMC so that they may be kept informed of the situation. Immediate notification to the Engineer is mandatory, who in turn must notify the Employer.

8.2.6 Emergency Response Procedure

An emergency will be reported from any source: supervisor/ foremen, worker on site, an outside agency, or the public. It should be borne in mind that circumstances may change during the course of an emergency.

The Incident Commander (Project Manager, and/or local emergency agency) will be responsible for the coordination of all on-site activities, emphasizing protecting people first, then environment, and finally property, including:

- Securing the area
- Accounting for personnel and the public; and
- Taking actions depending on the type of emergency.

Responders with appropriate training and fire suppression will be authorized to assist in fire emergency response within the limits of their training and available equipment. Similarly, employees with appropriate training and spill response and clean-up will be authorized to assist in an emergency response within the limits of their training and available equipment. The Incident Commander will have the ultimate authority over how to dispatch project employees to assist with an emergency response. A level 2 or 3 emergency could cause a need for evacuation such as fire and explosion, particularly at quarry and camp site.

The following table (**Table 21**) summarises the procedure which will be followed in different emergency situations

Table 21: Response Procedure for Emergencies

No.	Emergency	Receptor	Emergency Action
1.	Mishap spills of hazardous material such as large amount of concrete, bitumen, oil, fuel, or paint on the ground or in a river system	Escape through site drains to cause soil, surface, groundwater pollution, water source that is used by	<ul style="list-style-type: none">• If safe to do so, isolate source of leak or spillage to prevent further losses• Isolate the affected area to prevent unauthorised access• Protect side drains by sealing outfall using suitable bung• Use absorbent or brooms to contain spread of spillage - stock held in main workshop• Notify NEMC and Project Manager

No.	Emergency	Receptor	Emergency Action
			<ul style="list-style-type: none"> • Transfer any residual contents and contaminated absorbents to a suitable temporary storage container • Obtain specialist advice of decontamination of surfaces, drains and the interceptors • Remove bung from outfall chamber only when authorised by NEMC
2.	Fire or explosion	Properties, site users and staff	<ul style="list-style-type: none"> • Shout loudly “Fire, Fire!” and “Moto, Moto!” to inform others of the emergency • Isolate the affected area and evacuate site • If safe to do so, tackle any fire using appropriate fire fighting equipment or appliance (fire extinguisher, sand, water etc.) • Dial police emergency number
3.	Personal injury to workers or member of the public resulting from accident at site	Staff or member of the public	<ul style="list-style-type: none"> • The Project manager will be notified of the injury • A qualified first aid attendant will administer first aid until the injured is taken to hospital (where necessary) • Where deemed necessary, the site construction manager will notify the police (e.g. death) • All key supervisors will be notified of the injury • Should a an employee become injured and require emergency off-site medical transportation, he/she will be accompanied by a project representative to give pertinent information needed • In the event of death, the construction manager will inform the deceased’s next of kin
4.	Outbreak of pandemic diseases such as cholera, diarrhoea, meningitis disease	Workers	<ul style="list-style-type: none"> • The project Manager will be notified of the outbreak • Workers will be informed of the outbreak and advised on measures to prevent themselves from contracting the diseases • The H & S Manager to carryout appropriate measures, including treatment of the affected workers, prevent further spread of the disease • Commune officers shall also be informed

8.2.7 Emergency Preparedness

Emergency preparedness is essential for effective emergency response. Essential elements of emergency preparedness will include:

- Chain of Command
- Resources
- Training; and
- Public Education (Community Planning)

8.2.7.1 Chain of Command

The organizational structure outlined earlier identifies the ERT; the role of project management in classifying the incident as a Level 1, 2 or 3; and how members of the ERT will coordinate with and advise the management and Incident Commander.

The First Responder will act as the On-Site Commander until a Incident Commander and/or a member of the project management (e.g. Construction Manager) arrives and gives direction to respond to the situation.

The Incident Commander will usually be the on-site commander. Until the Incident Commander arrives, members of the ERT will be responsible for securing the area, mobilizing the emergency response personnel, accounting for all personnel and members of the public, overseeing public and environmental protection, establishing and maintaining communications; and taking direction from the Incident Commander.

Any incidents which require an emergency response will be post-appraised and documented by the First Responder in conjunction with the ERT.

8.2.7.2 Resources

Resources for emergency response will include standard medical first aid kits, firefighting equipment (fire extinguishers, sand, etc.), containment and clean equipment [absorbent (absorbent booms and pads, rice hull, sand), brooms, shovel], construction equipment (e.g. bulldozer, forklift, etc.), workers trained in first aid, emergency vehicles, and hospital/dispensaries.

8.2.7.3 Training

Daily safety meetings will be conducted during construction that will inform employees of the emergency response procedures, directions to medical facilities, emergency action plans, and the location of written documentation.

The contractor's foremen shall attend specific safety training that addresses familiarization with the terrain and environmental issues in the project area. The agenda for this specialized training may include:

- Geographical considerations: elevation and terrain
- Particularly sensitive habitats
- Travel considerations: 4-wheeler, foot travel
- Wildlife: Bugs to Snakes
- Laws
- Spill prevention
- First aid and First aid kit familiarization
- Common illness/diseases
- Drug and alcohol issues
- Vehicle safety
- Emergency contacts
- Forest fires and what to do to prevent forest fires
- Communications
- Sensitivity of local residents; and/or

During construction, field personnel will also be trained by the Contractor in a variety of measures to make the job site safe:

- When and how to notify all others when actions or activities undertaken by them could affect health or safety of employees; to inform the Contractor of all injuries to workers; and who/how to report to Contractor any unsafe conditions that come to their attention.
- If in the course of the work an employee could be exposed to hazardous chemicals, or harmful physical agents, the location of material safety data sheets will be specified and made available for review.
- PPEs are expected to be worn that may include reflective vest, protective eyewear, gloves, hard hat, and footwear appropriate for the job site. Steel-toed footwear will be required on a project-specific basis.

SECTION 9: ENVIRONMENTAL AND SOCIAL MONITORING PLAN

Environmental and Social Monitoring Plan is an objective, periodical, reliable, and continuing process of observation and assessment of environmental changes. It is intended to ensure implementation of mitigation measures is done in accordance with regulations and standards. It is therefore based on monitoring indicators, which will have to be compared with targets to gauge the effectiveness of the mitigations plans.

It is one of the most important elements of the ESMP and has the following objectives:

- Collection of environmental and social baseline data (Table 22) as basis for gauging the effectiveness of implementation of proposed mitigation measures
- To ensure that mitigation and benefit enhancement measures have been adopted and are effective
- To identify any negative impacts unforeseen during ESIA stage and propose appropriate mitigation measures
- To provide information on the actual nature and extent of key impacts and effectiveness of mitigation and benefit enhancement measures

9.1 MONITORING PLAN

9.1.1 Modes of Monitoring

Two basic forms of monitoring shall be performed as described hereunder:

Effects monitoring: Effect monitoring will record the consequences of activities on one or more environmental components. This will involve physical measurement of selected parameters or the execution of surveys to establish the nature and extent of induced changes.

Measurement Based Inspection: This will involve evaluation of trends in the values of environmental and social parameters systematically measured (quantitatively and/or qualitatively) and collected, to ensure that they are within acceptable legal and technical standards. This will involve collection of samples for analysis. In this, water and air samples will be collected and analysed.

The main tools that will be used for monitoring are checklists, visual examinations, and quantitative measurements of environmental effects monitoring parameters. Written records will be kept detailing the dates that monitoring took place and the findings of the monitoring.

9.1.2 Baseline Data Collection

Prior to commencement of construction activities, during mobilization phase, the Contractors shall collect and document baseline data for different environmental aspects at strategic locations: settlements, camp, quarry, borrow sites, and water courses. The baseline data that shall be collected will include air quality (dust level), water quality (pH, turbidity), and noise levels. The baseline data collected will be used to compare environmental impacts of the “No Project”

and in the presence of the project and so determine the extent of impacts caused by the project. The following table (Table 22) list baseline parameters that shall be collected.

Table 22: Locations of sites where baseline data shall be collected

No.	Parameter	Location for Data Collection
1.	Air quality (dust level)	Across settlements, borrow, quarry, camp sites, crusher plant, batch plant, active road construction site
2.	Water quality (turbidity and pH)	Main rivers: Mkangazi, Lusungwe
3.	Noise level	Across settlements, borrow, quarry, camp sites
4.	Vegetation cover	Access or diversion routes, quarry and borrow sites
5.	Soil erosion	Wherever vegetation cover has been removed: access or diversion routes, across water courses, quarry, and borrow sites, wherever earthmoving activities (cut or fill) take place, the camp site, stock pile areas, and spoil disposal areas

9.2 MONITORING OF ENVIRONMENTAL AND SOCIAL PARAMETERS

The following table (Table 23) describe how monitoring of the implementation of proposed mitigation measure will be carried. The table lists the monitoring actions to be taken, the frequency of monitoring actions, locations where such actions are required to be taken, the units of measurement (where applicable), the target levels established and the responsible bodies. Notwithstanding the table-listed key issues, other unanticipated impacts shall also be monitored, and accordingly similar procedure for dealing with these impacts shall be followed to the satisfaction of the Engineer and Employer as well as in compliance with legal provisions.

