Director General
National Environmental Management Authority (NEMA)
P. O Box 67839-00200
Nairobi

RE: Environmental and Social Impact Assessment Study report for the proposed Rehabilitation and Upgrading of Bachuma Gate – Maji ya Chumvi (A109) Road

Pursuant to the Environmental Management and Coordination Act (AMCE) No. 8 of 1999, Section 58(1), the Second Schedule and EIA Regulations 2003 (Regulations 31, 34, and 35), I'm hereby pleased to submit an Environmental and Social Impact Assessment (ESIA) and Environmental Management and Monitoring Plan (EMMP) Report for the above proposed rehabilitation and upgrading of Bachuma gate – Maji ya Chumvi (A109) road.

Name Report prepared by:

Maina Githinji
ESIA LEAD EXPERT
P O Box 3952-00506 Nairobi

Lead Expert, Reg No 1126 (NEMA)  Signature  Date

Name of the Proponent

The Director General,
Kenya National Highways Authority (KeNHA),
P. O. Box 49712 – 00100,
Nairobi, Kenya
Tel. 254 20 8013842

Signature  Date
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List of Abbreviations and Acronyms in this Report

- AADT: Average Annual Daily Traffic
- AIDS: Acquired Immune Deficiency Syndrome
- BoQ: Bills of Quantities
- DWO: District Works Officer
- EMCA: Environmental Management and Co-ordination Act
- ESMMP: Environmental and Social Management and Monitoring Plan
- EIA: Environmental Impact Assessment
- GOK: Government of Kenya
- HIV: Human Immune Virus
- KeNHA: Kenya National Highways Authority
- Km: Kilometres
- KShs: Kenya Shillings
- M: metres
- MoR&PW: Ministry of Roads and Public Works
- WB: World Bank
- NEMA: National Environment Management Authority
- Pers, Comm.: Personal Communication
- Sq Km: Square Kilometres
- STD: Sexually Transmitted Diseases
- ToR: Terms of Reference
- www: World wide web
CHAPTER 1

1 EXECUTIVE SUMMARY

1.1 Introduction

The Government of the Republic of Kenya (GOK), through Kenya National Highways Authority (KeNHA) has earmarked some funding through the Development Budget for use rehabilitating and upgrading of Bachuma Gate – Maji ya Chumvi (A109) road, a section of Mombasa – Nairobi. The road is located in the Coast Province of Kenya within the formerly known Taita Taveta district, with a small section in Kaloleni district. The total length of the project road is approximately 53.4km, commencing at the Bachuma gate entrance to the Tsavo East National Park and terminating just 100m before the Maji ya Chumvi river bridge.

One of the key objectives of the study to rehabilitate the proposed road is to document the present condition of the environment and identify the positive and negative impacts that may result from the rehabilitation and upgrading works of the road.

1.2 Project Description

The objective of the detailed rehabilitation and overlay design as set out in the terms of reference was to identify the most appropriate and economically justified rehabilitation and strengthening solution to provide further design lives of 10 and 15 years at the preliminary design stage. The project road is an existing all weather road where the proposed upgrading was to be analysed for viability and appropriate engineering design. From inspection of maps and site visits, and engineering report by the consultant, no re-alignment (alternative route) of the existing road was found necessary.

Because of the high standards required for the road and in conformity with the adjacent road sections, it is proposed that road sections will be widened to carriageway widths of 7.0m width and also that the shoulder widths be increased to 2.0m.

The project is located in the map indicated in the ‘Location Map’ provided in the ANNEX 1.

1.3 Policy, Legal and Institutional Framework

The Government of Kenya’s Policy on Road Transport is to provide efficient and reliable road network to spur social, economic and security improvement. Kenya's National Environment Action Plan process culminated in the formulation of the policy on Environment and Development under Sessional Paper No. 6 of 1999. This policy presents broad categories of development issues that require a sustainable approach. Its main objectives are to ensure that:

- all development policies, programmes and projects take environmental considerations into account from the onset,
- an independent environmental and social impact assessment (EIA) report is prepared for any project or development before implementation.

The study has been guided by the NEMA’s draft EIA Guidelines (November 2002), and the World Bank’s Integrated Environmental and Social Assessment Guidelines.

The key legal instruments applicable to environmental and social management with respect to this road project are:

- Environmental Management and Coordination Act (EMCA), 1999
- Environmental Impact (Assessment and Audit) Regulations, 2003
1.4 Project Justification & Alternatives

The objective of the project is to improve road transport services along the A109, which forms part of the Northern Corridor, by improving the highway and enhancing mobility on the road. The proposed road project is heavy trafficked, with annual average daily traffic estimated at 3420 in 2011, based on traffic studies and growth rates carried out by the consultant in September 2003. As shown from these traffic studies, the heavy traffic is increasing with time as a result of the high economic growth experienced in Kenya and surrounding countries which use the road for its transportation of goods to and from Mombasa. The road also serves as an important role in the tourism industry by providing links to major tourist attractions such as Tsavo, Amboseli and Maasai Mara National parks, as well as the coastal towns of Mombasa and Malindi. The poor physical condition of this section of the road between Bachuma gate and Maji ya Chumvi, and its limited capacity are associated with significant travel time, high fuel consumption, high vehicle emissions as well as social inconveniences.

Upgrading and rehabilitating the road will improve economic activities such as stimulating economic growth of Kenya and other countries served by the road, and towns along the road. Indirect economic growth will be generation of employment opportunities for the local communities and provision of access to markets, schools, health facilities and administrative centres as well. Other benefits achieved will be achievement of the objectives of the economic recovery strategy (ERS) and poverty reduction strategy in Kenya.

There are no alternatives to the rehabilitation and overlay design of Bachuma Gate – Maji ya Chumvi section of the Nairobi to Mombasa (A109) road that fulfil the same objectives and functions as the current road. There are no other roads that links Mombasa to other parts of Kenya and other Eastern African countries that provides fast and cheap land transportation that can act as an alternative to the proposed road project.

Although there is air and rail transportation to Mombasa, this mode of transport cannot handle the amount of people and goods the road is currently serving. Therefore the road is the most important transport link from Mombasa to other parts of the country, and serving other Eastern African countries, Southern Sudan and parts of Democratic Republic of Congo.

Based on the above scenarios, the following options have been considered:

i. “Do nothing" option;

ii. Rehabilitate the existing carriageway and incorporate a better pavement with a wider shoulder, and improve on safety and traffic management along the road such as traffic signs, installation of bumps/humps, build parking bays, etc;
The first option will not achieve the objective of the project, since the road is in bad condition, and it is the only section of the road along Nairobi - Mombasa Road (A109) that has not been rehabilitated and widened to meet international trunk road standards. Traffic movement along the section of the road will also be hindered by deterioration of the road, thereby exacerbating the loss in vehicle maintenance, economic time, and therefore productivity, and result in higher fuel consumption, increased levels of air pollution and severely hindering mobility between the 55km section.

The second option may provide the best solution for the next 10-15 years, of improving the pavement and widening the shoulders to improve road condition and improve on safety along the road.

1.5 Environmental Baseline and Socio-Economic Conditions

**District Administrative Structures** - The road is located in the Coast Province of Kenya within the formerly known Taita Taveta and a small section in Kilifi districts, being part of the Nairobi - Mombasa (A109) road. The total length of the project road is approximately 53.4km, commencing at the Bachuma gate entrance to the Tsavo East National Park and terminating just 100m before the Maji ya Chumvi river bridge.

**Population Structure and Distribution** - The greater length of the road passes through an area with very low population, traditionally regarded as a wildlife dispersal area. In that regard, the area is regarded as dangerous for human settlement. The steadily growing population is concentrated in towns and villages along the road project, with key population located at Samburu, Taru, Mackinnon, and Meli Kubwa. There is a little bit of human settlement between Samburu and Maji ya Chumvi river bridge, as you tend to move further away from the national park. In this section, the Duruma ethnic community dominates the human settlement, particularly in Samburu and Silaloni divisions.

**Topography and Geology** - The terrain of the project area is rolling to undulating. The surface levels generally fall eastwards towards the coast and lies at about 397m at Mackinnon Road, 366m at Taru and 305m at Samburu and 244m on the Mnago Dunguni hills just before Maji ya Chumvi. The physiography consists of non-dissected erosion plains which are flat to gently undulating areas with very broad interfluves alternating with shallow bottom lands or valleys. The geology of the project area ranges from pre-Cambrian schist and gneisses of the Basement system to Permo-triassic shales, sandstones and conglomerates. The latter sediments are collectively called the Duruma sandstones.

**Climate and Rainfall** - The climate of the project area consists of Arid to Semi-Arid zones, which are influenced by two monsoon wind systems. The area falls within the coastal hinterland rainfall regime which is characterised by two rainy seasons; the long rains from March to May and short rains from November to December, both occurring at the change of monsoons. The two dry seasons in January - February and June - September are clearly defined, but still each month receives between 3% and 6% of the yearly rainfall. The average annual rainfall of the area is 500mm. Temperatures are fairly hot. Mean monthly maximum temperatures ranges from around 27°C to 32°C. Mean monthly minimum temperatures range from around 10°C to around 19°C.

**Vegetation and Wildlife** - Natural vegetation of the area is largely dry savannah woodlands dominated by Acacia and Commiphora species. From near Samburu to the end of the road project, the vegetation changes to coastal woodlands with conspicuous presence of Ulvaria species, and Euphorbia candelabrum. The road starts at the Bachuma Gate, an entry point to Tsavo East National Park, one of Kenya’s largest national parks and a major tourism attraction. The park has various wildlife resources, such as the Elephants, antelopes, hyenas, etc, and sometimes the wildlife moves beyond the park boundaries on to the road and other developed areas along the road.
Land use and other economic activities - The area is categorized as an Arid and Semi-Arid (ASAL) with very little agricultural crop production. Livestock farming is the main source of income for majority of the population of the area along the road project. There is a little trickle down benefits as a result of the tourism industry through local employment of people and selling of tourism products and items such as curios and hand carvings. The main land use in the project area includes national park, and semi-permanent cultivation and grazing. The main crops are maize, pigeon peas and some cassava. The road runs through the national park from Bachuma to Mackinnon Road.

Water Resources and Hydrology - People along the project road depend on nearby seasonal rivers/streams on the valleys which drain most of the water from the surrounding mountains such as Mnago Dunguni hills. The area is subjected to severe dry seasons, limiting the availability of water in the area for human consumption, livestock, and wildlife. There are no permanent rivers crossing the entire road project. There are a few water projects along the project road, and new projects are under implementation on areas that are not served with piped water.

Road Condition - The road section between Bachuma gate and Maji Ya Chumvi bridge is currently a 3m wide carriageway, with no shoulders provided, with the last major rehabilitation done in 2001. A number of defects, mainly longitudinal and transverse cracks and other deformations have started appearing on the road surface. On some sections of the road, slippage cracks are visible on both lanes, and the pavement is also deformed within the vicinity of the slippage cracks and on road edges.

Drainage and Soil Erosion - The general slope of the land is in the West-East direction rather than North-South across the road. The project area therefore does not have major soil erosion or drainage problems and the existing drainage structures serve only localized surface run-offs. However, during the rainy seasons, residents, especially near towns have experienced flooding on their properties from the surface runoff from the road, since there is no provision of drainage structures near towns located along the road.

Mining and Tourism Attractions - There is little mining of commercial minerals in the area. There is however a substantial tourism activities for tourists visiting the Tsavo National Park, Amboseli National Park, Maasai Mara and other Wildlife Conservatories along the road, and those travelling towards the coastal towns of Mombasa and Malindi.

1.6 Consultative and Public participation (CPP)

Several issues were raised by the stakeholders during the consultative public meeting. The following are the summary of views and benefits noted and presented by the stakeholders:-

- The stakeholders requested that the contractor employs his skilled and unskilled labour from the local residents along the road project.
- The residents advised that the contractor should make provisions for creation of awareness among his workers and the local community on HIV/AIDS.
- The stakeholders also requested construction of parking bays at centres along the road project to stimulate growth of businesses from motorists using the road.
- The project will also reduce the cost of transportation of goods for the communities along the road project.
- The local community suggested that suggestion boxes should be placed at various centres to open up communication between them, the government, and the contractor where they can give recommendations of minimizing the environmental impacts during the implementation of the project.
- They noted that the project will contribute to the reduction of accidents especially near market centres along the road.
- It will also open up the area for greater internal and external investment opportunities.
- The stakeholders also requested the contractor to strictly implement a program that will reduce air, noise, and water pollution during the construction period.
• The stakeholders also indicated they are willing to relinquish some land for road construction at an agreed compensation if necessary

1.7 Anticipated Impacts

In summary, the environmental issues likely to be of concern during the upgrading works of the project road are summarized below.

Positive Impacts

- Improved traffic flow
- Improved access to the towns and market centres
- Better access to hospitals, clinics, and schools along the project road
- During construction works, direct and indirect opportunities for business and temporary employment will arise for the local people, thus raising the standards of living
- Improved marketing of agricultural products
- Lower vehicle operating costs
- Opening up of the area for other opportunities and development

Negative Impacts

The potential negative impacts are minimal, and will mainly be felt during the construction phase of the project.

- Considering the physical geography of the area, there is a possibility of land degradation in some parts mainly through soil erosion
- Nuisance from noise and air (dust) pollution
- Ecological damage resulting from excavation works at material sites, route deviations, clearance of areas for construction camps, storage of equipment (fuel, lubricants and machinery);
- Water resources could be affected through altered drainage along the road during and after construction
- Social disruption and disturbance caused by the teams undertaking the construction works through displacement to give way for re-alignment.
- The workforce and construction works may exert pressure on water sources
- Access to towns/market centres could contribute to increase of crime and the spread of sexually transmitted diseases (STDs) and HIV/AIDS along the road.
- Sanitation and solid waste disposal at the construction camps are issues that could also impact negatively on the environment.
- Site clearance and construction works will have some degree of impact of flora and fauna of the area

1.8 Mitigation

Mitigation in some form is possible for all adverse impacts that may result from the proposed upgrading works.

- Changes to the hydrological regime will be taken into account in the road design through the construction of box and cross culverts so that the flow of water is unimpeded. Side drains and mitre drains, required to direct road runoff away from the road, will be properly designed to prevent accumulation of by the side of the road.
- The speed of road runoff is one of the major contributing factors to erosion and scouring in the side drains along the slopes of a road. In order to reduce the impact of runoff; scour checks and gabion mattresses should be introduced in the side drains at specified intervals, depending on the gradient of the slope. Grouted stone pitching and rock fill gabion works will be necessary to protect culvert inlets and outlets and control soil erosion.
• Dust emissions can be reduced during construction by dampening the gravel site areas, deviations and the road sections that are to be worked on. In the case of deviations, slowing the speed of traffic by using bumps and/or clearly marked road signs may contribute to reduced dust levels. Dust is a problem to settlements, wildlife and vegetation, and is exacerbated during the dry season. Poorly maintained vehicles emit noxious fumes (carbon dioxide, carbon monoxide, nitrogen oxides, and sulphur oxides), therefore necessary to properly maintain the plant and equipment used regularly.
• Deviations should wherever practical, be constructed within the road reserve. All deviations will be planned and their routes specified in the contract documents.
• Loss of land, and crops is usually mitigated through compensation. The Commissioner for Lands in the Ministry of Lands and Settlement should determine the amount of compensation to be paid for private land.
• Blasting of rock outcrops should be done only once a stability analysis has been conducted. Blasting should be done during the day, and residents in the vicinity of any blast sites should be suitably warned, including the time and date that the blasting is to take place. Blasting should not be carried out at night.
• The workforce at the camps should be discouraged from buying charcoal and cutting down trees and wooded shrubs for any wood, the act of which should be prohibited anywhere along and within the area of the project road.
• A central canteen for the workforce at each camp would contribute towards the general health in the camp as kitchen wastes can be disposed of in an organised manner, while hygiene can be monitored. The location of pit latrines in the camps should preferably be downhill of any potable water sources, or at least 200 m from any water body.
• HIV/AIDS and STD awareness campaigns should be conducted in the camps as well as in the towns, settlements/trading centres.
• Diligence on the part of the contractor is essential in mitigating negative impacts, and therefore mitigation measures should be specified in the tender documents and conditions of contract.

1.9 Environmental and Social Management and Monitoring Plan (ESMMP)

A comprehensive ESMMP is provided in this document, where mitigation measures, design features, or actual impacts can be monitored to ensure environmental acceptability of the project during and after construction. In some cases, monitoring can be done as part of routine or periodic maintenance, while other parameters, especially socio-economic or ecological imports, can only be effectively assessed in the longer term. Parameters that can be monitored during and after construction include:

- efficiency of drainage structures
- soil conservation interventions
- borrow pit rehabilitation
- sanitation at workmen’s camps
- impact on public health (for example due to HIV/AIDS and STDs, dust and clean drinking water)
- water quality
- noise quality
- impact on road safety

1.10 Conclusions and Recommendations

1.10.1 Conclusions

It is anticipated that in the long term there will be considerable economic benefit accruing to the areas of influence of the road project due to the direct and indirect economic benefits, improved traffic flow and increased business activities through the towns and market centres along and near the road project.
With completion of the Bachuma Gate – Maji ya Chumvi section of the Nairobi to Mombasa (A109) road, a fast and a good quality link will be provided in Kenya and other countries. The quality of life for residents areas along the road will also improve as development of centres along the road will develop, giving the residents an opportunity for economic growth. Key negative impacts will result from a number of issues including soil erosion during earth and excavation works and the construction of structures, e.g. culverts, cross-drains and bridges. Soil erosion, particularly as a result of excavation works at the gravel pits, can be mitigated through proper supervision and efficient operation activities. Pollution due to air, dust, noise, and sediments will occur during construction. During operation, vehicular air pollution and noise will increase due to the improved road. This will also impact on public health. Sewage systems or waste collection do not serve homes and towns along the road project. Therefore, sanitation and hygiene in the workmen’s camps will be a concern, but this can be mitigated by maintaining proper hygiene conditions at the camps.

With the total mitigation costs accounting for less than 5% of the total project costs, the Project is considered feasible environmentally as well as economically. It can be concluded that in the long term there will be considerable economic benefit accruing through increased business activities to the areas of influence of the market. Therefore, the proposed Bachuma Gate – Maji ya Chuma road rehabilitation and upgrade has positive impacts that outweighs the key negative impacts that results from the construction works.

1.10.2 Recommendations

The recommendations made in this report are summarised as follows:

- Establish office of public relations, complaints desk and suggestion boxes for communications along the road project
- The contractor should employ some of his unskilled and skilled labour from the local residents which the road traverses. It is recommended that this should be taken seriously as it could cause friction among communities living along the route and the construction workers from outside the area. Where possible local residents should be used during construction works
- New gravel pits must be cordoned off or fenced during use, and rehabilitated after use or converted to water pans for use by local people and wildlife
- It is also recommended that during implementation of the project, rehabilitation of the area water projects should be considered which in turn would provide water for the construction. The project should then be reverted to the community and act as a social responsibility to the community
- Unnecessary clearing of vegetation should be avoided to preclude additional erosion. Shrubs and grass should be planted along road embankments to prevent erosion
- Road safety signs and other precautionary features should be constructed to guard against the likelihood of increased incidence of accidents especially at railway crossings, schools and market centres.
- A copy of the environmental management and monitoring plan must be given to the Contractor prior to construction. The contractor needs to draw up an environmental management plan of his own to show how he will address all the mitigation measures. The Supervising Engineer is responsible for assessing the Contractor’s environmental management plan.
- Compensation to landowners through direct negotiations and agreement between the Ministry of Lands and the land owners/group ranches or clans who must relinquish their land for the project road must be fair and payments have to be made promptly. Compensation should cover crops, all structures (permanent and mud-and-wattle structures, sheds, fences, etc.) and land.
1.11 Presentation of this Report

This report presents the findings of the preliminary study for the project roads, and recommends mitigation measures that should be incorporated in order to minimise adverse impacts that may arise from the design, construction and operation works.

**Chapter 1** Gives an Executive Summary and recommendations of the EISA and EMMP study

**Chapter 2** Gives an introduction and background information relevant to the study, describing the objectives and requirements of the study.

**Chapter 3** Outlines the legal and regulatory framework of the study.

**Chapter 4** Describes the environmental and social baseline information which includes the administrative, physical, natural and social environments of the project area.

**Chapter 5** Briefly outlines the Project justification and alternatives to the project

**Chapter 6** Briefly outlines the key project components that are relevant to the environmental study, including the current environmental and socio-economic impacts and observations due to the existing road.

**Chapter 7** Outline the views gathered by stakeholders during the Consultative Public Participation (CPP)

**Chapter 8** Addresses impacts anticipated and proposed mitigation measures during and after road upgrading works.

**Chapter 9** Environmental Management and Monitoring Plan

1.12 Study Experts

The study team involved the following experts:

(i) Maina Githinji - ESIA Project Lead Expert (Kinconsult Associates)
(ii) Eng Peter Otaya - Highway Engineer (Kinconsult Associates)
(iii) Dr Evans Mwangi - Ecologist / Biologist (Kinconsult Associates)
(iv) Peter Kahara - Sociologist (Kinconsult Associates)
(v) Fredrick Maseno - Occupational Health and Safety expert (Kinconsult Associates)
CHAPTER 2

2 INTRODUCTION

2.1 Background
The Kenya National highways Authority (KeNHA) contracted KINCONSULT ASSOCIATES to carry out an Environmental and Social Impact Assessment for the detailed rehabilitation and overlay of Bachuma Gate – Maji ya Chumvi (A109) road.

An environmental and social impact assessment (EIA) study, of the existing road and proposed works, has been undertaken as part of the requirements of the terms of reference. An environmental management, mitigation and monitoring plan has also been prepared to provide details of mitigation measures necessary to reduce existing impacts and minimise any additional adverse environmental impacts during and following rehabilitation works of the road section. The environmental mitigation plan outlines institutional requirements and responsibilities necessary for the successful implementation of these mitigation measures.

2.2 Objectives of the Study
The overall objective of the study is to ensure that all environmental concerns are integrated in the implementation of the project in order to contribute to sustainable development of the general area. The study will document the present condition of the environment and identify the positive and negative impacts at primary, secondary and tertiary levels that may result from the rehabilitation works of the Bachuma Gate – Maji ya Chumvi (A109) road.

The objectives of the Environmental and Social Impact Assessment (ESIA) are:

- To fulfil the legal requirements as outlined in Section 58 to 69 of the Act and Regulation 31 of the EIA Regulations;
- To prepare a project report for submission to NEMA;
- To obtain background biophysical information of the site, legal and regulatory issues associated with the project;
- To assess and predict the potential impacts during site preparation, construction and operational phases of the project;
- To allow for public participation;
- To make suggestions of possible alterations to the proposed design, based on the assessment findings;
- To propose mitigation measures for the potential significant adverse environmental impacts and safety risks;
- To prepare an Environmental Management and Mitigation Plan.

2.3 Scope
The scope of work conformed to the Terms of Reference (ToR) and included technical studies, field investigations, consultative public participation, discussion with key informants, identification of impacts, setting out of mitigation and preventative measures and a study of other project alternatives suggested in this report. The study was not to be limited to the project roads corridor, but also encompassed the surrounding areas.
2.4 Approach and Methodology

The approach and methodology for conducting this study is based on the Environmental Management and Co-ordination Act, 1999, and the Environmental (Impact Assessment and Audit) Regulations, 2003, and any other regulatory/statutory requirements in Kenya.

The Environmental Management and Co-ordination Act, 1999, indicates that all major roads, and roads in scenic, wooded or mountainous areas and wetlands require an environmental impact assessment (EIA) to be carried out. This study forms part of the preliminary environmental impact assessment study.

Fieldwork for the preliminary EIA study was conducted in January and February 2011.

Checklist methods together with the review of previous reports and unpublished works on the environment of the study were used to identify the environmental impacts of the project. Public involvement through consultative public participation meetings, interviews with key public figures and individuals in the area were also key to gathering information required to doing the environmental impact assessment for the road project.

Preliminary data on topographical surveys, hydrology and drainage, soils and materials investigations, and condition surveys of the existing project roads were also collected in the field during the visits to the area the project is located.

2.5 Terms of Reference (ToR)

In order that a comprehensive study of the environmental impacts of the proposed project is achieved, the following form part of the major activities that were conducted by the team of experts:

a) Give a brief profile including but not limited to historical background, project overview, description of baseline information (climate, vegetation, flora, fauna, soils, topography, socio-economic activities, location and project funding etc, as well as legal and institutional framework

b) Analysis of potential impacts of construction and rehabilitation of project, with the study area with special focus on Environmental features within prioritized road network

c) Specify which impacts are negative/positive, reversible/irreversible direct or indirect

d) Provide workable mitigation measures for the negative impacts

e) Aid in consultative public participation process

f) Assess the possibilities of project alternatives

g) Prepare / develop an environmental mitigation and management plan

h) Identify the procedures of project decommissioning considering factors to be taken into account during decommissioning and disposal of project materials

i) Prepare a draft final report

j) Present the daft final report to the stakeholders for review and their contribution

k) Take into account the comments of the stakeholders into the final report

l) Produce final reports – 15 copies (10 for NEMA, 5 for Chief Engineer Roads)

m) Ensure the study team incorporates all requirements of the EMCA 1999 and EIA/EA regulations 2003

A standard environmental impact assessment was conducted using several techniques including route reconnaissance, literature review, desktop research, fieldwork, data analysis and interviewing with appropriate personnel, in order to satisfy the terms of reference.