Table 23: Environmental and Social Monitoring Plan

No.	Impact	Parameter/ Activity to be Monitored	Sampling area	Monitoring Frequency	Measuring Method	Measuring Unit	Target Level/ Indicator	Responsibility
1.	Creation of employment	<ul style="list-style-type: none"> • Age of employees • Ratio of local people to immigrants employed by the Contractor, • Workers employment contract • Wages paid to workers • Working hrs 	Camps, quarry, active construction sites	Throughout mobilization construction & demobilization phases	<ul style="list-style-type: none"> • Interview with workers and Contract • Review of employment records (payrolls) 	<ul style="list-style-type: none"> • Age of workers • Percentage of employee especially non-skilled from the local community • Percentage of women workers 	<ul style="list-style-type: none"> • No workers under the age of 18yrs is employed by the Contractors • Non- skilled workers dominated by people from the local community • All workers have employment Contract • Working hrs are in accordance with Labour relations act • Wages are in accordance with GN 196 of 28 June 2013. 	Contractor under supervision of Engineer, village government leaders along the project road
2.	Generation of Dust	<ul style="list-style-type: none"> • Level of dust generated by construction activities • Implementation of dust suppression measures • Use of dust masks/ respirators 	<ul style="list-style-type: none"> • Project road and diversion roads across dwellings and work sites • Access roads to material borrow areas • Quarry sites, and crusher plant • Concrete batch plant • Active work sites 	<ul style="list-style-type: none"> • Weekly during dry season for project, diversion, and access roads • Weekly throughout the year for quarry, crusher, and concrete batch plant based monitoring 	<ul style="list-style-type: none"> • Visual observation • Use of Dust Level meter • Interview of workers and communities along the road 	<ul style="list-style-type: none"> • Percentage of workers using dust masks in areas with high • Whether water is sprayer on the roads • Level of dust at PM_{2.5} scale 	<ul style="list-style-type: none"> • Dust abatement measures are done as prescribed • Absence of clouds of dust • All workers working in high dust level equipped with dust mask • Zero complains by workers and local communities • PM_{2.5} ≤ 25µg/m³ 	Contractor under supervision of Engineer, communities along the project road
3.	Gaseous emissions	<ul style="list-style-type: none"> • Level of exhaust generated by equipment, bitumen fumes • Working environment for workers exposed to hazardous gaseous fumes • Use of respirators and masks by workers 	Borrow pits, quarry sites, crusher plant, campsite, mechanical workshop, construction sites	Weekly during mobilization and construction period	Visual observation	<ul style="list-style-type: none"> • Presence of high level of smoke • Whether engine tuning, spray painting, and welding works are carried out in well ventilated areas • Whether appropriate PPEs are worn by workers during 	<ul style="list-style-type: none"> • No excessive smoke from equipment • Equipment engine tuning, spray painting, and welding done in a well ventilated area • Appropriate respirators used by workers during spray 	Contractor under supervision of Engineer

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No.	Impact	Parameter/ Activity to be Monitored	Sampling area	Monitoring Frequency	Measuring Method	Measuring Unit	Target Level/ Indicator	Responsibility
		carrying out spray painting, pre-coating of chippings, and bitumen spraying				spray painting, chipping pre-coating and bitumen spraying	painting, bitumen pre-coating of chipping, and bitumen spraying	
4.	Generation of noise and vibrations	<ul style="list-style-type: none"> • Level of noise, generated by equipment • Presence of exhaust mufflers • Use of ear plugs by staff working in very noisy environment 	Mechanical workshop, quarry site, crusher plan, batch plant	Weekly Daily	<ul style="list-style-type: none"> • Visual observation • Listening • Interview with workers • Sound level meter 	<ul style="list-style-type: none"> • Percentage of workers in high noise environment using ear plugs, of ear plugs • Whether all equipment have exhaust mufflers • Noise level in dBA scale 	<ul style="list-style-type: none"> • Equipment engines properly tuned • All equipment fitted with mufflers • All workers working in very noisy environment equipped with ear plugs • Noise level ≤ 85 dBA 	Contractor under supervision of Engineer
5.	Loss of vegetation	<ul style="list-style-type: none"> • Implementation of measures to prevent or minimize loss of vegetation • Implementation of compensation of lost vegetation • Management of cleared trees 	<ul style="list-style-type: none"> • Sections with exotic tree forest strips (refer to Table 18 both sides • Material borrow areas and quarries • Diversion and access roads 	<ul style="list-style-type: none"> • Monthly during mobilization • Once after every one week during mobilization • Weekly during construction period 	<ul style="list-style-type: none"> • Visual observation • Interview with local communities 	<ul style="list-style-type: none"> • Whether width of clearing is limited to within CoI • Whether unnecessary clearing of trees is avoided • Whether exotic trees strip forest is harvested before commencement of construction • Whether top soil removed during clearing and grubbing, material borrowing stockpiled for future use • whether grass planted on bare soil around streams and steep slopes, whether cleared tree are not buried but left for the local people to use for fire wood 	<ul style="list-style-type: none"> • Width of clearing confined to CoI • Unnecessary clearing of vegetation is voided • Exotic trees strip forest is harvested before commencement of construction • Top soil removed during clearing and grubbing and material borrowing stockpiled for top soiling • Cleared trees left around borrow pit and road side for the local people • Contractor does not use trees as a sources of energy or Contractor does cut trees or use cleared trees to make marker pegs 	Contractor under supervision of Engineer, local authorities
6.	Loss of land	Land acquisition procedure	Camps, all borrow pits, quarries, and spoil areas	Monthly	<ul style="list-style-type: none"> • Review of borrow pits documents • Interview of owners of land 	Whether compensation of land and crops done in accordance with Clause 1214 of standard specs,	Land acquisition done in accordance with Clause 1214 of Standard specifications and Land Act	

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No.	Impact	Parameter/ Activity to be Monitored	Sampling area	Monitoring Frequency	Measuring Method	Measuring Unit	Target Level/ Indicator	Responsibility
						Land Act and its Regulations	and its Regulations	
7.	Soil erosion	<ul style="list-style-type: none"> • Implementation of measures to prevent/minimize soil erosion • Condition of areas adjoining rivers • Management of storm water during construction of culverts 	<ul style="list-style-type: none"> • All rivers • Borrow pits, quarry, and culverts • Where there has been clearing of ground cover • During earthworks (fill and cut) take place, fill 	Monthly	Visual observation	<ul style="list-style-type: none"> • Whether specified temporary erosion control measures are in place • Whether specified temporary measures to control surface runoff are in place • Whether specified permanent erosion control measures (top soiling, grassing, checks, stone pitching, and tree planting) are implemented 	<ul style="list-style-type: none"> • Specified temporary erosion control measures are in place • Specified temporary measures to control surface runoff are in place • Specified permanent erosion control measures (top soiling, grassing, checks, stone pitching, and tree planting) are implemented 	Contractor under supervision of Engineer
8.	Soil pollution by fuel, oil, and bitumen	<ul style="list-style-type: none"> • Implementation of measures to prevent and deal with oil / fuel spill • Operations of mechanical workshops • Operations of bitumen heating and chipping pre-coating facilities • Management (including storage) of lubricants and bitumen • Management of used oil and fuel filters 	<ul style="list-style-type: none"> • Workshops at both camps • Bitumen storage, heating and chipping pre-coating site 	Weekly throughout construction period	<ul style="list-style-type: none"> • Visual observation • Interview with local communities, turbidity meter • Review of Contractors documents 	<ul style="list-style-type: none"> • Whether lubricants containers placed on concrete-paved ground with secondary containment • Whether filling and topping up of lubricant is done by a hand pump/funnel • Whether topping up of lubricant done in the presence of drip pan • Whether there is no leakage of fuel or oil from equipment • Whether used oil is kept in sealed leak-proof containers on concrete-paved ground with secondary containment • Whether used oil and fuel 	<ul style="list-style-type: none"> • Lubricants containers placed on concrete-paved ground with secondary containment • Filling and topping up of lubricant is done by a hand pump/funnel • Topping up of lubricant done in the presence of drip pan • There is no leakage of fuel or oil from equipment • Used oil is kept in sealed leak-proof containers on concrete-paved ground with secondary containment • Used oil and fuel filters are stored in leak proof containers on concrete-paved ground secondary 	Contractor under supervision of Engineer

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No.	Impact	Parameter/ Activity to be Monitored	Sampling area	Monitoring Frequency	Measuring Method	Measuring Unit	Target Level/ Indicator	Responsibility
						filters are stored in leak proof containers on concrete-paved ground secondary containment • Whether bitumen drums are stored on polythene lined level ground with at least 10cm layer of sand	containment • Bitumen drums stored on polythene lined level ground with at least 10cm layer of sand • Waste oil, used oil and fuel filters, and empty bitumen drums collected for disposal by NEMC company	
9a.	Sedimentation of river systems	• Implementation of measures to prevent sedimentation of rivers • Level of sedimentation of river systems	All river systems	Weekly week during construction across the river systems	• Visual observation • Interview with local communities, turbidity meter	• Whether spoil or construction materials are disposed or stocked near water courses • Whether there is no disturbance on areas adjoining rivers • Whether there is any complaints from downstream users on water pollution	• Measures to prevent sedimentation are implemented • Turbidity as measured in NTU \leq 10% deviation from the baseline • No complaint is received from downstream users of a river	Contractor under supervision of Engineer
9b.	Pollution of river systems by hydrocarbons (oils and bitumen)	• Implementation of measures to prevent pollution • Presence of hydrocarbons in river course	All rivers	Twice per week during construction across the river systems Weekly when waster is abstracted from any river for construction works	Visual observation	• Whether equipment working on river banks has fuel or oil leaks • Whether refuelling is done near water courses • Whether refuelling is done by pump • Whether there is any sign of floating hydrocarbon product (thin-film, rainbow sheen)	• No fuel or oil leak from equipment working on river banks • No refuelling is done near water courses • No sign of floating hydrocarbon product	Contractor under supervision of Engineer
9c.	Pollution of river systems by fresh cement products (concrete,	• Level of pollution by cement • Implementation of measures to prevent pollution	All major rivers	Once per week during construction of culverts	• Visual observation • pH meter	• Whether concrete are isolated from water courses • Whether washing of concrete handling equipment is done near	• Concrete works are isolated from water courses • No washing of concrete handling equipment is done near water courses	Contractor under supervision of Engineer

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No.	Impact	Parameter/ Activity to be Monitored	Sampling area	Monitoring Frequency	Measuring Method	Measuring Unit	Target Level/ Indicator	Responsibility
	concrete slurry, cement wastewater	• Level of water pollution in acidity unit				water courses • Complains from local people in the downstream • Acidity in pH scale • turbidity in NTU scale	• No complaints from local people in the downstream • pH ≤ 1 deviation from the baseline	
10.	Disruption of domestic water supply pipe line utilities	• Damages to pipe lines • Implementation of measures to prevent damages to water supply utilities • Response to complaints with regard to damaged water supply utilities • Reinstatement of damaged water supply utilities • Installation of service ducts	Where there are water supply utilities within the CoI.	Weekly during construction of the road section	• Visual observation • Interview with local communities	• Whether Contractor liaise with local water authorities whenever construction is being done across sections with utilities within CoI • Whether utilities within CoI carefully removed before commencement of construction • Whether utilities not damaged • Whether there is timely response to complaints with regard to damages to water supply utilities • Whether installations of service ducts done in consultation with local water supply authorities	• Contractor liaise with local water authorities before commencement of construction across sections with utilities within CoI • Utilities within CoI carefully removed before commencement of construction • Utilities not damaged • There is timely response to complaints with regard to damages to water supply utilities • Locations of service ducts determined in consultation of local water supply authorities	Contractor under supervision of Engineer, Water Engineer for Buhigwe and Kasulu District, local communities
11.	Generation of wastes (visual impact, soil and surface and ground water pollution)	• Management of wastes • Treatment and disposal of wastes	Camps and work sites	Weekly throughout mobilization, construction and demobilisation periods	Visual observation	• Whether wastes are managed, treated, and disposed of as prescribed in Sub-Section 2.4.2.5 and 7.1.3, and 7.2.4.3 • Whether Contractors have written agreements with NEMC certified for collection and disposal of hazardous wastes	• Wastes are managed, treated, and disposed of as prescribed in Sub-Section 2.4.2.5 and 7.1.3 • Contractors have written agreements with NEMC certified for collection and disposal of hazardous wastes	Contractor under supervision of Engineer
12.	Reduction in rivers' flows	Compliance with water resources Management	Sources of water for construction works	Monthly	• Visual observation	• Whether the Contractor has permits for all sources of	• The Contractor has permits for all sources of water used	Contractor under supervision of

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No.	Impact	Parameter/ Activity to be Monitored	Sampling area	Monitoring Frequency	Measuring Method	Measuring Unit	Target Level/ Indicator	Responsibility
		Act			<ul style="list-style-type: none"> Review of Contractors' submissions 	<ul style="list-style-type: none"> Whether the Contractor complies with environment conditions specified by permits Whether Contractor does not abstract water from R.Bogwe 	<ul style="list-style-type: none"> for the project The Contractor complies with environment conditions specified by permits The Contractor does not abstract water from R.Bogwe 	Engineer
12.	Increased consumption of energy and natural resources	Sources of energy for cooking and other construction activities	Camps and work sites	Monthly	Visual observation	Whether the Contractor uses charcoal and firewood for cooking and bitumen boiling	The Contractor does not use charcoal and firewood for cooking and bitumen boiling	Contractor under supervision of Engineer
13.	Damage to graves	Measures to prevent damage to graves	Around grave yard	During construction across sections with grave yards specified in sub-section 4.3.5	<ul style="list-style-type: none"> Visual observation Review of Contractors' submissions Interview with local communities 	<ul style="list-style-type: none"> Whether all the graves within CoI are relocated in accordance with Grave (removal) Act Whether graves outside CoI are clearly marked/ and protected from damage during construction of respective sections Whether there are any complaints from local communities 	<ul style="list-style-type: none"> Before commencement of construction of section with graves: All graves within CoI are relocated in accordance with Grave (removal) Act Before commencement of section with graves, Whether graves outside CoI are clearly marked/ and protected from damage during construction of respective sections Whether there are any complaints from local communities 	Contractor under supervision of Engineer
14.	Disruption of community access to dwellings and business areas	Availability of temporary pedestrian crossings at settlements	Dwellings	Monthly	<ul style="list-style-type: none"> Visual observation Interview with local communities 	<ul style="list-style-type: none"> Whether appropriately spaced temporary pedestrian crossing are availed at all dwellings Whether local communities complain about the absence of pedestrian crossings 	<ul style="list-style-type: none"> Appropriately spaced temporary pedestrian crossing are availed at all dwellings There are no complaints about lack of pedestrian crossings 	Contractor under supervision of Engineer, local communities

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No.	Impact	Parameter/ Activity to be Monitored	Sampling area	Monitoring Frequency	Measuring Method	Measuring Unit	Target Level/ Indicator	Responsibility
15.	Health problems associated with handling cement and concrete	<ul style="list-style-type: none"> • Work practice • Use of PPE • Hygiene 	<ul style="list-style-type: none"> • Bridge and culvert work sites • Concrete batch plant area • Precast yard • Where there is laying of cement-stabilized layer 	Monthly	<ul style="list-style-type: none"> • Visual observation • Interview with workers 	<ul style="list-style-type: none"> • Whether appropriate PPE are used by workers working with cement and concrete • Whether workers work in the manner that minimizes release of cement dust and contact with wet cement product • Whether PPE are issued as required and worn-out PPE are replaced as required 	<ul style="list-style-type: none"> • Workers working with cement and concrete are equipped with appropriate PPE (gloves, coveralls, with long sleeves, water-proof boots, suitable dust masks, eye protection gear) are used • Workers work in the manner that minimizes release of cement dust and contact with wet cement product • PPE are issued and worn-out PPE are replaced immediately 	Contractor under supervision of Engineer
16.	Risks of fire and explosion	<ul style="list-style-type: none"> • Workers behaviours • Implementation of measures to prevent fire and respond to fire incident 	Workshop	Monthly	<ul style="list-style-type: none"> • Visual observation • Interview with workers 	<ul style="list-style-type: none"> • Whether adequate, appropriate, and easily accessible fire extinguishers are availed at strategic locations • Whether there is evidence that workers are trained how to use fire extinguishers 	<ul style="list-style-type: none"> • The Contractor avail adequate, appropriate, and easily accessible fire extinguishers are availed at strategic locations • The Contractor has evidence that workers are trained how to use fire extinguishers 	Contractor under supervision of Engineer
17.	Generation of human sanitary wastes	Availability of ablution facilities	Work sites	Monthly	<ul style="list-style-type: none"> • Visual observation • Interview with workers 	Whether there are ablution facilities at all work sites that lasts for at least a month	All work sites that last for at least month have ablution facilities	Contractor under supervision of Engineer
18.	Traffic congestion and accidents	<ul style="list-style-type: none"> • Implementation of measures to prevent traffic congestion and accidents • Implementation of road safety training programme for schools 	<ul style="list-style-type: none"> • Project, diversions, and access roads across dwellings and schools • Schools 	<ul style="list-style-type: none"> • Weekly for monitoring implementation of measures to prevent accidents • Monthly for monitoring 	<ul style="list-style-type: none"> • Visual observation • Interview of road users, schools, local communities • Review of 	<ul style="list-style-type: none"> • Whether there are flagmen at approaches to all active construction sites and material borrow area junctions • Whether there are appropriately posted night- 	<ul style="list-style-type: none"> • Flagmen are deployed at approaches to active construction sites and material borrow area junctions • Night-reflective warning signs (speed limit, speed 	Contractor under supervision of Engineer, school children/ teachers

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No.	Impact	Parameter/ Activity to be Monitored	Sampling area	Monitoring Frequency	Measuring Method	Measuring Unit	Target Level/ Indicator	Responsibility
		<ul style="list-style-type: none"> Travel speeds of project vehicles 		implementation of road safety training programme	contractors monthly ESMP and HSMP compliance reports	<p>reflective warning signs to warn the public about potential danger (speed limit, speed humps, works ahead, etc.)</p> <ul style="list-style-type: none"> Whether there are physical barriers (concrete barricades, tape etc.) to protect employees and other road users Whether there are speed-restraining humps on approaches to all accident black spots (e.g. school children crossing, dwellings, etc.) Whether pedestrians and other traffic are rerouted away from active construction sites Whether the public is protected from all ground openings into which a person or vehicles could fall by night-reflective barricades Whether the Contractor has evidence that there is awareness creation program on road safety issues among school children Whether parked construction equipment are guarded Whether works are protected immediately at 	<p>humps, works ahead, etc.) appropriately posted to warn the public about potential danger (speed limit, works ahead, etc.)</p> <ul style="list-style-type: none"> Physical barriers (concrete barricades, tape etc.) are in place to protect employees and other road users Speed-restraining humps are installed at approaches to all accident black spots (e.g. school children crossing, dwellings, etc.) Pedestrians and other traffic are rerouted away from active construction sites The public is protected from all ground openings into which a person or vehicles could fall by night-reflective barricades Review of Contractors' compliance reports and interviews with school children and teachers provide evidence that the Contractors implement awareness creation program on road safety issues among school children Parked construction equipment are guarded Works are protected immediately at the end of the day All accidents and incidents 	