The following tasks were undertaken under the above ToR:

**Task 1: Site visit and scooping of the works**

A site visit prior to the commencement of the EIA study with the aim of the reconnaissance survey to establish the scope for the public consultation exercise and establish the likely engineering interventions along the project route was undertaken by the ESIA team.
**Task 2: Description of the proposed project and associated activities**

The EIA team took a desk study to gather detailed information about the project and the study areas. The outcomes from this study will be documented in the project background information documents, and was used during the public consultation processes, and also in the final reporting. Documents being sought for review included (but are not limited to):

- District profiles of the project roads;
- Site plans, preliminary designs, construction plans, and support services for the works;
- Location maps of roads under the project;
- Various maps (topographical, geological, hydrological, soils, vegetation cover, protected sites, environmentally sensitive locations, human settlements, land use maps under the project influence zone).

The environmental team has described the proposed project in terms of its geographic, ecological, socio-economic setting and include maps at appropriate scales, where applicable. The team has also described all the project activities from site preparation through to construction, post construction and operation and maintenance.

**Task 3: Policy, Legal, Regulatory and Administrative Framework**

The key legislation that was used to conduct the ESIA study will be the Environmental Management and Co-ordination Act of 1999. A description is given of the pertinent regulations, standards and regulatory bodies governing environmental quality, health and safety, protection of endangered species, parks and protected areas, sitting and land use control. The Environmental (Impact Assessment and Audit) Regulations, 2003 provides the basis and procedures for carrying out Environmental Impact Assessments (EIAs) and Environmental Audits. These are also used in conjunction with the Environmental Act.

**Task 4: Description of the baseline environment**

The results of the desk study, Task 2, were used to present baseline information on the environmental characteristics of the pre-project situation. The description involves:

- The physical environment (topography, geology, soils, climate, hydrology, water resources, etc);
- The ecological environment (land use, flora and fauna, sensitive habitats etc.);
- The social and cultural environment, including as appropriate (population, land use, planned development activities, community structure, employment and labour market, sources and distribution of income, cultural properties - such as historical and archaeological significant sites, indigenous people, and traditional tribal lands and customs);

**Task 5: Analysis of alternatives of the proposed project**

From the reconnaissance survey, there are limited alternatives of the project. An assessment of alternatives is therefore be limited to analysis of the alternatives identified in accordance with design route, choice of materials and equipment, methods of operation and maintenance, only where these are presented.

**Task 6: Determination of potential impacts of the project**

Potential Impacts were determined as significant positive or negative, direct or indirect, short or long term, reversible or irreversible, or widespread or specific/localised, and temporary or permanent. Based on this and the knowledge of local conditions, a comprehensive checklist was drawn up for the assessment of environmental and social impacts during pre-construction, construction and operations stages.
Task 7: Public consultation process
The legal requirement for public consultation is provided for in the Environmental Impact Assessment and Audit Regulations, Regulation 17. A public consultative, participation and review process was conducted to gather views from all stakeholders of the road project. This was followed up by documenting the findings and stakeholder opinions, expectations, views on the project design and incorporating them into the final report.

Task 8: Development of mitigation and management plans
For each significant impact identified in Tasks 6 and 7, a description of the appropriate mitigation and enhancement measures to prevent, minimise, mitigate or compensate for adverse impacts or to enhance the project environmental and social benefits and where appropriate indicate cost implications is given.

Task 9: Development of monitoring plan
The baseline survey conducted as part of the Environmental Assessment identifies and characterise appropriate indicators through which baseline monitoring can determine any significant changes. Where necessary, sampling and monitoring programmes are recommended to monitor site conditions. The objective of environmental effects monitoring is to assess the accuracy of any predictions made in the Environmental Assessment concerning potential impacts. This will help assess recovery trends and sites that potentially require additional restoration activities.

Task 10: Presentation of Environmental Impact Assessment Report
The objectives of the environmental study are to undertake an Environmental Impact Assessment (EIA) in accordance with Kenyan law. As a result, the Environmental (Impact Assessment and Audit) Regulations of 2003, contained in Kenya Gazette Supplement No. 56, Legal Notice 101, was used to prepare the report format and contents of the EIA Report.
CHAPTER 3

3 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

3.1 Environmental Protection and Management at the National Level
The Government of Kenya's Policy on Road Transport is to provide efficient and reliable road network to spur social, economic and security improvement. Kenya's National Environment Action Plan process culminated in the formulation of the policy on Environment and Development under Sessional Paper No. 6 of 1999. This policy presents broad categories of development issues that require a sustainable approach. Its main objectives are to ensure that:

- all development policies, programmes and projects take environmental considerations into account from the onset,

- an independent environmental and social impact assessment (EIA) report is prepared for any project or development before implementation.

The study has been guided by the NEMA’s draft EIA Guidelines (November 2002), and the World Bank’s Integrated Environmental and Social Assessment Guidelines.

The Environmental Management and Co-ordination Act (EMCA), is the legislation that governs ESIA studies in Kenya. This EIA falls under the Second Schedule, which lists the projects required to undergo EIA studies in accordance with section 58 (1-4) of the Act.

Part 3 of this Schedule, refers to transportation projects and these include inter alia, all major roads and all roads in scenic, wooded or mountainous areas and wetlands, therefore according to the above Act, this project requires an EIA study. The approach and methodology for conducting this study is based on the World Bank environmental guidelines, and the EMCA 1999, and Kenyan Environmental (Impact Assessment and Audit) Regulations 2003.

The law has made provisions for the establishment of the National Environment Management Authority (NEMA), which has the statutory mandate to supervise and co-ordinate all environmental activities. Upon the completion of this ESIA study, it will be submitted to NEMA for review and comments.

Policies and legislation highlighting the legal and administrative requirements pertinent to this study and relating to land and natural resources, water management, and public health are briefly summarised below.

3.2 Environmental Impact Assessment
Policies and legislation highlighting the legal and administrative requirements pertinent to this study are presented below.

The Local Government Act Chapter 265 Laws of Kenya: provides for making by-laws and institutions by the Local County Councils. By-laws can be made on the governance of a project under the provisions of this Act.

The Traffic Act Chapter 403 Laws of Kenya: consolidates the law relating to traffic on all public roads. The Act also prohibits encroachment on and damage to roads including land reserved for roads. The project is under the provision of the Act.

The Land Acquisition Act Chapter 295 Laws of Kenya: provides for the acquisition of land for public benefit. The project is under the provision of the Act.
The Registered Land Act Chapter 300 Laws of Kenya: provides for the absolute proprietorship over land (exclusive rights). Such land can be acquired by the state under the Land Acquisition Act in the project area.

The Land Adjudication Act Chapter 95 Laws of Kenya: provides for ascertainment of interests prior to land registrations under the Registered Land Act.

The Wayleaves Act Chapter 292 Laws of Kenya: provides for certain undertakings to be constructed e.g. pipelines, canals, pathways etc., through or under any lands. The project is under the provision of the Act.

The Water Act Chapter 372 Laws of Kenya: The Act vests the water in the State and gives the provisions for the water management, including irrigation water, pollution, drainage, flood control and abstraction. It is the main legislation governing the use of water.

The Lakes and Rivers Act Chapter 409 Laws of Kenya: This Act provides for protection of rivers, lakes and associated flora and fauna. The provisions of this Act may be applied in the management of the project.

The Wildlife Conservation and Management Act, Cap 376: This Act provides for the protection, conservation and management of wildlife in Kenya. The provisions of this Act should be applied in the management of the project.

The Public Health Act Chapter Laws of Kenya: Provides for the securing of public health and recognises the important role of water. It provides for prevention of water pollution by stakeholders, among them Local Authorities (county councils).

3.3 Public Health

The Ministry of Roads and Public Works (MoR&PW) has guidelines on environmental protection and mitigation measures. In the Ministry’s Standard Specification for Road and Bridge Construction a number of clauses address protection of water sources, health safety and accidents, water supply, maintenance of the engineers staff houses, offices, laboratories, and attendance upon the engineer and his staff. Refer to Standard Specification Clauses 116, 117, 125, 135, 136, and 137.
CHAPTER 4

4 ENVIRONMENTAL AND SOCIAL BASELINE

4.1 District Administrative Structures

The road is located in the Coast Province of Kenya within the Taita Taveta and Kwale districts, being part of the Nairobi - Mombasa (A109) road. The total length of the project road is approximately 53.4km, commencing at the Bachuma gate entrance to the Tsavo East National Park and terminating just 100m before the Maji ya Chumvi river bridge.

4.2 Environmental and Socio-economic Conditions

4.2.1 Topography and Geology

The terrain of the project area is rolling to undulating. The surface levels generally fall eastwards towards the coast and lies at about 397m at Mackinnon Road, 366m at Taru and 305m at Samburu and 244m on the Mnago Dunguni hills just before Maji ya Chumvi. The physiography consists of non-dissected erosion plains which are flat to gently undulating areas with very broad interfluves alternating with shallow bottom lands or valleys.

The geology of the project area ranges from pre-Cambrian schist and gneisses of the Basement system to Permo-triassic shales, sandstones and conglomerates. The latter sediments are collectively called the Duruma sandstones.

The Basement system rocks underlie the area from the start of the project to Mackinnon Road. They consist of various gneisses, migmatites, granulites and calcareous rocks comprising a series of metamorphosed sediments. The basement system rocks of the project area consist more specifically of various horn blonde gneisses and biotite schist and migmatites, with quartz-feldspar pegmatite lenses.

Duruma sandstone series comprise a series of sedimentary rocks from permo-triassic times and lay unconformably on the basement system rocks with a gentle dip towards the south-east. The series consists of three major lithological divisions, but within the project area, two groups of beds belong to it:- the taru grits and the Maji ya Chumvi beds.

Taru grits or lower Duruma sandstone series date from Permian and probably Upper Carboniferous times and consist of various arkose and sandstone groups. The arkose is typically coarse grained and may contain up to 50% feldspars. The sandstones vary in texture and composition. The Taru grits are a fluvialite formation derived directly from the Basement system rocks further west. They are dominantly composed of the true Arkoses of grit and sandstone grade. The taru grits underline the area from Mackinnon Road to Samburu.

Maji ya Chumvi beds date from lower Triassic times and form part of the middle Duruma sandstone series. They consist of carbonaceous shales interbedded with siltstones. These rock types often contain free salts, resulting in springs and rivers with brackish or saline water. The Maji ya Chumvi
beds are slightly unconformable to the Taru grits. Yellow rippled sandstones overlie the grits, passing by alteration into thin-bedded carbonaceous muddy sandstones and gritty shales. They are abruptly succeeded by soft blue shales with quartzite and calcareous siltstones and the heighest beds are irregularly bedded micaceous sandstones. The base of the lower Maji ya Chumvi beds is the top of the highest bed of the Taru grits. Within the project area the Maji ya Chumvi beds underlay the area from around Manjewa to Maji ya Chumvi.

The lower Maji ya Chumvi beds consist of soft yellow sandstones, which at some places is intercalated with hard, blue, banded flagstones. Above the soft yellow sandstones, carbonaceous shaly flags and gritty shales, with occasional thick bedded, hard, green siltstones and mud crack patterns are present.

Above the lower Maji ya Chumvi beds are the upper Maji ya Chumvi beds. The upper Maji ya Chumvi beds consist of yellow and white quartzite layers which are intercalated with the soft blue micaceous shales. The soft yellow sandstones are thin bedded fine to medium in grain and are variably well or unevenly bedded, the latter type being more micaceous and containing pyroclastic and dendritic form. The arenaceous beds are well-bedded and crossed by closely spaced joints which divide them into rectangular blocks. Such blocks litter the ground in great numbers. In the Maji ya Chumvi River bed these blocks are widespread.