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No.	Impact	Parameter/ Activity to be Monitored	Sampling area	Monitoring Frequency	Measuring Method	Measuring Unit	Target Level/ Indicator	Responsibility
						<p>the end or end of the day,</p> <ul style="list-style-type: none"> Whether all accidents and incidents are reported to the Engineer soon after their occurrence Whether drivers of project vehicles are formally informed of speed limit of 60km/hr and that they adhere to this speed limit Whether measures to prevent re-occurrence of accidents and incidents 	<p>are immediately reported to the Engineer</p> <ul style="list-style-type: none"> Drivers of project vehicles are formally informed of speed limit of 60km/ hr and that they adhere to this speed limit There are measures to prevent re-occurrence of accidents and incidents 	
19.	Risk of accidents to animals and human associated with material borrowing	<ul style="list-style-type: none"> Management of material operational borrow areas Closure of material borrow areas 	<ul style="list-style-type: none"> Dwellings Material borrow areas and quarries 	Weekly	<ul style="list-style-type: none"> Visual inspection Reviews of requests by Contractors' for approval of material borrow areas 	<ul style="list-style-type: none"> Whether procedure for approval of material borrow areas by Contractor are in accordance with Sub-Clause 1214 of Standard specifications of Road Works Whether only borrow pit at minimum distance of 500m from dwellings are approved by the Engineer Whether all borrow pits and quarries are self-draining when operational and after their closure Whether maximum depth of borrow pits is 3m Whether maximum depth of quarry face is 10m Whether all borrow pits and quarries are reinstated in accordance with Clause 1703e) of Standard specifications of 	<ul style="list-style-type: none"> The Contractor complies with Sub-Clause 1214 of Standard specifications during land acquisition for borrow pits and quarries Only request for borrow areas located at minimum distance of 500m from dwellings are approved by the Engineer The Contractor ensures that all borrow pits and quarries are self-draining when operational and after their closure Depths of borrow pits are limited to 3m Maximum depth of quarry face is 10m All borrow pits and quarries are reinstated in accordance with Clause 1703e) of Standard specifications of Road 	Contractor under supervision of Engineer

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No.	Impact	Parameter/ Activity to be Monitored	Sampling area	Monitoring Frequency	Measuring Method	Measuring Unit	Target Level/ Indicator	Responsibility
						Road Works and to the satisfaction of the Engineer before the Contractor is issued with TOC	Works and to the satisfaction of the Engineer before the Contractor is issued with TOC	
20.	Safety risk associated with to blasting, drilling and rock excavation	<ul style="list-style-type: none"> Storage and management of explosive Operations at quarries 	<ul style="list-style-type: none"> Magazine Quarries Rock excavation site along the project road 	Monthly	<ul style="list-style-type: none"> Visual observation Review of documents from Contractor Interview of local communities near quarries 	<ul style="list-style-type: none"> Whether Contractors have licences for explosive storage magazines Whether blasting done by holders of blasting certificates issued by Commissioner of Mines Whether blasting done between 08:00 hrs and 16:00 hrs 	<ul style="list-style-type: none"> Contractors have licences for explosive storage magazines Blasting is done by holders of blasting certificates issued by Commissioner of Mines Blasting is done between 08:00 hrs and 16:00 hrs 	Contractor under supervision of Engineer, Inspector of Mines and Explosives
21.	Hazard due to workers fall from height or being hit by falling objects or materials	<ul style="list-style-type: none"> Conditions of scaffold, ladders, and work platform Use of PPE by workers 	<ul style="list-style-type: none"> Workshops Culverts construction work sites 	Weekly	<ul style="list-style-type: none"> Visual observation Interview with workers 	<ul style="list-style-type: none"> Whether overloading of scaffold is prevented Whether scaffold board is free from unacceptable faults Whether scaffold is erected by experienced scaffolders and competent supervision Whether ladders used for access are securely tied at their upper ends Whether ladders stand on a firm and level ground Whether ladders are secured to prevent sway Whether ladders that cannot be tied at their top secured at the bottom are footed Whether ladders extend beyond the place of landing by at least 1 m unless adequate handhold 	<ul style="list-style-type: none"> Overloading of scaffold is prevented Scaffold board is free from unacceptable faults Scaffold is erected by experienced scaffolders and competent supervision Ladders used for access are securely tied at their upper ends Ladders stand on a firm and level ground Ladders are secured to prevent sway Ladders that cannot be tied at their top secured at the bottom are footed Ladders extend beyond the place of landing by at least 1m unless adequate handhold is available There are no ladders with 	Contractor under supervision of Engineer

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No.	Impact	Parameter/ Activity to be Monitored	Sampling area	Monitoring Frequency	Measuring Method	Measuring Unit	Target Level/ Indicator	Responsibility
						<ul style="list-style-type: none"> is available •Whether there are no ladders with missing or defective rungs •Whether boards of platform are laid close boarded and end without space between the edges of adjacent boards, whenever there is any possibility of people below being struck by materials or tools falling through a gap in the working platform •Whether all workers under the platform are equipped with safety helmet and shoes all times 	<ul style="list-style-type: none"> missing or defective rungs •Boards of platform are laid close boarded and end without space between the edges of adjacent boards, whenever there is any possibility of people below being struck by materials or tools falling through a gap in the working platform •All workers under the platform are equipped with safety helmet and shoes all times 	
22.	Hazard due to stepping on sharp object or striking/ tumbling against objects	<ul style="list-style-type: none"> •Housekeeping at work sites •Use of PPE by workers 	<ul style="list-style-type: none"> •Workshops •Culverts construction work sites 	Weekly	<ul style="list-style-type: none"> • Visual observation • Interview with workers 	<ul style="list-style-type: none"> • Whether a good housekeeping is maintained all the time • Whether all the workers are equipped with steel-toe safety shoes 	<ul style="list-style-type: none"> • A good housekeeping is maintained all the time • All the workers are equipped with steel-toe safety shoes 	Contractor under supervision of Engineer
23.	Hazard due to manual handling – overexertion	<ul style="list-style-type: none"> •How manual handling of loads is done •Implementation of measures to prevent over-exertion 	<ul style="list-style-type: none"> •Workshops •Culverts construction work sites 	Weekly	<ul style="list-style-type: none"> • Visual observation • Interview with workers 	<ul style="list-style-type: none"> • Whether team handling is practices when carrying heavy loads • Whether mechanical aid (e.g. wheelbarrow, hydraulic crane etc.) is used when loads being carried are heavy 	<ul style="list-style-type: none"> • Team handling is practices when carrying heavy loads • Mechanical aid (e.g. wheelbarrow, hydraulic crane etc.) is used when loads being carried are heavy 	Contractor under supervision of Engineer
24.	Hazard due to workers being struck or crushed mobile	<ul style="list-style-type: none"> •How excavation and lifting by crane is done •Implementation of measures to prevent 	<ul style="list-style-type: none"> •Culverts and bridge work sites •Line drain work sites •Where rolling works is 	Weekly	<ul style="list-style-type: none"> • Visual observation • Interview with workers 	<ul style="list-style-type: none"> • Whether there is no worker or member of public within swivel radius of machine during excavation 	<ul style="list-style-type: none"> • There is no worker or member of public within swivel radius of machine during excavation 	Contractor under supervision of Engineer

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No.	Impact	Parameter/ Activity to be Monitored	Sampling area	Monitoring Frequency	Measuring Method	Measuring Unit	Target Level/ Indicator	Responsibility
	equipment	workers and the public being hit or crushed by mobile equipment	being done			<ul style="list-style-type: none"> Whether workers in the trench are kept well away from the face and those at ground level kept outside slewing radius of the machine. Whether experienced banks man is used to guide the operator and to ensure that other workers remain well clear of the operation when operator cannot see all parts of the jib and bucket Whether all workers exposed to such dangers have received induction as necessary Whether there are barriers to separate workers, pedestrians, and vehicles from moving equipment All workers have high reflective vests and hard hats as minimum PPE 	<ul style="list-style-type: none"> Workers in the trench are kept well away from the face and those at ground level kept outside slewing radius of the machine. Experienced banks man is used to guide the operator and to ensure that other workers remain well clear of the operation when operator cannot see all parts of the jib and bucket Whether all workers exposed to such dangers have received induction as necessary Whether there are barriers to separate workers, pedestrians, and vehicles from moving equipment All workers have high reflective vests and hard hats as minimum PPE 	
25.	Hazard due to electrocution	<ul style="list-style-type: none"> Insulation and earthing of electrical panel and cables 	<ul style="list-style-type: none"> Control rooms for crusher, pug mill, concrete batch plant, bitumen heating facility, and generator sets Power outlets at workshops 	Monthly	<ul style="list-style-type: none"> Visual observation Interview with workers 	Whether control panels and cabling are well insulated and earthed	Control panels and cabling are well insulated and earthed	Contractor under supervision of Engineer
26.	Risk of excessive exposure of workers and	<ul style="list-style-type: none"> Storage of gauge Transport of gauge it is transported Protection of workers and 	<ul style="list-style-type: none"> Storage facility for nuclear gauges Work site (where the gauge is used) 	Weekly	<ul style="list-style-type: none"> Visual observation Interview with workers 	<ul style="list-style-type: none"> Whether the Contractor has a licenses to own and use the nuclear gauges Whether the gauges are 	<ul style="list-style-type: none"> The Contractor has licenses to own and use the nuclear gauges Gauges are stored in a 	Contractor under supervision of Engineer, TAEC

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No.	Impact	Parameter/ Activity to be Monitored	Sampling area	Monitoring Frequency	Measuring Method	Measuring Unit	Target Level/ Indicator	Responsibility
	communities to ionizing radiation resulting from the use of nuclear gauges	public against exposure to radiations				<p>stored in a facility approved by TAEC</p> <ul style="list-style-type: none"> Whether transportation of gauges done by a dedicated car marked with warning signs in accordance with law and regulations Whether staff operating the gauges are trained in accordance with the law Whether working areas are demarcated by reflective tapes 	<p>facility approved by TAEC</p> <ul style="list-style-type: none"> Gauges transported by a dedicated car marked with warning signs in accordance with law and regulations Only staff trained in accordance with the law are allowed to operate the gauges Working areas are always demarcated by reflective tapes 	
27.	Increased incidence of HIV / AIDS	<ul style="list-style-type: none"> HIV/AIDs alleviation program Distribution of condoms 	Camps, work sites, toilets	Monthly	<ul style="list-style-type: none"> Visual observation Review of training reports Visual observation Interview with workers 	<ul style="list-style-type: none"> Whether condoms are distributed at strategic points Whether there is evidence that the Contractor conducts training Whether No. of trainings conducted are in accordance with approved training programme 	<ul style="list-style-type: none"> Condoms are distributed at strategic points There is evidence that training that the Contractor conducts training Whether No. of trainings conducted are in accordance with approved training programme 	Contractor under supervision of Engineer, approved HI/AIDs training NGO

9.3 DETAILS ON MONITORING FOR POLLUTION OF SURFACE WATER

As indicated in Table 22, the effects of construction activities across/along rivers monitoring and reporting on water quality shall be done by the Contractor (through E & S Manager). The monitoring shall basically entail routine monitoring of rivers across the project road during earthworks and construction of or culverts. It shall consist of making field measurements of turbidity and pH. The procedure for routine monitoring shall be as follows:

- Two water sampling points shall be established at all major rivers and those used for domestic purposes, one 100m upstream, and the other point will be placed 50 down stream
- Measurements of pH (a gauge for effectiveness of control of water pollution during concreting activities) and Turbidity (NTU) [a gauge for effectiveness of soil erosion control] shall be taken at point approximately 30 minutes before the start of construction activity each day.
- pH measurement shall be taken at each site twice/day during construction activities
- Measurements for Turbidity and pH will be taken at mid depth in the water column.

9.4 RESPONSIBILITIES FOR MONITORING IMPLEMENTATION OF ESMP

To ensure effective implementation of the mitigations measures, the Supervising Engineer shall deploy an Environmental and Social Specialist (ESS), who will be responsible for regular monitoring of implementation of ESIA, ESMP, Site Specific Environmental and Social Management Plan (SSESMP), and Site Specific Health and Safety Management Plan (SSHSM) by the Contractor. He/she should as well be responsible for ensuring that reporting of implementation of the measures is completed in accordance with the requirements.

The ESS will have the following responsibilities:

- Review Contractor's SSESMP and SSHSM
- Monitoring the effectiveness of the ESMP and other mitigation measures.
- Asses the performance of environmental controls and proposed mitigation measures
- Ensure that the Contractor corrects/ review mitigation measures that are not functioning acceptably
- To provide regular reports on monthly basis on the status of the Contractor's compliance with the ESIA, ESMP, SSESMP, and SSHSM.
- When available on site, attend monthly progress meetings
- To provide input for the preparation of monthly progress report by the Supervising Engineer

The ESS shall visit the project site for 14 days every month. During the visit the ESS shall carry out site inspection and review relevant Contractors documents to determine the compliance of the Contractor with SSHSEM. If necessary, the ESS may interview Contractor's staff.

If the ESS believes that there is a potential for unacceptable impacts, he/she may require changes in the operating procedures or additional mitigations measures. If on the opinion of the ESS, there is serious environmental, social, of health and safety violation by the Contractor, he/she may advise the Resident Engineer to suspend part or all works, until such time that the Contractor has rectified all the serious environmental, health and safety deficiencies to the satisfaction of the Engineer.

SECTION 10: SUMMARY OF PUBLIC CONSULTATIONS AND OPINION EXPRESSED

An important element in the process of impact assessment is consultation with stakeholders (Interested and Affected Parties) to gather information needed to complete the assessment. It is a process whereby different stakeholders influence and share their views regarding development initiatives, decisions, and resources that have an impact on their lives and livelihoods.

Public consultation encourages easier project acceptance and reduces resistance which would otherwise slow down or hamper the project implementation.

Fundamentally these consultations were intended to collect views, concerns, perceptions of the stakeholders related to the rehabilitation of the road. Information related to population, socio-economic activities, environmental issues, sources of livelihood and living standards were also collected.

Prior to the commencement of detailed ESIA, the experts visited the TANROADS Regional Manager based in Kigoma to inform them of the impending ESIA.

Stakeholders and public involvement was therefore aimed at assisting the consultant in:

- Determining the scope of the ESIA review
- Deriving specialist knowledge about the site
- Evaluating relative significance of the likely impacts
- Improve project design and, thereby, minimize conflicts and delays in implementation;
- Proposing mitigation measures
- Ensuring that the ESIA review is objective, truthful and compete
- Facilitate the development of appropriate and acceptable entitlement options;
- Increase long term project sustainability and ownership

10.1 PROJECT STAKEHOLDERS

The project stakeholders of this project can be classified into the following categories:

- Ministry of Works, Transport, and Communication: Road Sector Environment Section under the department of Works is responsible for overseeing management of environment within the road sector and the preparation/implementation of ESIA required in the road sector
- The project proponent - Tanzania National Roads Agency
- Buhigwe and Kasulu District Councils: the following department executives are relevant to this project; Planning and Liaison Officers, Forest Officer, Game Officers, Water Engineers, and Environment Management Officers (responsible for promoting environmental awareness in the district related to the protection of the environment and the conservation of natural resources)
- Government institutions: Tanzania Electric Company Ltd, National Environment Management Council (NEMC)
- Communities in the DIZ and AI of the project area

During ESIA study most of the above stakeholders were consulted as shown by stakeholders consultation form in Appendix II which is signed by each of the stakeholder who was consulted.

10.2 HOW STAKEHOLDERS WERE INVOLVED

Consultation with statutory bodies and institutions were made through direct personal interviews. The agenda for these consultations included:

- Presenting the Project
- Defining the Regional/District institutional framework
- Discussing recent experience with respect to compensation eligibility criteria and entitlement packages
- Obtaining from the authorities their environmental and socio-economic concerns and perceptions regarding the proposed road
- Domestic water supply profile in the project area, locations and distribution of domestic water utilities along and across the project road
- Environmental profile in the project area, possible environmental impacts of the project and mitigation measures
- Whether there is any wildlife or forestry protected area in the neighbourhood of the project area.

The following table (Table 24) lists dates, names, and issues that were discussed with statutory officials as well as governmental and non-governmental organizations that were consulted during ESIA study.

Table 24: Schedule of Consultation with Statutory Bodies and Institutions during ESIA Study

Date	Name of Person	Title	Issues Discussed
15/07/2016	Wilson Ruheta	DWE – Kasulu DC	<ul style="list-style-type: none">• Domestic water supply profile for villages along the project road.• Water supply utilities that are likely to be affected by the road upgrading• On-going water supply development and plans that are likely to be affected by the road upgrading• Potential impacts of proposed road upgrading to water supply utilities and proposal to mitigate them
15/07/2016	Edwin R. Kunyekwa	DFO/DEMO - Kasulu DC	<ul style="list-style-type: none">• Environmental profile, including vegetation cover profile along the project road, with special interest in forest• Whether there exist any forestry protected areas in the neighbourhood of the project road• Potential impacts of the project to the environment including forestry and proposal for mitigation measures
15/07/2016	Elicana A. Maige	DGO - Kasulu DC	<ul style="list-style-type: none">• Whether there is any wildlife area along the project road and if any potential impacts to the wildlife area and mitigation measures

Date	Name of Person	Title	Issues Discussed
15/07/2016	Jacob W. Kilatu	TFS - Kasulu DC	<ul style="list-style-type: none"> Whether there are development plans that are likely to affect any affected by the proposed road upgrading Potential impacts of the project and proposal for mitigations measures
22/07/2016	Anosta Nyamoga	DED- Buhigwe DC	<ul style="list-style-type: none"> Introduction of the proposed road upgrading project and seeking for consent to discuss with executive under him Whether he has any environmental/ social issues that should be considered during the study
22/07/2016	Mwafrika Nyamoga Taragwa Thomas Getruda Nicholas	Ag. DWE – Buhigwe DC Water Officer - Buhigwe DC Water Officer - Buhigwe DC	<ul style="list-style-type: none"> Domestic water supply profile for villages along the project road. Water supply utilities that are likely to be affected by the road upgrading On-going water supply development and plans that are likely to be affected by the road upgrading Potential impacts of proposed road upgrading to water supply utilities and proposal to mitigate them
22/07/2016	Aiden Ngotomeli	Ag. DE - Buhigwe DC	Potential sources of naturally-occurring construction materials
22/07/2016	Said A. Hue	Ag. DPLO - Buhigwe DC	<ul style="list-style-type: none"> Whether there are development plans that are likely to affect any affected by the proposed road upgrading Potential impacts of the project and proposal for mitigations measures
22/07/2016	Kasulwa James	DFO - Buhigwe DC	<ul style="list-style-type: none"> Vegetation cover profile along the project road, with special interest in forest Whether there exist any forestry protected areas in the neighbourhood of the project road Potential impacts of the project to forestry and proposal for mitigation measures

The public was consulted through public meetings which were conducted at selected villages. The main objectives of community consultations were:

- To provide clear and accurate information about the project to the communities along the proposed road
- To obtain main concerns and perceptions of the population and their representatives regarding the road;
- To obtain opinions and suggestions directly from the affected communities on their preferred mitigation measures

To ensure that these groups participate in meetings, advance notices were sent to village government leaders to inform the communities, including disabled, women, aged people, and youth of the meeting. Secondly, every village indicated the convenient date, time, and convenient venue to convene the meetings. In collaboration with village leaders, central locations were identified for the meeting venues.