### 4.2.2 Climate and Rainfall

The climate of the project area consists of Arid to Semi-Arid zones, which are influenced by two monsoon wind systems. The area falls within the coastal hinterland rainfall regime which is characterised by two rainy seasons; the long rains from March to May and short rains from November to December, both occurring at the change of monsoons. The two dry seasons in January - February and June - September are clearly defined, but still each month receives between 3% and 6% of the yearly rainfall. The average annual rainfall of the area is 500mm.

Temperatures are fairly hot. Mean monthly maximum temperatures ranges from around 27°C to 32°C. Mean monthly minimum temperatures range from around 10°C to around 19°C. Diurnal and seasonal variations in temperature are slight. The diurnal range of the average temperature is about 10°C, while the seasonal range is only about 5°C. Absolute maximum temperature is not excessive, and temperatures above 40°C are extremely rare.

Evaporation rate in the area is high, with the average annual potential evaporation ranging from 2100-2400mm.

### 4.2.3 Erosion

There is no major soil erosion observed along the road project, due to the nature of sandy loam with granite base soils located along the road, good in absorbing water quickly. Since the area is also has an Arid to Semi Arid climate, with little rainfall during the year, there is very little effect on soil erosion along the road project. However, some floods are experienced during some rainy seasons, with little impact on soil erosion since the area relatively flat or gently sloping.

### 4.2.4 Water Resources and Hydrology

People along the project road depend on nearby seasonal rivers/streams on the valleys which drain most of the water from the surrounding mountains such as Mnago Dunguni hills. There are no permanent rivers crossing the entire road project. The seasonal river crossing the road project is Maji ya Chumvi river, located at the end of the project. The area is subjected to severe dry seasons, limiting the availability of water in the area for human consumption, livestock, and wildlife.

There are a few water projects along the project road, and new projects are under implementation on areas that are not served with piped water. None of the few water supply pipes are located on the road reserve and will therefore not be a problem during the road construction.
4.2.5 Vegetation and Wildlife

Natural vegetation of the area is largely dry savannah woodlands dominated by Acacia and Commiphora species. From near Samburu to the end of the road project, the vegetation changes to coastal woodlands with conspicuous presence of Ulvaria species, and Euphorbia candelabrum.

The road starts at the Bacuma Gate, an entry point to Tsavo East National Park, one of Kenya’s largest national parks and a major tourism attraction. The park has various wildlife resources, such as the Elephants, antelopes, hyenas, etc, and sometimes the wildlife moves beyond the park boundaries on to the road and other developed areas along the road.

The area is categorized as an Arid and Semi-Arid (ASAL) with very little agricultural crop production. The livestock kept by the local population provides the livelihood base since the rainfall amounts experienced in the area cannot support food crops. Water that accumulates on ponds during the rainy seasons provides critical support to wildlife and livestock, as well as water for human consumption in the area. It is noticeable that the vegetation and forests on the mountains located along the road project has been destroyed by the local residents through charcoal burning, with little re-forestation efforts to rehabilitate the destruction, with only a few scattered trees, shrubs and other vegetation left to cover erosion. The vegetation in some sections of the road is not sufficient to resist the enormous flow of water from the upper parts of the area.

4.3 Socio-economic Profile

4.3.1 Demographic and Distribution Characteristics

The greater length of the road passes through an area with very low population, traditionally regarded as a wildlife dispersal area. In that regard, the area is regarded as dangerous for human settlement. The steadily growing population is concentrated in towns and villages along the road project, with key population located at Samburu, Taru, Mackinnon, and Meli Kubwa.

There is a little bit of human settlement between Samburu and Maji ya Chumvi river bridge, as you tend to move further away from the national park. In this section, the Duruma ethnic community dominates the human settlement, particularly in Samburu and Silaloni divisions.

<table>
<thead>
<tr>
<th>Authority</th>
<th>Population</th>
<th>Urban Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voi</td>
<td>32,176</td>
<td>16,863</td>
</tr>
<tr>
<td>Taveta</td>
<td>52,456</td>
<td>11,495</td>
</tr>
<tr>
<td>Taita Taveta county</td>
<td>162,039</td>
<td>8,032</td>
</tr>
<tr>
<td>TOTAL</td>
<td>246,671</td>
<td>36,390</td>
</tr>
</tbody>
</table>

Source: 1999 census

The district covers an area of 16,975 km² of which a bulk 62% or 11,100 km² is within Tsavo East and Tsavo West National Parks. The remaining 5,876 km² is occupied by small scale farming and livestock keeping, ranches, sisal estates, water bodies such as Lakes Chala and Jipe in Taveta, and the hilltop forests which occupy less than 100 km² or approximately 10 km² out of 587.5 km².
4.3.2 Land use and other economic activities

Livestock farming is the main source of income for majority of the population of the area along the road project. There is a little trickle down benefits as a result of the tourism industry through local employment of people and selling of tourism products and items such as curios and hand carvings.

The main land use in the project area includes national park, and semi-permanent cultivation and grazing. The main crops are maize, pigeon peas and some cassava. The road runs through the national park from Bachuma to Mackinnon Road.

There are a number of townships along the road and these are settled areas.

Besides the national park, agriculture and livestock keeping, there are a number of other land uses around Bachuma Gate. There are a few shops and public institutions including Mwanatibu railway station at Km 2+375, and Kenya Agricultural Research Institute at km 4+400.

Mackinnon Road township and its environs extends between about Km 9+300 to Km 11+800. It serves business and residential premises, as well as public institutions including police post, mosque, polytechnic, MOR&PW camp and shops. There is also a railway station at Km 13+550.

Meli Kubwa trading centre, extending from around Km15+200 to Km 16+000, is also settled with a number of shops and is linked to other trading centres including Canada and Kilimbasi.

Mgalani trading centre extends from about Km 18+400 to Km 19+500. It is developed with business and residential premises and it has a number of shops. It also has some public facilities and institutions, including playground and a primary school.

Taru township extends from about Km 24+400 to Km 24+900. It is settled and developed with several business shops and residential premises. Besides the business facilities, there is a secondary school, primary school and a railway station within the township. There is a commercial rock quarry run by Crescent Construction Company at Km 25+330.

Samburu township extends from about Km 38+700 to Km 40+300. It is settled and developed with several shops and residential premises. It also houses a number of public institutions, including MOR&PW camp, police station, provincial administration offices, churches, Non-Governmental Organisations, and both primary and secondary schools. It has major links to Kinango town, and Silaloni town.

Between Taru and Samburu, there are also other forms of land use, including farming, mainly sisal farming with Taru sisal estate between Km 27+600 and Km 28+800. There is also Kenya pipeline corporation oil pumping station at Km32+748 and a railway station at Km 33+400.

Kasima Lwenya trading centre extends from around Km 49+200 to Km 49+300 and it is settled. It has a few shops and residential premises. The other land use activities within the centre are charcoal selling and rock quarrying for masonry stones in Kaloleni quarry in the outskirts of the centre. There is a primary school near the centre. There is also a commercial hard stone quarry (Zaire quarry) at km 50+000.

4.3.3 Mining and Tourism Attractions

There is little mining of commercial minerals in the area. There is a substantial tourism activity along the road, with tourists visiting the Tsavo National Park, Amboseli National Park, and other Wildlife Conservatories along the road, and those travelling towards the coastal towns of Mombasa and Malindi.
5 PROJECT JUSTIFICATION & ALTERNATIVE TO THE PROJECT

During ESIA study, it is important to consider project alternatives in reference to the environmental as well as economic relevance of the project. Careful review of the proposed project in relation to the adjacent regions, movement of people and goods, tourism, and the need to enhance a sustainable development of the areas indicated that there is no other alternative to the route.

5.1 Justification

The objective of the project is to improve road transport services along the A109, which forms part of the Northern Corridor, by improving the highway and enhancing mobility on the road. The proposed road project is heavy trafficked, with annual average daily traffic estimated at 3420 in 2011, based on traffic studies and growth rates carried out by the consultant in September 2003. As shown from these traffic studies, the heavy traffic is increasing with time as a result of the high economic growth experienced in Kenya and surrounding countries which use the road for its transportation of goods to and from Mombasa. The road also serves as an important role in the tourism industry by providing links to major tourist attractions such as Tsavo, Amboseli and Maasai Mara National parks, as well as the coastal towns of Mombasa and Malindi. The poor physical condition of this section of the road between Bachuma gate and Maji ya Chumvi, and its limited capacity are associated with significant travel time, high fuel consumption, high vehicle emissions as well as social inconveniences.

Upgrading and rehabilitating the road will improve increase economic activities such as stimulating economic growth of Kenya and other countries served by the road, and towns along the road. Indirect economic growth will be generation of employment opportunities for the local communities and provision of access to markets, schools, health facilities and administrative centres as well.

In addition, the following will be accomplished.

5.1.1 Economic recovery strategy (ERS)

The Kenyan Government launched its economic recovery Strategy for Wealth and Employment Creation (ERSWEC) in June 2003. It outlines the objectives of its economic and social programme for the period 2003-2007. This strategy is largely inspired by the Poverty Reduction Strategy Paper. The major challenges facing the Kenya Government are the restoration of economic growth, the expansion of employment opportunities and the reduction of poverty levels in Kenya.

The key objectives of the ERS that will be achieved through construction of this project road will be:

- Achievement of rapid economic growth in an environment of macro-economic stability
- Strengthening of the institutions of governance
- Improvement and expansion of the physical infrastructure of the area
- Investment in human capital of the poor people along the project road

5.1.2 Poverty reduction strategy

The Government’s economic program recognises that economic recovery is the most effective strategy to reducing and eradicating poverty. In line with this strategy, this project will help in:

- Creation of jobs to the local people (long term and short-term)
- Reduce poverty levels through creation of opportunities as the area develops due to improvement in physical infrastructure of the area
- Contribute to the achieve a high real GDP growth rate though opening up of potential industries like fisheries in the area
5.2 Project Alternatives
There are no alternatives to the rehabilitation and overlay design of Bachuma Gate – Maji ya Chumvi section of the Nairobi to Mombasa (A109) road that fulfil the same objectives and functions as the current road. There are no other roads that links Nairobi and Mombasa that provides fast and cheap land transportation between the two towns that can act as an alternative to the proposed road project.

Although there is air and rail transportation between Nairobi and Mombasa, this mode of transport will not be able to handle the amount of people and goods the road is currently serving. Therefore the road is the most important transport link between the surrounding centres and towns and the communities along the project area, from Mombasa to/from Nairobi.

projections), and upgrading the road will improve increase economic activities such as stimulating agricultural and commercial activities along the route. Indirect economic growth will be generation of employment opportunities for the local communities and provision of access to markets, schools, health facilities and administrative centres as well as.

Based on the above scenarios, the following options have been considered:

iii. “Do nothing” option;
iv. Rehabilitate the existing carriageway and incorporate a better pavement with a wider shoulder, and improve on safety and traffic management along the road such as traffic signs, installation of bumps/humps, build parking bays, etc;

The first option will not achieve the objective of the project, since the road is in bad condition, and it is the only section of the road along Nairobi - Mombasa Road (A109) that has not been rehabilitated and widened to meet international trunk road standards. Traffic movement along the section of the road will also be hindered by deterioration of the road, thereby exacerbating the loss in vehicle maintenance, economic time, and therefore productivity, and result in higher fuel consumption, increased levels of air pollution and severely hindering mobility between the 55km section.

The second option may provide the best solution for the next 10-15 years, of improving the pavement and widening the shoulders to improve road condition and improve on safety along the road.

5.3 Future projects consideration
As traffic levels increase in the long term, there will be a need to reassess the traffic volume situation to suggest alternative means of solving the congestion problem and associated issues that may arise in future, such as increasing the number of lanes or making the road a dual carriageway with grade separation interchanges at major towns.
CHAPTER 6

6 KEY PROJECT COMPONENTS

6.1 General Design Features

The road designs have been described in more detail in the Final Engineering Design Report by the consultant, MECE Consulting Engineers, in association with CAPEconsult and BKS Group (Pty) Ltd, who were commissioned in September 2003 by the Government of Kenya through the implementing agency, the then Ministry of Roads & Public Works to carry out detailed rehabilitation and overlay design of Bachuma Gate – Maji ya Chumvi section of the Nairobi to Mombasa (A109) road.

For the purposes of the preliminary environmental impact assessment, it is necessary to understand certain features of the design of the road in order to identify significant impacts that may arise as a result of the project.

The objective of the detailed rehabilitation and overlay design as set out in the terms of reference was to identify the most appropriate and economically justified rehabilitation and strengthening solution to provide further design lives of 10 and 15 years at the preliminary design stage. The project road is an existing all weather road where the proposed upgrading was to be analysed for viability and appropriate engineering design. From inspection of maps and site visits, and engineering report by the consultant, no re-alignment (alternative route) of the existing road was found necessary.