Consultations and public meetings were held in six (6) different venues to allow community members to participate fully by arranging close to their places of residences. People of from groups of different interests were involved as well as ward and village and district officials whereby varying views, concerns and questions about the project were expressed by communities and other stakeholders and were collected by the consultant team for review and or further use.

During consultation the stakeholders were briefed on the proposed road project as well as the ESIA process, and the governing environmental legislation. The public was then given opportunities to air their views and opinions concerning the project. Potential impacts, both positive and negative impacts as well as mitigation measures were also gathered as presented in the preceding section.

Presented in Table 25 is a schedule of public consultative meetings, which were held in different villages along the project road corridor. The schedule shows dates, participated Villages, and the number of community members that participated in the meetings.

Table 25: Schedule of Consultative Meetings with Communities along the road

No	Date	Time	No of Participants	
			Participated Village(s)	No of Attendees
1.	22 nd July 2016	Unrecorded	Munanila, Musagara, Mkatanga,	86
2.	23 rd July 2016	10:03 – 11:01 hrs	Kibwigwa	48
3.	23 rd July 2016	Unrecorded - 14:45 hrs	Songambele	30
4.	24 th July 2016	12:19 – 13:47 hrs	Kasulu town	62
5.	24 th July 2016	Unrecorded	Herujuu	46
6.	25 th July 2016	Unrecorded	Kitagata	54

The meetings were chaired by village chairmen and recording of minutes was done by village Executive officers. Copies of minutes of the meetings are attached as Appendix II. Notably although the minutes were recorded by the village representatives, the consultant also recorded issues, concerns, and views of the participants to be included in the public consultation chapter of this report to ensure that all discussed issues do not pass unrecorded.

10.4 RESULTS OF STAKEHOLDERS CONSULTATION

10.4.1 Consultation with Statuary Bodies and Institutions

The following table (Table 26) summarizes issues and concerns that were raised by the statutory bodies and institutions that were consulted during ESIA study.

Table 26: Results of consultation with Statuary Bodies and Institutions

No.	Institution/ Village	Issues/ concerns
1.	Wilson Ruheta – DWE, Kasulu	<p>Sources of domestic water for villages along the project road are:</p> <ul style="list-style-type: none"> Herujuu and Karunga villages: Pumping scheme with source at Chogo. Several (3 Nos) of Domestic points and distribution pipe lines are close to the project road. In addition some distribution pipe lines cross the project road. Kasulu: A number of distribution lines either run along or cross the road. Plans are under way to rehabilitate the existing water supply system for Kasulu town. Plans are underway to rehabilitate the existing water supply system for Kasulu as well as construct additional water supply sources. The design for new sources was done between years 2003 – 2004.

No.	Institution/ Village	Issues/ concerns
		<ul style="list-style-type: none"> The water supply utilities are likely to be disrupted by construction activities. To mitigate the impact, prior to commencing construction works, the utilities should be relocated. In addition, the design should provide services ducts to allow for future extension/ expansion of the existing water supply system. Locations of service ducts should be established in consultation with DED office
2.	Edwin R. Kunyekwa – DFO/ DEMO, Kasulu DC	<ul style="list-style-type: none"> Significant vegetation along the project road consists of cypress, eucalyptus strip trees that are located along the road. Most of these trees are privately owned. Some of the trees are located too close to the road that construction activities will necessitate clearing some of them. There is no forest protected area in the DIZ of the road
3.	Elicana A. Maige – DGO, Kasuu DC	There is no wildlife area in the neighbourhood of the project area.
4.	Jacob W. Kilatu – DPLO, Kasulu DC	<ul style="list-style-type: none"> Several government institutions buildings such as schools, dispensaries/ health centres, and administrative buildings located close to the road are likely to be affected by the road upgrading activities, especially widening and construction of diversion roads. Private properties, such as buildings and farmlands) are also likely to be affected by the project. To mitigate the impact, construction activities should be done in a manner that minimizes impacts to government and private properties. Construction will employ both skilled and non-skilled labour. To enhance the positive impact, priority for employment should be given to the local people. The project should minimize the impact due to blasting, material borrowing
5.	Anosta Nyamoga – DED, Buhigwe DC	<ul style="list-style-type: none"> The project road is very important as it connects the District with regional head quarter. Presently the road is passable with lots of difficulties during rainy season. The design of the road should ensure that drainage system is adequate The District should be availed with Bill Of Quantities for monitoring purpose
6.	Mwafrika Nyamoga – Ag. DWE, Buhigwe DC Taragwa Thomas – Water Officer, Buhigwe DC Getruda Nicholas - Water Officer, Buhigwe DC	<ul style="list-style-type: none"> Munanila, Musagara, and Mkatanga villages are supplied with pipe water from pumping schemes. There are several Domestic Points (DPs) along the road. The DPs are however no longer operational. Plan are underway to revive the DPs Bwelanka: Improved springs and open traditional shallow wells Mulera and Buhigwe villages are supplied with pipe water from Herujuu group scheme. A number of DPs are close to the road and distribution pipe either cross or close to the road Kavomo: Herujuu group scheme. A number of DPs are close to the road Songambebe: Distribution pipes are either close or cross the road. In addition, a storage tank, several DPs and valve chambers are located close to road. <p>The DPs, valve chambers, and water storage tanks located close to the road as well as distribution pipe lines across the road are likely to be disrupted. To mitigate the impacts:</p> <ul style="list-style-type: none"> Utilities that are located within the RoW should be retained, but if found impractical; they should be compensated at the cost of the

No.	Institution/ Village	Issues/ concerns
		project. <ul style="list-style-type: none"> • Service ducts should be installed to allow future extension or extension of the services. Locations of service ducts should be decided after consulting relevant district authority
7.	Aiden Ngotomeli – Ag. DE, Buhigwe DC	Potential sources of naturally-occurring materials are: <ul style="list-style-type: none"> • Kibande (between Munanila and Buhigwe), 5 Km off the project – road - source of G15 material • Herujuu, 4 Km off the project road as a source of G15v material • Herujuu – source of hard stone
8.	Said A. Hue – Ag. DPLO, Buhigwe DC	The proposed road upgrading will have the following impacts to the following development following plans: <ul style="list-style-type: none"> • Enhancement of the proposed construction of District council's office and staff housing (1 Km off the project road) • Enhancement of the proposed construction of bust stand, about 200m off the project road • Enhancement of the proposed construction market 100m off the project road • Relocation of houses along the road <p>To mitigate the impact, it is proposed that relocation of houses should be done in accordance to the law</p>
9.	Kasulwa James – DFO, Buhigwe DC	<ul style="list-style-type: none"> • Significant vegetation along the project road consists of cypress, eucalyptus strip trees that are located along the road. Most of these trees are privately owned. Some of the trees are located too close to the road that construction activities will necessitate clearing some of them. • There is neither wildlife nor forestry protected area in the neighbourhood of the project area

10.4.2 Consultation with Communities along the Project

The following table (Table 27) summarizes issues and concerns that were raised by the public through public meetings and interviews during ESIA study. It is worth to note that the views are not categorized according to village/meeting because there were many repeated issues.

Table 27: Results of consultation with the Public

Village	No.	Issues/Comment from community	Response by Consultant to Issue Raised
Mkatanga and Musagara	1.	Increase in agricultural production: The project will assist farmers to access markets for farm produce and purchase farm inputs at a reasonable prices	It is a valid potential impact
	2.	Job opportunities to village members: The project will create petty business especially to youths as well as women who will be there for small business like food vendors. During road construction residents will get temporary and permanent employment from the contractors	The contractor will be advised give priority in employment, especially unskilled labour to people residing along the project road. Nevertheless contractors are reluctant to employ local people because of their tendency of stealing project properties especially cements, fuels and steel bars.

Village	No.	Issues/Comment from community	Response by Consultant to Issue Raised
			The village leaders are advised to collaborate with contractors to safeguard the project properties
	3.	Improved access to social services: This will enable village dwellers to reach social health services on time at reasonable cost especially to pregnant women	The contractor shall provide health facilities to his workers as much as possible
	4.	Increase of Crimes: The increase of crimes will be influenced by interaction between people from neighbouring countries unless immediate precautions are in place like establishing police stations nearby villages, community policing and all guests should be reported to village leaders	The contractor will also engaged security guards to his compound as other important locations and the engineers compound
	5.	Psychological disturbance: will be faced by victims who will lose their properties with no payment during construction period	All eligible affected people will be compensated according to the Tanzania regulations and international good practice
	6.	HIV/ AIDS prevalence: Road project will have a negative impact on current growth rate of HIV/ AIDS. The presence of the road project might make the infection to shoot up if mitigation measures for the disease are not developed to accompany the implementation of the road project	The HIV/AIDS campaign will be launched along the road project construction to all project workers as well as villages surrounding the project
	7.	Increased road accidents: Accidents will increase during operations therefore precautions of installation of bumps; zebra crossing should be included in the road design. It is also important to educate communities on road uses as well as road act	All mentioned strategies will be incorporated in the project. During the road construction traffic management plan will be developed and implemented
Kibwigwa and Songambele	1.	Development of urban centres : The project will open up the newly established Buhigwe district through enhanced socio economic activities including increased social services, infrastructure such as electricity and telecommunication	It is a valid potential impact
	2.	Parking area considered in the design: Since the road is a trunk road, it is important to consider in the design on establishment of special areas for trucks parking to avoid unnecessary accidents caused by poor packing of the trucks	This will be incorporated in the design
	3.	Increased/ improved social and financial services and infrastructure: Upgrading of the It will influence investors and services currently unavailable in the district particularly at the district headquarters at Buhigwe town including Banks, Good guest houses, Hotels, Restaurants, Insurance services and other Government departments	It is a valid potential impact
	4.	Increase of infectious disease and accidents: Infectious diseases and accidents will increase therefore the capacity of existing medical services should be strengthened to cope with the increased demand during road construction and operation stage	The contractor will take care of his work force by providing medical facilities. The responsible authorities will take care of the rest