The design recommendations were undertaken in accordance with the standards and on the basis of data and recommendations contained in the following Ministry of Roads, Public Works and Housing Manuals, specifications and documents, and other government documents and Transport and Road Research Laboratories (TRRL) reports as listed below:

(i) Road Design Manual, Part I; “Geometric Design of Rural Roads”, January 1979,
(ii) Road Design Manual, Part III; “Materials and Pavement Design for New Roads”, August 1987,
(iii) Road Design Manual, Part IV; “Bridge Design”, August 1993,
(iv) Road Design Manual, Part V; “Pavement Rehabilitation and Overlay Design”, May 1988,
(vi) Manual for Traffic Signs in Kenya, Part II, June1975,
(vii) Standard Specifications for Road and Bridge Construction, 1986,
(viii) Historical 60-point traffic census data for the project road,
(xiii) TRRL; “LR 623: The Prediction of Storm Rainfall in East Africa”, by D. Fiddes, J. A. Forsgate and A. O. Grigg,
(xiv) TRRL; “LR 706: The TRRL East African Flood Model”, by D. Fiddes,

Other features of relevance to the environmental assessment are as follows:

- Deviations will be necessary during the upgrading works
- Key materials sites have been identified
- Workmen’s camps and the contractors’ camps will have to be established along the project roads.
- Some people might be relocated to make way for new construction works in some sections of the road

6.2 Road Use and Traffic projections
The traffic surveys were carried out in 2003 along the Bachuma Gate – Maji ya Chumvi section and the results were analysed to determine the base year traffic flows (table 6.1).

**Table 6.1 – 2003 Average Annual Daily Traffic flows (AADT)**

<table>
<thead>
<tr>
<th>Vehicle type</th>
<th>Traffic flows (AADT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars</td>
<td>217</td>
</tr>
<tr>
<td>Light Goods Vehicles (Vans)</td>
<td>91</td>
</tr>
<tr>
<td>Light Goods Vehicles (Matatus)</td>
<td>202</td>
</tr>
<tr>
<td>Light Goods Vehicles (Pick-ups and others)</td>
<td>224</td>
</tr>
<tr>
<td>Medium Goods Vehicles (Tankers)</td>
<td>22</td>
</tr>
<tr>
<td>Medium Goods Vehicles (Others)</td>
<td>160</td>
</tr>
<tr>
<td>Heavy Goods Vehicles (Tankers)</td>
<td>169</td>
</tr>
<tr>
<td>Heavy Goods Vehicles (Others)</td>
<td>1063</td>
</tr>
<tr>
<td>Buses</td>
<td>212</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2360</strong></td>
</tr>
</tbody>
</table>

*Source: Final Engineering Report, 2003 by MECE / CAPE consult / BKS Consulting Engineers*

Using a growth rate average of 4%, the estimated AADT is at 3420 in 2011 according to the report, which shows the traffic along the road is growing very fast.

6.3 Current Environmental and Socio-Economic Concerns of the Road Project
A study of the current environmental and social/socio-economic concerns in the project area was carried out. From observations in the field, a number of aspects affecting the natural, physical and social environment were noted. These observations are also intended as useful pointers during the final design stage of the project road.

6.3.1 Road Condition
The road section between Bachuma gate and Maji Ya Chumvi bridge is currently a 3m wide carriageway, with no shoulders provided. The road’s major rehabilitation of re-carpeting was done in 2001, with some repairs done on deteriorated and defects on some sections of the road regularly. However, the lower layers are still largely obscured by the re-carpeting. A number of defects have, however, started appearing on the road surface. The main defects observed on the road were longitudinal and transverse cracks and deformations. On some sections of the road, slippage cracks were observed on both lanes, and the pavement is also deformed within the vicinity of the slippage cracks.
6.3.2 Drainage and Erosion
The general slope of the land is in the West-East direction rather than North-South across the road. The project area therefore does not have major drainage problems and the existing drainage structures serve only localized surface run-offs. No evidence of the major drainage structures being overtopped or under performing was found.

However, during the rainy seasons, residents, especially near towns have experienced flooding on their properties from the surface runoff from the road, since there is no provision of drainage structures near towns located along the road. There is no heavy erosion evident along the road project, and its improvement will only improve any drainage and minimize any effects of soil erosion.

6.3.3 Impact on Town Centres and Economic Impact
There are already considerable economic activities and development noted along the road project, and it is expected that improvement of the road will stimulate development and improve the economic conditions of the shopping centres and enhance the economic growth of the area.

6.3.4 Planning and Future Developments
Settlement along the project route is concentrated in towns and shopping centres, and it is predicted that an increase of settlements along the roads will continue to rise as an outcome of the road improvement. It will therefore be important for the local authorities to come up with the master plan of the towns and shopping centres along the road project to ensure developments of these areas do not encroach the road reserve of the road.

6.4 General Impacts of the Road Project

6.4.1 Economic Benefits
The main economic benefits that will be generated by the road project will be reduction in vehicle operating cost savings, reduced travel time, and cost savings from reduced accidents. The road also serves as part of the Northern Corridor, a link between the port of Mombasa and not only major towns in Kenya, but also to neighbouring countries Uganda, Rwanda, Burundi, and Democratic Republic of Congo. Improvement of the road section will greatly enhance traffic flow especially of heavy goods vehicles, which dominates the A109 road. There is a need to upgrade the existing road as well as building parking bays for heavy goods vehicles at major town centres along the section.

The road also will also serve as a major contributor to the tourism industry, through enhancement of tourism activities to the Parks, and cutting travel time of tourists coming or going to various tourism attractions along A109 road such as Tsavo and Amboseli. The benefits from a reduction in the number and severity of accidents constitute an important element of the economic benefits. Another economic benefit of the road project will be the reduction of the total number of accidents per vehicle-km in the project corridor. There are various accidents on the section of the road, especially near town centers, and with the improvement of the road, it is expected that a accidents will be reduced through installation of speed bumps/humps to reduce the speed of traffic, and in return a reduction of traffic accidents.

6.4.2 Impact on Market Centres
There are a lot of activities along the project route, mainly because the road serves as the link to major towns like Mombasa and Nairobi. Rehabilitation of the section of the road and by building parking bays at the town centres will greatly have an economic impact on the shopping centres along the road project, by encouraging stopovers by heavy goods vehicles at the centres.
6.4.3 Gravel Pits and Sand Sources
There are a number of quarry activities noticed along the road project, and are documented in the Final Engineering Report by the consultant. These quarry sites located along the road, and others identified during material investigations can be used as a source of materials for the project.

Table 6.2 – Material Borrow Site

<table>
<thead>
<tr>
<th>Chainage</th>
<th>Volume M³</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 + 400 RHS</td>
<td>19,000</td>
<td>Existing material site</td>
</tr>
<tr>
<td>0 + 800 RHS</td>
<td>24,000</td>
<td>Existing material site</td>
</tr>
<tr>
<td>13 + 000 RHS</td>
<td>20,000</td>
<td>Existing material site</td>
</tr>
<tr>
<td>16 + 000 RHS</td>
<td>11,000</td>
<td>Existing material site</td>
</tr>
<tr>
<td>20 + 900 L &amp; RHS</td>
<td>24,000</td>
<td>Two Existing material sites</td>
</tr>
<tr>
<td>39 + 700 LHS</td>
<td>32,000</td>
<td>New material site</td>
</tr>
<tr>
<td>Total</td>
<td>130,000</td>
<td></td>
</tr>
</tbody>
</table>

Source: Final Engineering Report, 2003 by MECE / CAPE consult / BKS Consulting Engineers

Abandoned quarries and gravel pits left after exhausting the mines will render some areas unsuitable for cultivation. During the rainy seasons, water can accumulate in the pits, posing a potential health risk by creating stagnant water and providing a breeding habitat for vectors such as mosquitoes, which spread malaria. Children are also at risk if they play in the water and in open pits.

Once the final material sites are identified and commencement of the project is near, consultations will be held with all interested stakeholders to determine how they would want the quarries and gravel sites compensated and rehabilitated after use.

6.4.4 Road Reserve
Along the project road, encroachment of vegetation and crops, onto the road reserve is very minimal. No clearance of vegetation which is beneficial for the road edges in reducing soil erosion especially along the embankments and shoulders was noted. However, there is some encroachment of the road reserve by commercial establishments such as shops in various town centres, and will have to be relocated or demolished to pave way for the upgrading of the road. No major utilities such as water pipes and power on the road reserve which might cause disruption and social problems during construction of the road project were noted during the reconnaissance.

6.4.5 Road Safety
There are a number of reported cases of accidents along the project road according to the stakeholders interviewed, because little attention has been given to road safety, especially near town centres. There is a lack of warning or directional signs, especially near or on the approach to railways crossings, schools and trading/market centres.
CHAPTER 7

CONSULTATIVE AND PUBLIC PARTICIPATION (CPP)

7.1 Overview
Public consultation is considered as a crucial part of an environmental impact assessment study in creating awareness and bringing ownership to the communities along the project road. Road projects in the past have been implemented without involving the affected and interested persons whom the project is to serve. Stakeholders are those persons, communities or groups likely to be affected by the project, project beneficiaries and national and local government agencies with responsibilities to manage the natural resources.

It is important that people living along the project roads and its area of influence are aware of the proposed road improvements. People must be told well in advance that they may need to relinquish their land so that they can prepare and plan for any changes to their lifestyles. The mental and social impact of the project on the communities is consequently diminished.

The Implementing Authority’s District Works Officer (DWO) or other appointed agent should represent KeNHA on the ground. The DWO/agent follows progress of the project from planning through design, construct and operation. Through the District Development Committee he must inform the district administration (i.e. District Commissioner, District or Divisional Officers, Chiefs, etc.) of the progress on the project. The district administration, in turn, should keep the local population posted on the progress of the project, and of any relevant developments relating to the project. Other effective channels for dissemination of information are churches, women’s groups and other self-help groups.

7.2 Participants
In the case of the road project involved, views were sought from stakeholders by means of holding public meetings and impromptu interviews with road users. These consultations revealed that there is a general social acceptance of the road project by an overwhelming majority of the population. The stakeholders indicated that the road project is very popular as a Public Investment in the area. Most of the interviewees lauded the government for finally agreeing to undertake the road construction.

The stakeholders attending the meetings included farmers, church leaders, teachers, local Governmental officers, business persons, traders, community leaders, youth and women groups.

A sample questionnaire and list of those interviewed along the project area is given in Annex II.

7.3 Schedule of Public meetings
The public participation was conducted by interviewing the communities, users and other stakeholders along the road project. The EIA team held an interactive session with the public along the road project at Bachuma Gate, Mackinnon, Meli Kubwa, Taru, and Samburu. Stakeholders’ views using questionnaires were also used to gather their views on the road project and what would be the pros and cons of rehabilitating and upgrading the road.

7.4 Views from Stakeholders

7.4.1 Direct benefits
The stakeholders indicated that the improvement of the road will greatly enhance the economic development of the area, and reduce travel time and vehicle maintenance costs experienced along the section of the road. Others key benefits noted by the stakeholders include:
• Improve the current lack of transportation for people and goods along the road project to urban Markets, Hospitals, Schools and Administration Centres
• Reduce cost of farm inputs and improve price benefits from farm outputs for the communities along the road project.
• Contribute to the reduction of insecurity and crime in the area.
• Open up the area for greater internal and external investment opportunities.

7.4.2 Consultation of ongoing works
The participants appealed to be informed by the relevant authorities the status of the project, because although they know there are plans to upgrade the road, they do not know the project plans. This they said would help especially for those residents who might be affected by the project, such as those who have encroached the road reserve. They indicated they would like to be given an early warning so as to get ample time to relocate and settle in their new places, and minimize any losses that might occur as a result of the relocation of their properties.

7.4.3 Suggestion Boxes
The local community suggested that suggestion boxes should be placed at various centres to open up communication between them, the government, and the contractor. They also requested to be given the names of the lead project managers to communicate to them when need arises.

7.4.4 Employment
Participants indicated that the project will have immediate benefits to the local people through employment opportunities created during the duration of the project. The stakeholders requested that the contractor employs his skilled and unskilled labour from the local residents, especially the youth who reside along the road project where possible. The community indicated that there is also skilled labour within the community and the contractor should consider utilizing these people as much as he can.

7.4.5 Access and Drainage
The stakeholders requested that the drainage and access should be improved especially in town centres where residents have experienced flooding in their properties during heavy rains. They also requested that the project should provide access roads to market centres, schools, health centres, and other public utilities and amenities along the road project. The stakeholders also requested that all the drainage structures should direct runoff to its natural course. Where the runoff is not drained on its natural course, it should then be shared out through mitre drains to avoid large runoff flows into individual farms hence causing soil erosion.

7.4.6 Dust Emissions
The participants appealed the control of dust to avoid damaging of their businesses and food crops during the construction period. They indicated that they would like the contractor to water effectively the diversions to avoid dust problems.

7.4.7 Parking bays Market centres
The stakeholders along the road indicated that they would like consideration in construction of parking bays for buses and heavy trucks in major centres located along the road project. The residents believe the construction of the parking bays will encourage stopovers of motorists, especially heavy goods trucks, which will help in growth of businesses along the road, especially in the hotel and food industry.

7.4.8 Diseases
The community recognized that the project is likely to increase incidences of sexually transmitted diseases especially HIV/AIDS and other communicable diseases during the construction. The
communities noted that the influx of money from the project and economic activities during and after the project is implemented will enhance the transmission and spread of diseases. They also appreciated that increased traffic will increase mobility and thus increased incidence of diseases from other regions. The residents therefore advised that the appointed contractor should make provisions for creation of awareness among his workers and the local community on HIV/AIDS.

7.4.9 Social Responsibility Appeal

Participants along the road project also appealed to the government to consider providing the local community with water, and build new schools, dispensaries and expand existing ones located along the road project to encourage growth of the centres and spur economic growth in the area.
CHAPTER 8

8  ANTICIPATED IMPACTS DUE TO THE PROJECT

8.1  General

This chapter focuses on the impacts likely to occur as a result of the proposed construction works on the project road. Mitigation measures for the various impacts are also described in this chapter, while management and monitoring of impacts is dealt with in Chapter 9.

Upgrading works will be confined to the existing alignment. Works will include rehabilitating and upgrading the road from the current 6m wide carriageway to 7m carriageway with 2m wide shoulders on both side of the road, the installation and re-installation of culverts, provision of side drains and mitre drains, installation of road furniture, and route deviations.

In general, the main environmental issues likely to be of concern during the construction phase of the project roads include:

- Considering the physical geography of the area, there is a possibility of land degradation in some parts mainly through soil erosion
- Nuisance from noise and air (dust) pollution
- Ecological damage resulting from excavation works at material sites, route deviations, clearance of areas for construction camps, storage of equipment (fuel, lubricants and machinery);
- Water resources could be affected through altered drainage along the road during and after construction
- Social disruption and disturbance caused by the teams undertaking the construction works through displacement to give way for re-alignment.
- The workforce may exert pressure on water sources
- Access to towns/market centres could contribute to the increase of crime and the spread of sexually transmitted diseases (STDs) and HIV/AIDS along the road.
- Sanitation and solid waste disposal at the construction camps are issues that could also impact negatively on the environment.
- Site clearance and construction works will have some degree of impact to flora and fauna of the area

8.2  Summary of Main Issues

8.2.1  Economic Benefits

The Project will have significant impacts on both urban economics and rural poverty in the project area. The greatest beneficiaries from a monetary standpoint will be the current road users, who will experience greater efficiency, higher safety, and less wear and damage to their vehicles. Another group of beneficiaries will be the business owners along the road project, who will get an opportunity to get improved facilities when the road is complete, through construction of parking bays, improved drainage, and cheaper transport costs for their commercial goods. Local residents, especially the youth will also benefit from expanded opportunities for seasonal employment during the construction period of the road.

8.2.2  Impacts on Hydrology, Drainage and Water Resources

Since the road already exists, there will be very little impact on the hydrology, drainage and water resources of the area. In fact, the impact will be positive around towns located along the road since
construction works will involve improvement of drainage in these areas, such as installation of culverts and open drains.

Wastewater and hazardous materials (fuel, oil, acids, caustics, etc.) may also drain into streams and drainage areas, causing pollution to surface water or groundwater. This is particularly true for construction campsites, and staging areas where workers, construction equipment, and building materials are most concentrated, such as at storage sites or at locations where extensive use of construction equipment is required.

During operation of the road, the main pollutants for the surface waters are the runoff waste water containing materials generated by wearing of the road and bridge pavements, tires, break shoes, dust, dirt, and petroleum-containing substances.

The presence of the workmen’s camp and construction activities and relocation of any existing water supply pipes is likely to put pressure on water resources and as a result put a strain the local communities.

8.2.3 Soil Erosion and Land degradation

Road construction will intensify the effects of natural soil erosion due to vegetation removal, soil disturbance, and exposure of bare soil surface. Since the road already exists, there will be minimal effects associated with embankment construction in the plain area, road sections with heavy cuts and fills, borrow and spoil sites, as well as bridge and culvert construction sites. However, if appropriate measures are not taken during the rainy when seasons during construction period, increased erosion loss could be significant.

Soil quality is usually deteriorated as a result of the operation of the road, especially due to the settlement of the emissions exhausted by the vehicles and other agents used in the construction and maintenance process, and spills that might occur during accidents.

Discharge of pollutants from construction machinery (oil/grease) and construction camps (Equipment camps, workmen camps, material holding and preparation camps) have a potential to degrade the related land and soils. This also has the potential to affect the soil productivity thereafter and slow infiltration of pollutants into groundwater sources.

Dumping of spoil and overburden from the road construction to other areas could affect the soil quality, surface topography and vegetation at the micro-level of the affected locations if not well selected.

8.2.4 Deviations

During rehabilitation and upgrading works, it will be necessary to have some deviations in order to allow uninterrupted traffic flow. Although deviations should ideally remain within the road reserve, this is not always practical or possible, so traffic may have to be diverted temporarily across private land. In such cases, landowners will have to be compensated for loss of crops/grazing land, nuisance, fencing, etc. However, because the road has a big road reserve, deviations of the road outside the road reserve will be minimal or absent during the duration of project.

8.2.5 Materials Sites

There are some concerns relating to gravel sites and hardstone quarries including vegetation clearance, landscape scars, dust and general disturbance during excavation, and the need to reinstate or landscape the sites when the contractor has completed quarrying.

Dust and noise during excavation and quarrying will affect homesteads located near the borrow sites. The Resident Engineer will need to establish the general wind directions on project roads and advice the Contractor accordingly.
New hardstone quarries may have to be opened for the project works, which may result to loss of land and soil in some areas along the road project. Traffic to the materials sites will also pose a nuisance to people living around them.

8.2.6 Workmen's Camp

During rehabilitation works, there will be some direct employment opportunities for both skilled and unskilled labour on the project roads. Furthermore, indirect employment opportunities are bound to arise from the provision of services to the construction teams. Camps for these roads would generally require approximately 2 to 5 acres of land, and an area will have to be allocated for the heavy equipment and for crushing hardstone.

The District Officers and Local Chiefs should discourage the use of wood from the surrounding areas. In such cases kerosene or gas will have to be used for heating and cooking purposes.

In setting up the workmen's camps, consideration will be given to water availability. Water supplies are not a problem for the area, but permission will be needed before the water can be accessed. Water in the camps is important in terms of maintaining hygiene and sanitary conditions. The demand for water might put temporary pressure on local residents.

8.2.7 Air Quality and Noise Pollution

Air, noise and dust pollution and disposal of oil wastes is already occurring to a certain extent (whether significant or not) along the project road. The situation will be exacerbated temporarily during construction, but will also occur during operation, specifically to vehicular air pollution and noise, as a result of anticipated increased traffic along the roads. Exhaust and engine emissions from vehicles cause air pollution, which can have an impact on public health, as well as soils, crops and water supplies.

Air effects during the implementation phase

The ambient air quality will be directly affected by NOx, SO2 and dust emissions generated by the road transfer of construction materials and by the operation of road construction equipment. The affected area includes the construction route, the mobilisation area and their direct environment in a range of about 100 m. The emissions of the vehicles and construction equipment do not represent any direct hazard to human health. Therefore, the impact level will be acceptable in the construction phase.

Air effects in the operation phase

Generally, the area affected by air pollution due to the operation of the road is limited to a roadside zone of 50-80 m width. In the relevant area the ambient air quality will be determined by the traffic emissions. Pollution rates exceeding the health limits are unlikely to occur even in critical circumstances beyond a 30 m range from the road axis. The emission rate of harmful materials along the road is estimated to reach a somewhat high but not significant level. At the border of the corridor, i.e. in a distance of 50 m from the road axis on both sides, the specified limits will not be exceeded by any of the polluting components at the whole length of the route. Air pollution due to traffic emissions will significantly be reduced in most of the accessed communities. The level of air quality changes in the direct and indirect impacted areas is acceptable.

8.2.8 Water Sources, Surface and Sub-surface water pollution

Construction water for the proposed road will be abstracted from sources selected from the rivers and streams along the corridor. While the possible points of abstraction have not been identified, experience has it that most abstractions are carried out using diesel pumps mounted along the river banks. Oil spills from the pumping machines and tankers transporting water to the construction sites
could impact the water sources and quality with serious implications to the downstream dependants including the wildlife. Competition of the water resources between the construction works and other dependants could also become a concern if not well managed, and will therefore require attention to avoid any conflict.

Rainwater washes out atmospheric pollutants, picks up roadway deposits, and runs off into rivers and streams. Where culverts, drains and retention ditches are required, sediment loads in the rivers and streams will increase as a result of construction debris and excavation works along the banks. The Resident Engineer should ensure that the Contractor disposes of all construction debris in a sensible manner, and does not throw it into any of the rivers/streams.

During construction period, oil wastes may become an issue if oil is carelessly stored, handled, or drained from construction vehicles and equipment.

Sewage, solid and oil/petroleum wastes also produced at the camps could also pollute sources of water, land and soil.

During operation period, road users spilling materials (oils, foodstuffs, materials, and other wastes) particularly during accidents, tends to leave pollutants on the road reserve and the adjacent lands compromising natural resources and people’s health.

8.2.9 Safety

The project road will be widened and motorists will drive at higher speeds than experienced currently. It is therefore likely that the residents there may be an increase in the number of accidents in the road section, especially at the town centres.

There is also a considerable amount of non-motorised traffic, specifically livestock and pedestrians on the road. Increased vehicular traffic travelling at high speeds as a result of the improved road condition will pose a hazard to livestock and pedestrians.

8.2.10 General Public Health

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

Exhaust fumes from leaded fuel can in the long-term lead to renal complications for people whom reside along the road reserve. Equally the leaded compounds will accumulate on any roadside vegetation planted for consumption purposes.

Sanitation and hygiene in the workmen’s camp are also issues of concern, and if not properly addressed may lead to outbreaks of illnesses such as cholera, hepatitis, typhoid etc.

Road projects are associated with an increase in sexually transmitted diseases such as STDs and, HIV/AIDS due to the influx of workmen interacting with the local people. Construction teams, as well as the greater number of drivers, who are expected to pass through the trade centres and settlements, can also cause social upheaval among communities along the project road.

The contractor shall take an active role in civic and public health education to his employees and the community. To this end, the contractor shall include in his camp a health clinic and social Hall to facilitate the health campaigns.

The contractor will co-ordinate with the district HIV/AIDS control council, health officers and the local NGO’s undertaking education and sensitization programmes to ensure regular supply of public health information and HIV/AIDS videos to be shown to the workforce in the social hall.