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Village	No.	Issues/Comment from community	Response by Consultant to Issue Raised
	5.	Increase of early and unplanned pregnancies: This is due to the interaction with guests who will be there for construction purpose as most of them will be men without wives, therefore constructor's camps should be built faraway from villages	There should be collaboration between parents, teachers and village governments to reduce truancy of school children
	6.	Students/pupils absenteeism: Due to the invasion of road constructions many students/ pupils will leave school search unskilled job hence decline in the quality of education. Stakeholders should clearly set strong by policy and rules to guide students/pupils	As above
Kasange and Herujuu	1.	Raised household income and standard of living: The proposed project will raise number of buyers (increased demand). Increased demand will raise prices of farm produce consequently increased income of farmers, hence accelerated quality of life	It is a valid potential impact
	2.	Employment opportunities to youth during project construction: Employment opportunities – the project will provide jobs to villagers either directly as labourers during road construction or indirectly through trading with workers and road users during and after construction, hence reducing poverty to some extent	
	3.	Improvement on transportation services: Due to the improvement on transportation services it will enable people to reach at the intended places timely at reasonable cost	
	4.	Increase of road accidents: Many people are not familiar with road signs especially children, elders and while others are normally drunk while crossing the road	
	5.	Family instabilities: The project workers might solicit couple and seduce them for sexual activities and this might cause conflict within families or breakage of marriages. So for that case villagers as whole should corporate in order to maintain their family status	
	6.	Unfair compensation: Communities are worried that the government might not pay them the real value of the affected properties. Most of the villagers think that the government will give them low compensation	The government will compensate every affected property according to the government schedule of properties. There are schedules made by the government in the Ministry of land in valuation department, these values are updated every year to take care of inflation of Tanzanian shilling. The same schedule which is used in other project will be used to evaluate the properties of this project
	7.	Temporary road diversions and bridge during road construction: During road construction temporary routes should be prepared so that vehicles/buses continue to	The suggestion will be presented to the responsible authority for consideration.

Village	No.	Issues/Comment from community	Response by Consultant to Issue Raised
		operate along the route. For example, near Herujuu village there is Kingati bridge. So villagers requested that during construction, the government should rehabilitate the Kingati bridge so that it will assist villagers to continue doing their daily activities with less impacts	The community were told that the operations of the services will continue during construction
	8.	Replacement of social infrastructure: If the project affect any public property e.g. school, water facilities, village market, church, mosque or any other institution, the Government should make sure that those properties are relocated for instance at Songambebe village there is community water well, community market and worshipping structures.	All affected community structures will be compensation and the users will be able to elect a new structure for use.
	9.	PAP participation: Compensation exercise should be implemented in a participatory manner where all family members will be aware of the entitlements of the affected properties and the amount of money expected to be received. This will help to avoid misuse of the money and family conflicts. The couple should be both signatories of the bank account.	It was stressed during the community meeting that all the couples affected should open a joint account where the both partners will be able to get money jointly and budget its used.
	10.	Adequate time should be provided to PAP for re-location. All PAPs wanted to know when the exercise is expected to take place. PAPs wanted to get prior-information on the commencement of the project particularly construction activities.	The PAPs were told that prior information will be given to them on time so that they can prepare themselves for vacating the RoW.
	11.	Indecisive tendency of the government retard people's development: Information about this road improvement has been heard for a long time but there is no serious steps taken to implement the plans. This has retarded development of people especially those residing along the road corridor, as they can neither improve their structures nor expand their businesses. They also cannot plant crops on the fields. The communities are keen to know when the project is going to be implemented as one of villager said that in the year 2010 they were informed about the same project but surprisingly until now the project is not yet implemented	The government is there for the development of its people. It has good intention for every citizen; however, the government has limited resources to implement every intention. It has to look for resources from different group within and outside. It is true that the government wanted to improve this road long time ago but the funds were not available to complete this long road. The government had to go and outsource funds from the AfDB. Now the funds are available now the government will construct this road as planned
	12.	Entitlement framework for tree owners is not known: Some people planted trees along the corridor for different uses either for shading or for timber, firewood and even charcoal. Entitlement for compensation of trees is not clear	Eligibility criteria will be used to select those who are eligible compensation and those who are not entitled. There are two measurements those who are located in 22.6to 30 metres will be

Village	No.	Issues/Comment from community	Response by Consultant to Issue Raised
			compensated while those in below 22.5 are not entitled for compensation
	13.	People's favour: Villagers requested the government to think profoundly and consider those who will be affected without compensation meaning that those who are within (45m) so the government should favour them by finding new destination for them to reside.	It might be difficult to rethink about those who are within 45m, because by doing so the government will be breaking its own laws.

10.5 STAKEHOLDERS CONCERNS AND HOW THEY HAVE BEEN ADDRESSED

Most of the concerns which were raised by stakeholders during consultation have been incorporated in the ESIA. Nevertheless, some of the concerns or proposals by the stakeholders could not be included due to technical and legal reasons. Table 28 summarises how concerns that were raised during ESIA study have been addressed in ESIA report.

Table 28: Stakeholders' Issues Response Form

No.	Issues Raised by Stakeholders	Response by Consultant to Issue Raised	Section in ESIA
1.	Road upgrading activities are likely to disrupt a number of domestic water utilities in particular domestic points, valve chambers, and pipe lines within the right of way. Construction activities are also likely to damage a water tank at Songambe. To mitigate the impact, prior to commencing construction works, utilities that are within the corridor of impact (domestic points, valve chambers, and pipe lines) should be relocated/compensated at the cost of the project. In addition, the design should provide for services ducts to allow for future extension/ expansion of the existing water supply system. Locations of service ducts should be established in consultation with DED office.	Domestic water supply utilities that are located within the RoW should be retained, but if they cannot be retained, they should be compensated	7.2.3.4
2.	Construction activities will employ both skilled and non-skilled labour. To enhance the positive impact, priority for employment should be given to the local people.	Priority of employment is given to the local people	7.1.1 and 7.2.1
3.	The project should minimize the impact due to blasting, material borrowing	Impacts related to blasting have been proposed	7.2.2.2 and 7.2.1.7
4.	The design of the road should ensure that drainage system is adequate	The impact has been addressed in the design through proper design of culverts to ensure that they are	7.2.4.3

No.	Issues Raised by Stakeholders	Response by Consultant to Issue Raised	Section in ESIA
		capable of sustaining possible peak water flows.	
5.	The District should be availed with Bill Of Quantities for monitoring purpose	This cannot be decided at the ESIA study level, but will be by the project proponent during tendering stage	NA
6.	The proposed road upgrading will cause damage to several houses along the road. To mitigate the impact, it is proposed that relocation of houses should be done in accordance to the law	Affected properties outside 22.5m from the centreline of the existing road will be evaluated and compensated in accordance with the law.	7.2.3.3
7.	The project will create petty business especially to youths as well as women who will be there for small business like food vendors. During road construction residents will get temporary and permanent employment from the contractors	The contractor will be advised give priority in employment, especially unskilled labour to people residing along the project road.	7.1.1
8.	Road upgrading will improves access to social services: This will enable village dwellers to reach social health services on time at reasonable cost especially to pregnant women	The contractor shall provide health facilities to his workers as much as possible	6.6.1.8
9.	Road upgrading will increase the rate of crimes. The increase of crimes will be influenced by interaction between people from neighbouring countries unless immediate precautions are in place like establishing police stations nearby villages, community policing and all guests should be reported to village leaders	The contractor will also engaged security guards to his compound as other important locations and the engineers compound	6.6.2.6
10.	Victims who will lose their properties with no payment during construction period will suffer psychological disturbance	All eligible affected people will be compensated according to the Tanzania regulations and international good practice	7.2.3.3
11.	Road project will have a negative impact on current growth rate of HIV/ AIDS. The presence of the road project might make the infection to shoot up if mitigation measures for the disease are not developed to accompany the implementation of the road project	The HIV/AIDS campaign will be launched along the road project construction to all project workers as well as villages surrounding the project	7.2.12.2.4
12.	The road upgrading will Increase road accidents. Accidents will also increase during operations therefore precautions of installation of bumps; zebra crossing should be included in the road design. It is also important to educate communities on	All mentioned strategies will be incorporated in the project. During the road construction traffic management plan will be developed and implemented	6.2.6, 6.3.2.7, 6.3.3.8, 6.6.2.1

No.	Issues Raised by Stakeholders	Response by Consultant to Issue Raised	Section in ESIA
	road uses as well as road act		
13.	The project will open up the newly established Buhigwe district through enhanced socio economic activities including increased social services, infrastructure such as electricity and telecommunication	It is a valid potential impact	6.6.1.7 and 6.6.1.9
14.	Since the road is a trunk road, it is important to consider in the design on establishment of special areas for trucks parking to avoid unnecessary accidents caused by poor packing of the trucks	This concern will be incorporated in the design	2.2
15.	Upgrading of the road will influence investors and services currently unavailable in the district particularly at the district headquarters at Buhigwe town including Banks, quality guest houses, Hotels, Restaurants, Insurance services and other Government departments	It is a valid potential impact	6.6.1.10
16.	Infectious diseases and accidents are likely to increase. The capacity of existing medical services should therefore be strengthened to cope with the increased demand during road construction and operation stage	The contractor will take care of his work force by providing medical facilities to his workers. The responsible authorities will take care of the rest.	7.2.12
17.	It is likely that there will be an increase in unplanned pregnancies: This will result from interaction with guests who will be there for construction purpose as most of them will be men without wives, therefore constructor's camps should be built faraway from villages	There should be collaboration between parents, teachers and village governments to reduce truancy of school children	7.2.10, 7.2.12.2.4
18.	Construction activities are likely to tempt school children to abstain from school in search of unskilled job hence decline in the quality of education.	There should be collaboration between parents, teachers and village governments to reduce truancy of school children	6.3.11
19.	The proposed project will raise number of buyers (increased demand). Increased demand will raise prices of farm produce consequently increased income of farmers, hence accelerated quality of life	It is a valid potential impact	6.6.1.13
20.	Improvement on transportation services will reduce travel time and cost	It is a valid potential impact	6.6.1.6, 6.6.1.11
21.	Many people are not familiar with road signs especially children, elders and while others are normally drunk while crossing the road	The Contractor shall design and implement a training programme to create road safety awareness for all the schools along the project road	7.2.3.8