8.2.11 Other indirect Socio-Economic Aspects

There will be some indirect socio-economic aspects derived from improved access into the market centres, through a complex chain effect due to improved economy in the areas along the road project. Such impacts include:
a) Settlement Pattern changes

There is a tendency of an increased settlement of people in the areas main economic centres. Due to such an economic improvement, people tend to migrate from other areas and settle in these market centres and towns. This may in turn lead to an increased pressure on the demand and supply of goods and services such as housing, water, sanitation and energy sources.

b) Increased employment opportunities

Demand and supply of goods and services for the workforce creates a temporary indirect employment to the local communities. After construction, a completed road is expected to spur the growth of commercial and other types of businesses and services in the area. This generates more long term indirect employment opportunities for the local population, thereby contributing to the overall economic growth where wealth creation and poverty reduction along the road corridor and in the hinterland is realized.

c) Growth of Social Investments

The upgraded road will provide faster movement of people, goods and services in the area, which will likely stimulate more public and private investments such as facilities which include but not limited to schools, health centres, water, energy, and sanitation mainly in the urban centres. The reduced vehicle operating costs due to improvement of the riding quality compared to the current road situation greatly enhances accessibility to such basic facilities, for the local communities and others neighbouring the road corridor.

d) Cost and benefits of environmental impacts

The main costs of environmental impacts will be associated with activities during the construction period, such as prevention of soil erosion and minimization and improvement of the surrounding ecosystem. Mitigation measures will be taken to minimize the environmental costs by reducing the identified adverse environmental impacts. The benefits of the environmental impacts will include reduction of air emissions and noise through reduced traffic congestion and better road condition.
## 8.3 Positive Impacts

Table 8.1: Anticipated Environmental Impacts on the Bachuma gate – Maji ya Chumvi (A109) Road project

<table>
<thead>
<tr>
<th>Environmental Aspect</th>
<th>Anticipated Impacts/Remarks</th>
<th>Proposed Mitigation during Design and Construction phases</th>
<th>Proposed Mitigation during Operation and Decommissioning phases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes in hydrology/drainage</td>
<td>• Improvement of drainage systems near town centres</td>
<td>• Design adequate roadside drainage and culverts to accommodate peak runoff</td>
<td>• Monitor roadside drainages, culverts, outfalls regularly for damages</td>
</tr>
<tr>
<td></td>
<td>• Reduction of soil erosion near the road</td>
<td>• All drainage and surface runoff to be directed to existing natural drains and NOT onto people’s farms and settlement</td>
<td>• Continuous maintenance of drainages and culvert</td>
</tr>
<tr>
<td></td>
<td>• Control of soil erosion in people’s farms</td>
<td>• Replant road reserve with grass or stabilizing shrubs to prevent soil erosion</td>
<td>• Replenish vegetation along the road to prevent erosion and provide silt buffers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Spread and distribute runoff upstream of road reserve through silt retention dams, cascading gabions and distribution canals</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provide speed breakers on the outfall and distribute outfall flows</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Monitor roadside drainages, culverts, outfalls regularly for damages</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Continuous maintenance of drainages and culvert</td>
<td></td>
</tr>
<tr>
<td>Community &amp; Economic Activity</td>
<td>• Reduction in travel time for people and goods.</td>
<td>• Monitor growth of towns along the road</td>
<td>• Continuous improvement of infrastructures provide near the town centres</td>
</tr>
<tr>
<td></td>
<td>• Transportation of goods and services will be cheaper, and readily available, eventually improving the economy of the local community</td>
<td>• Liaise with physical planning department and local authorities for location of construction of parking bays, access and other amenities that can be constructed at market centres</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Growth of town centres along the road</td>
<td>• Provide access alternatives/side slip roads in areas with social and economic activities</td>
<td></td>
</tr>
<tr>
<td>Tourism Industry</td>
<td>• Indirect contribution to the tourism industry in Kenya as it serves a key tourists attractions of Mombasa and National parks such as Tsavo,</td>
<td>• Provide access to administrative centres located along the road project to provide security to local</td>
<td>• Continuance monitoring and maintenance of road condition</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Aspect</td>
<td>Anticipated Impacts/Remarks</td>
<td>Proposed Mitigation during Design and Construction phases</td>
<td>Proposed Mitigation during Operation and Decommissioning phases</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------------------</td>
<td>--------------------------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Amboseli &amp; Maasai Mara</td>
<td>Potential establishment of tourism oriented businesses along the road</td>
<td>and international tourists</td>
<td>Liaise with physical planning department and local authorities for location and access of administrative centres</td>
</tr>
<tr>
<td>Employment opportunities</td>
<td>Direct temporary employment for skilled and unskilled labour for many of the local people for example as casual labourers during construction works.</td>
<td>Utilize local labour during construction work</td>
<td>Utilize local labour during maintenance</td>
</tr>
<tr>
<td>Access to Health and Educational facilities</td>
<td>Public health awareness campaigns, follow-up of patients and outreach initiatives at the construction camp during the construction period.</td>
<td>Provision of a well equipped health facility at the construction camp</td>
<td>Ministry of Health, local authorities and NGOs to continue public awareness and sensitization campaign on safety aspects</td>
</tr>
<tr>
<td>Material sourcing and sites</td>
<td>Material site owners will benefit from either the sale of material</td>
<td>Inform people living at/near the sites that the pits have been selected for exploitation</td>
<td>Restore and rehabilitate the borrow pits by returning the top soil, landscaping, and planting of vegetation, and fencing around</td>
</tr>
<tr>
<td></td>
<td>Rehabilitation of borrow pits can be used as water pans for wildlife and livestock.</td>
<td>Arable lands should not be used as borrow pits whenever possible. For new borrow pits the topsoil (30cm) should be kept aside and refilled after construction is over to</td>
<td>Regular rehabilitation of borrow sites to reduce siltation of the pits if being used as water pans</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Regular treatment of the water pans to reduce chances of mosquito breeding</td>
</tr>
</tbody>
</table>
### Environmental Aspect | Anticipated Impacts/Remarks | Proposed Mitigation during Design and Construction phases | Proposed Mitigation during Operation and Decommissioning phases
--- | --- | --- | ---
 |  |  | minimise the impact on the ecosystem and agriculture  
• Control and restrict access to gravel sites (e.g. by fencing steep quarry faces)Compensate owners as required  
• Provide proper management of excavation activities  
• Rehabilitate quarries and borrow pits to be used as water pans by local residents for their livestock and wildlife |  |

#### 8.4 Negative Impacts

<table>
<thead>
<tr>
<th>Impacts on or due to</th>
<th>Anticipated Impacts / Remarks</th>
<th>Proposed Mitigation during the Design and Construction phases</th>
<th>Proposed Mitigation during the Operation and Decommissioning phases</th>
</tr>
</thead>
</table>
| Loss of land/soil degradation | Loss of land and vegetation through  
• road clearing, top soil stripping, etc.  
• deviations that go beyond the road reserve  
• Access routes to borrow pits |  
• Top soil from construction quarries and borrow pits should be held on site as much as possible to backfill after construction materials are exhausted  
• Rehabilitation of quarries and borrow pits should be done immediately after exhaustion  
• Stick to the existing road reserve road alignment as much as possible to avoid loss of agricultural land, vegetation and property.  
• Compensation of land owners where deviations go beyond road |  
• Replenish vegetation along the road to prevent erosion and provide silt buffers  
• Monitor encroachment on areas considered prone to encroachment by increased settlements, especially near town centres |
<table>
<thead>
<tr>
<th>Impacts on or due to</th>
<th>Anticipated Impacts / Remarks</th>
<th>Proposed Mitigation during the Design and Construction phases</th>
<th>Proposed Mitigation during the Operation and Decommissioning phases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil erosion</td>
<td>♦ Increased soil erosion</td>
<td>♦ Minimize earthworks where not required</td>
<td>♦ Monitor and ensure proper maintenance of drainage structures</td>
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<tr>
<td></td>
<td></td>
<td>♦ Install erosion control measures</td>
<td>♦ Daily/regular cleaning and proper maintenance of drainage structures</td>
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<td></td>
<td></td>
<td>♦ Protect excavated sections of the route of storm water during heavy rains</td>
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<td>♦ Provide erosion channels to natural drains and rivers/streams to minimize erosion</td>
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<td></td>
<td></td>
<td>♦ Provide embankments and re-vegetate with grass and shrub species</td>
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<tr>
<td></td>
<td></td>
<td>♦ Monitor and ensure proper maintenance of drainage structures</td>
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<tr>
<td></td>
<td></td>
<td>♦ Daily/regular cleaning and proper maintenance of drainage structures</td>
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<td></td>
<td></td>
<td>♦ Enforce laws and fines to discourage traders, road users and consumers near town centres and on the road in disposing waste into the drains</td>
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<tr>
<td>Changes in hydrology/drainage</td>
<td>♦ Disruption of flow of runoff during the upgrading process due to blocked drains and culverts and the installation/re-installation of the same. An increase in paved sections means that there will be more runoff than normal, which will affect the drainage systems, hydrological regimes and storm drains. There will be an increase in drainage speed which in turn will create heavy outfalls and worsen soil erosion cases along the drainage systems</td>
<td>♦ Construct efficient drainage structures</td>
<td>♦ Monitor and Repair damaged drainage systems or rehabilitate by suitable methods</td>
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<td></td>
<td></td>
<td>♦ Control earthworks through cascading gabions and distribution channels</td>
<td>♦ Daily/regular cleaning and proper maintenance of drainage structures</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>♦ Enforce laws and fines to discourage traders, road users and consumers near town centres and on the road in disposing waste into the drains</td>
</tr>
<tr>
<td>Air and Noise Pollution</td>
<td>♦ Degradation of Air through dust emissions Air pollution from emissions by construction vehicles and other equipment during their operations Noise generated during construction activities such as operation of construction equipment, excavations, blasting, etc</td>
<td>♦ Construction activities should be carried out only during the day to avoid noise to the residents ♦ Excavation should only be undertaken with ordinary earth movers, and explosive blasting to be carried out under strict supervision. ♦ Regular watering of road</td>
<td>♦ Monitor oil spills, water pipe leakages along the road during the operation period</td>
</tr>
<tr>
<td>Impacts on or due to</td>
<td>Anticipated Impacts / Remarks</td>
<td>Proposed Mitigation during the Design and Construction phases</td>
<td>Proposed Mitigation during the Operation and Decommissioning phases</td>
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<tr>
<td>Water resources</td>
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<tr>
<td>- Surface water</td>
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<tr>
<td>- quality</td>
<td>Competition of water resources with the needs of the local population</td>
<td>Minimize use of water in streams mainly used by local people</td>
<td>Monitor oil spills, water pipe leakages along the road</td>
</tr>
<tr>
<td>- Piped water</td>
<td>Contamination of water resources with oil and fuel spills by construction equipment at camps and on the road</td>
<td>Incorporate erosion control measures during construction</td>
<td>Discourage uncontrolled vehicle maintenance along the road by motorists</td>
</tr>
<tr>
<td>- Surface runoff</td>
<td>Fuels and oil spills during vehicle maintenance along the road and during accidents</td>
<td>Ensure proper handling, storage and disposal of oil and oil wastes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bituminous materials and other associated chemicals may also find their way into adjacent streams near the road project.</td>
<td>Maintain, re-fuelling and cleaning of equipment should be done at designated locations where leakages can be contained</td>
<td></td>
</tr>
<tr>
<td>Vegetation/Flora</td>
<td>Destruction/clearance of vegetation for the carriageway, extension of the road reserve, and deviations.</td>
<td>Replant vegetation on reserve, diversion route and catchments areas upon completion</td>
<td>Replenish vegetation along erosion prone areas</td>
</tr>
<tr>
<td></td>
<td>Disruption of wildlife and fauna species during road reserve clearance, which might destroy their homes/nesting sites</td>
<td>Avoid unnecessary clearing of vegetation</td>
<td>Monitor the number of accidents with wildlife during operation stage</td>
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<td></td>
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<td></td>
<td>Monitor disruption diversion as a result of the</td>
</tr>
<tr>
<td>Impacts on or due to</td>
<td>Anticipated Impacts / Remarks</td>
<td>Proposed Mitigation during the Design and Construction phases</td>
<td>Proposed Mitigation during the Operation and Decommissioning phases</td>
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</tr>
<tr>
<td>Loss of crops</td>
<td>▪ Loss of crops due deviations, or provision of access roads to borrow pits</td>
<td>♦ Compensate land owners where diversions encroach their properties</td>
<td>n/a</td>
</tr>
<tr>
<td>Road safety</td>
<td>▪ During construction, there will be some increased danger to workers, pedestrians, livestock and wildlife along the road. During operation, a better and wider road means increased speeds by motorists which might increase the number of accidents on the road, especially head on collisions and knocking of pedestrians, wildlife and livestock.</td>
<td>♦ Inform the communities well in advance on the proposed work activities and dangers posed. ♦ Initiate a safety program and measures by creating awareness and educational campaigns for workers and local communities. ♦ Install appropriate road signage for safety of workers and road users during construction. ♦ Construct speed signs at high risk areas such as railway crossings and schools.</td>
<td>♦ Maintain road and warning signs for road users. ♦ Enforce speed limits on the road. ♦ Monitor road accidents.</td>
</tr>
<tr>
<td>Visual intrusion</td>
<td>▪ Visual intrusion due to road works and construction traffic.</td>
<td>♦ Control traffic during construction period through alternative routes. ♦ Sensitising motorists on visual intrusions along the road. ♦ Clear construction debris along the road to reduce intrusion on the roadway.</td>
<td>♦ Provide and maintain warning signs for areas affected by nocturnal glare. ♦ Provide medical and emergency evacuation plans for accidents by the police department.</td>
</tr>
<tr>
<td>Public health</td>
<td>▪ Increased dust, noise and air pollution levels could impact on public health. ▪ Increase of immigrant workers on road projects are associated with the spread of sexually transmitted diseases.</td>
<td>♦ Initiate a sensitization and awareness campaign on HIV/AIDS and STDs should be done to workers and local community. ♦ Provide medical and insurance cover for all workers.</td>
<td>♦ Monitor air, noise and pollution levels during operation. ♦ Monitor prevalence of prostitution, HIV/AIDS and STDs, especially along the main centres located on the main road. ♦ Maintain a continuous awareness program on health issues related to HIV/AIDS, STDs and air, noise and pollution.</td>
</tr>
<tr>
<td>Impacts on or due to</td>
<td>Anticipated Impacts / Remarks</td>
<td>Proposed Mitigation during the Design and Construction phases</td>
<td>Proposed Mitigation during the Operation and Decommissioning phases</td>
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<tr>
<td>Settlements/Induced settlements</td>
<td>▪ There could be an increase in informal settlements along the road.</td>
<td>♦ Liaise with physical planning department and local authorities for location of road provisions, access and other amenities.</td>
<td>♦ Consider streamlining access roads to other towns and centres to avoid congestion and settlements along the road reserve.</td>
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<td></td>
<td>▪ Crime rate may also increase especially after completion of the project as the area will be opened up and hence accessible from the major towns and other parts of the country</td>
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<tr>
<td>Workmen’s camps</td>
<td>▪ The presence of the camp is likely to lead to an increase in water usage putting a strain on the local communities.</td>
<td>♦ Consult local authority on a plan for usage of utilities to avoid strain on local residents.</td>
<td>♦ Completely remove the camp including permanent foundations and floors to discourage future informal settlement at the campsite.</td>
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<tr>
<td></td>
<td>▪ Solid waste disposal and sanitation problems can also be an issue at construction sites if not well managed</td>
<td>♦ Pay special attention on waste generation and disposal, sanitary conditions at the sites.</td>
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<td></td>
<td>▪ Strain on food and major utilities like water can also cause social unrest along the road project</td>
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</tbody>
</table>
CHAPTER 9