No.	Issues Raised by Stakeholders	Response by Consultant to Issue Raised	Section in ESIA
22.	The project workers might solicit couple and seduce local women for sexual activities and this might cause conflict within families or breakage of marriages. So for that case villagers as whole should corporate in order to maintain their family status	Cannot be mitigated at the project level	NA
23.	Communities are worried that the government might not pay them the real value of the affected properties. Most of the villagers think that the government will give them low compensation	The government will compensate every affected property according to the government schedule of properties. There are schedules made by the government in the Ministry of land in valuation department, these values are updated every year to take care of inflation of Tanzanian shilling. The same schedule which is used in other project will be used to evaluate the properties of this project	7.2.3.3
24.	During road construction temporary routes should be prepared so that vehicles/buses continue to operate along the route. For example, near Herujuu village there is Kingati bridge. So villagers requested that during construction, the government should rehabilitate the Kingati bridge so that it will assist villagers to continue doing their daily activities with less impacts	The community were told that the operations of the services will continue during construction	7.2.3.8
25.	If the project affect any public property e.g. school, water facilities, village market, church, mosque or any other institution, the Government should make sure that those properties are relocated for instance at Songambele village there is community water well, community market and worshipping structures.	All affected community structures will be compensation and the users will be able to elect a new structure for use.	7.2.3.4, 7.2.3.12
26.	Compensation exercise should be implemented in a participatory manner where all family members will be aware of the entitlements of the affected properties and the amount of money expected to be received. This will help to avoid misuse of the money and family conflicts. The couple should be both signatories of the bank account.	It was stressed during the community meeting that all the couples affected should open a joint account where the both partners will be able to get money jointly and budget is used.	7.2.3.3
27.	Adequate time should be provided to PAP for re-location. All PAPs wanted to know when the exercise is expected to take place. PAPs wanted to get prior-information on the commencement of the project particularly construction activities.	The PAPs were told that prior information will be given to them on time so that they can prepare themselves for vacating the RoW.	7.2.3.3
28.	Information about this road improvement has	The government is there for the	NA

No.	Issues Raised by Stakeholders	Response by Consultant to Issue Raised	Section in ESIA
	been heard for a long time but there is no serious steps taken to implement the plans. This has retarded development of people especially those residing along the road corridor, as they can neither improve their structures nor expand their businesses. They also cannot plant crops on the fields. The communities are keen to know when the project is going to be implemented as one of villager said that in the year 2010 they were informed about the same project but surprisingly until now the project is not yet implemented	development of its people. It has good intention for every citizen; however, the government has limited resources to implement every intention. It has to look for resources from different group within and outside. It is true that the government wanted to improve this road long time ago but the funds were not available to complete this long road. The government had to go and outsource funds from the AfDB. Now the funds are available now the government will construct this road as planned	
29.	Entitlement framework for tree owners is not known: Some people planted trees along the corridor for different uses either for shading or for timber, firewood, and even charcoal. Entitlement for compensation of trees is not clear	Eligibility criteria will be used to select those who are eligible compensation and those who are not entitled. There are two measurements those who are located in 22.5 to 30 metres will be compensated while those in within 22.5m are not entitled for compensation	7.2.3.3
30.	People's favour: Villagers requested the government to think profoundly and consider those who will be affected without compensation meaning that those who are within (45m) so the government should favour them by finding new destination for them to reside.	It will be difficult to rethink about those who are within 45m, because by doing so the government will be breaking its own laws.	7.2.3.3

SECTION 11: CONCLUSION AND RECOMMENDATIONS

11.1 CONCLUSION

The road upgrading is essential for the development of the economy of Tanzania and the neighbouring countries such as Rwanda, Burundi, and Uganda. The project will have both positive and negative impact to the environment and the local communities along it.

Given the fact that Burundi is a landlocked country with very high transport costs and transit time, the creation of a new corridor will reduce transport costs and provide a boost to Burundi's export as well as cutting the cost of imports. Lower inputs should give the Burundi economy higher growth rates.

For Tanzania the road will help local and regional traffic and open up areas of large agricultural potential. Greater economic interaction with Burundi will boost the regional economy and lower transport costs across all corridors

Other positive impacts the project will have improved road safety, and reduced maintenance costs of the road.

One of the most negative significant sociological impacts that will result from the road project will be the issue of resettlement and compensation due to permanent loss of land as the result of trying to recover and/or acquire the right of way required for the project road, new alignments on sharp curves or due to extension of road reserve. However, there will be no major realignment and therefore the number of people that will be displaced will be few. Other negative impacts will include disruption of public utilities, increased noise, and vibrations, and deterioration of ambient air quality during construction, increased traffic accidents, loss of vegetation, soil erosion, and soil and water pollution.

The spread of HIV/AIDs, STIs associated with immigrant road construction workforce, sitting of the construction camps and later the presence of truck drivers that will use the project road were mentioned to be sociological impacts of the project. This was a major concern and was highlighted during public consultations and the measures to be taken by the Contractor were mentioned to the respective communities consulted.

Measures have been proposed to enhance impacts which are positive to the environment and the local people. For those impacts that are negative, mitigation measures have been proposed to avoid or abate them to the extent possible for the purpose of maximizing benefits of the road project and minimizing detriments of the project intervention to the communities.

It has been estimated that the total cost for implementing mitigation measures (excluding the cost of compensation of affected properties) and monitoring plans is therefore **TZS 634,500,800/= (TZS Six hundred million, Five hundred Thousand Six hundred thousand Eight hundred only)**

11.2 RECOMMENDATIONS

Our recommendation, based on the assessment of the available information is that the road project be taken a step further into upgrading. Furthermore, it is recommended that the proposed mitigations measures be made binding for the construction and operation of the project road. This will ensure that environmental impacts are minimized and properly monitored during construction and operation and that unnecessary incidents and accidents are avoided. What's more important,

there are people occupying the road reserve. They have buildings within the road reserve and are involved in carrying out agricultural activities. The valuation of properties is on-going and compensation should be done at the early stage before commencement of road upgrading activities.

APPENDICES

APPENDIX I: PHOTOS



Photo 1: R.Bogwe at Km 46+900 - Note eucalyptus and Banana riparian vegetation



Photo 2: Bridge for R.Bogwe at Km 46+900



Photo 3: Typical Section where Realignment will be Necessary to Improve a Blind Horizontal Curve (Km 7+500)



Photo 4: Typical Section where Realignment will be Necessary to Improve a very Sharp Curve at Belanka Village Settlements (Km 11+100)



Photo 5: Strip of Large Cypress trees Close to the Road between Munanila and Mkatanga



Photo 6: Strip of eucalyptus trees Close to the Road between Km 4+700 and 6+900 LHS (Kibwigwa – Bwelanka)



Photo 7: Strip of eucalyptus trees Close to the Road between Km 4+700 and 6+900 both sides



Photo 8: Strip of Large eucalyptus trees Close to the Road between Km 21+700 and 21+900 LHS (Buhigwe – Songambe)



Photo 9: DP at Km 2+900, 8m RHS, Musagara primary school



Photo 10: Irritant Contact Dermatitis



Photo 11: Proposed Realignment Km 3+750 to 5+200



Photo 12: Proposed Realignment Km 20+400 to 21+200



Photo 13: Proposed Realignment Km 22+600 to 23+200

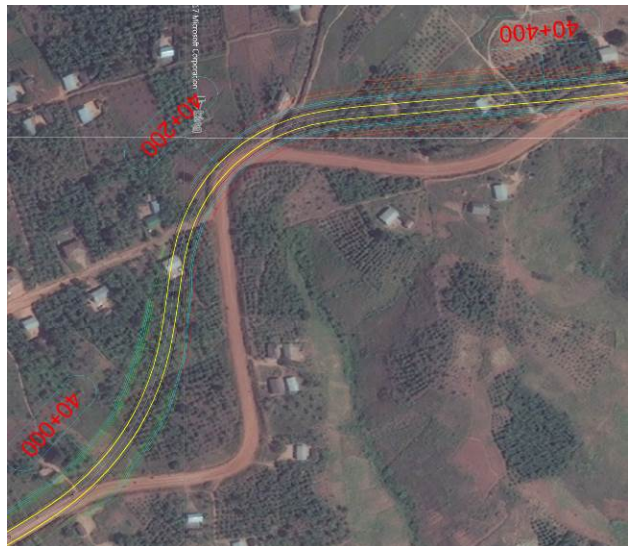


Photo 14: Proposed Realignment Km 39+800 to 40+400



Photo 15: A section R.Mgandazi – Note Farming Activities on water course



Photo 16: Acacia Vegetation characteristics between Km 2+900 and 4+100

APPENDIX II: LIST OF CONSULTED STAKEHOLDERS AND MINUTES OF CONSULTATIVE MEETINGS

APPENDIX III: TERMS OF REFERENCE AND LETTER OF APPROVAL BY NEMC

APPENDIX IV: LOCATION OF THE PROJECT ROAD

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