ENVIRONMENTAL AND SOCIAL MANAGEMENT MONITORING AND PLAN

9.1 Environmental and Social Management and Monitoring Plan

The responsibility for the incorporation of mitigation measures for the upgrading of roads lies with the Supervising Engineer, who must ensure that the Contractor implements all specified mitigation measures. In order for the Contractor to carry out environmental management activities during construction the Contractor should draw up an environmental management plan of his own to show how he will address the mitigation measures during the construction period. The Supervising Engineer is responsible for assessing the Contractor’s environmental management plan.

The MoR&PW Maintenance Unit will have to oversee the Supervising Engineer to confirm that mitigation is being implemented in the correct manner. The MoR&PW has set up an Environmental and Social Unit under its Planning Branch whose responsibility is to ensure that monitoring does take place, and in addition oversee environmental compliance and mitigation in all road related activities. The annual Maintenance Needs Assessment involving a Road Condition Survey/Inventory carried out by the District Engineer should include the Environmental Unit at the district level. This would ensure that all environmental problems are documented and the necessary mitigation measures indicated. The cost of implementing these mitigation measures can be incorporated into the road maintenance budget for the next financial year.

The types of parameters that can be monitored may include mitigation measures or design features, or actual impacts. In some cases, such as drainage structures and soil conservation interventions monitoring is fairly straightforward and can be done as part of routine or periodic maintenance. However, other parameters, particularly those related to socio-economic and ecological issues can only be effectively assessed over a more prolonged period of say 3 to 5 years.

9.2 Monitoring

Environmental Monitoring is a long-term process, which should begin at the start of construction and continue throughout the life of the road project. Its purpose is to establish benchmarks so that the nature and magnitude of anticipated environmental and social impacts can be continually assessed. Trends in environmental degradation or improvement can be established, and previously unforeseen impacts can be identified or pre-empted.

Environmental audits are supposed to be carried out one year after completion of the project. The audit would assess the relevance, efficiency and impact of any mitigation measures that have been employed.

Table 9.1 below summarises the environmental management plan for the project roads. It describes parameters that can be monitored, and suggests how monitoring should be done, how frequently, and who should be responsible for monitoring and action. The cost of monitoring and mitigation action plan are shown in the tender documents and Bill of Quantities (BoQ) prepared by the consultant. These costs are spread out within the BoQ since most of the activities are interrelated, apart from the HIV/AIDS component which has a separate bill on its own.
**ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN**

Table 9.1: Environmental Management and Monitoring plan for the Bachuma gate – Maji ya Chumvi (A109) Road project

<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Proposed Mitigation Action Plan</th>
<th>Responsibility for intervention and monitoring during design, construction and defects liability period</th>
<th>Parameters for Monitoring/Indicators</th>
<th>Timing - Recommended frequency of monitoring and Targets</th>
<th>Cost of Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavations, Clearance, Road Deviations</td>
<td><strong>CONSTRUCTION PHASE</strong>  ♦ Alignment and deviations should remain at the road reserve  ♦ Compensation of land owners</td>
<td>Design Engineer, Project Manager and Contractor</td>
<td>(c) check drawings and plans  (o) payment compensation records  ♦ Minimal road deviations from the current road alignment  ♦ Regular meetings with local communities</td>
<td>Continuous  ♦ Complaints from local residents (c)</td>
<td>Bill No. 1,4,5,7,8</td>
</tr>
<tr>
<td>Road Construction &amp; Equipment</td>
<td><strong>CONSTRUCTION PHASE</strong>  ♦ Speed control of vehicles  ♦ Construction of bumps along deviations  ♦ Regular watering of deviations  ♦ Proper maintenance of construction equipment  ♦ Provide workers with protection equipment  ♦ Sensitization of motorists/road and equipment operators</td>
<td>Design Engineer, Project Manager and Contractor, Traffic police</td>
<td>inspection / observation  ♦ Dust level along the roads  ♦ Exhaust fumes from the vehicles</td>
<td>daily/random  ♦ Minimal or no Noxious smoke and smell from vehicles  ♦ Nil particulate matter in the air</td>
<td>Bill No 1,5,9,20,22</td>
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<tr>
<td></td>
<td><strong>OPERATION PHASE</strong>  ♦ Institute regulations on vehicle</td>
<td>NEMA and other authorities</td>
<td>inspection / observation  ♦ Particulate matter from</td>
<td>Quarterly / random</td>
<td></td>
</tr>
<tr>
<td>Project Activity</td>
<td>Proposed Mitigation Action Plan</td>
<td>Responsibility for intervention and monitoring during design, construction and defects liability period</td>
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</tr>
<tr>
<td>Environmental and Social Impact</td>
<td></td>
<td></td>
<td>Vehicle emissions</td>
<td>♦ Nil dust particulate matter in the air ♦ Minimal complaints from traders and residents along the road</td>
<td></td>
</tr>
<tr>
<td>Material Sites, Road Construction &amp; Equipment</td>
<td>emissions</td>
<td></td>
<td></td>
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<tr>
<td>▪ Noise pollution</td>
<td>CONSTRUCTION PHASE ♦ Regular Sensitization of workforce and residents on potential noise levels ♦ Controlled operation of construction plant and equipment ♦ Controlled blasting at material sites</td>
<td>Project manager, Supervising Engineer and Contractor</td>
<td>inspection / observation ♦ Noise level along the road ♦ Number of Complaints from the residents ♦ Traffic reports</td>
<td>daily/random ♦ Minimal complaints from residents</td>
<td>Bill No 1,5,9,20,22</td>
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<tr>
<td>OPERATION PHASE Institute regulations on vehicle maintenance</td>
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<td></td>
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<td></td>
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<tr>
<td></td>
<td>DESIGN &amp; CONSTRUCTION PHASE ♦ Design to incorporate existing drainage pattern and avoid disturbing the same ♦ Develop water abstraction plan to minimize conflict with local residents and wildlife ♦ Proper handling, storage and disposal of oil and oil wastes ♦ Solid waste should not be dumped in or near any water bodies (rivers, streams, etc) ♦ No untreated discharge to be made to surface water, groundwater or soil.</td>
<td>Supervising Engineer and Contractor Municipal Health &amp; Environmental Officer</td>
<td>Inspection / method of waste collection ♦ Discharge into water bodies ♦ Complaints from the neighbouring communities or the authorities</td>
<td>(c) daily ♦ NO effects on physical status of water quality ♦ Status of streams rivers and wetlands in the area of influence</td>
<td>Bill No 1,5,9,20,22</td>
</tr>
<tr>
<td>Project Activity Environmental and Social Impact</td>
<td>Proposed Mitigation Action Plan</td>
<td>Responsibility for intervention and monitoring during design, construction and defects liability period</td>
<td>Parameters for Monitoring/Indicators</td>
<td>Timing - Recommended frequency of monitoring and Targets</td>
<td>Cost of Mitigation</td>
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<tr>
<td><strong>OPERATION PHASE</strong></td>
<td>♦ Monitor water quality of nearby water sources</td>
<td>Municipal Health &amp; Environmental Officer</td>
<td>inspection ♦ Complaints from the neighbouring communities or the authorities</td>
<td>(o) quarterly / random ♦ NO effects on physical status of water quality ♦ Status of streams rivers and wetlands in the area of influence</td>
<td></td>
</tr>
<tr>
<td><strong>CONSTRUCTION PHASE</strong></td>
<td>♦ Construction of parking bays ♦ Proper storage, handling and disposal of oil and oil waste ♦ Approved maintenance program for construction vehicles and equipment</td>
<td>Design Engineer, Supervising Engineer and Contractor</td>
<td>inspection ♦ Amount of discharge into water bodies ♦ Complaints from the neighbouring communities or the authorities ♦ Mechanical inspection of construction equipment</td>
<td>during construction and on completion ♦ NO effects on physical status of water quality of nearby water sources</td>
<td>Bill No 1,5,9,20,22</td>
</tr>
<tr>
<td><strong>OPERATION PHASE</strong></td>
<td>♦ Maintenance of cleanliness at parking bays ♦ Restriction of unauthorized servicing of vehicles at parking bays</td>
<td>Municipal Health &amp; Environmental Officer, local authorities</td>
<td>inspection ♦ Discharge into drainage structures/water bodies</td>
<td>monthly ♦ No oil discharges to drainage /parking bays areas</td>
<td></td>
</tr>
<tr>
<td><strong>CONSTRUCTION PHASE</strong></td>
<td>♦ Establish a well planned method of solid disposal of debris/garbage at the camp site ♦ Energy sources should be identified so as not to put a strain on the local resources ♦ Use of firewood/charcoal should be prohibited, alternatives such as kerosene and gas should be</td>
<td>Contractor and Supervising Engineer</td>
<td>Inspection ♦ Disposal methods of solid waste from the site ♦ Complaints on health and safety aspects related to construction activities ♦ Inspection of utilization of energy</td>
<td>daily ♦ Site cleanliness ♦ Amount of waste/debris on site ♦ NO use of firewood/charcoal as source of energy</td>
<td>Bill No 1,5,9,20,22</td>
</tr>
<tr>
<td>Project Activity &amp; Environmental and Social Impact</td>
<td>Proposed Mitigation Action Plan</td>
<td>Responsibility for intervention and monitoring during design, construction and defects liability period</td>
<td>Parameters for Monitoring/Indicators</td>
<td>Timing - Recommended frequency of monitoring and Targets</td>
<td>Cost of Mitigation</td>
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</tbody>
</table>
| **Town Centres**  
  - Solid waste  
  **OPERATION PHASE**  
  ◆ Provision of disposal bins at designated areas at the town centres near the road  
  ◆ Regular collection and disposal of garbage by the local authority/council | | Local Municipal council | Inspection  
  ◆ Schedule and disposal methods of solid waste collection from the town centres  
  ◆ Complaints of residents on status of garbage collection and cleaning of the waste at town centres | daily  
  ◆ Town centre cleanliness  
  ◆ Garbage accumulation  
  ◆ Number of drainage areas clogged  
  ◆ No report of pests infestation | |
| **Road Construction**  
  - Settlement Changes  
  **CONSTRUCTION PHASE**  
  ◆ Discourage informal settlement near the road | | Local Municipal Council | Inspection/observation  
  ◆ Number of informal settlements coming up along the project | monthly  
  ◆ Random inspection of new informal settlements | No direct costs |
| **Road Use**  
  - Traffic, Road Safety & Public health and safety  
  **OPERATION PHASE**  
  ◆ Controlled development along the road  
  ◆ Discourage informal settlement near the road  
  ◆  | | Local Municipal Council  
  Local Government officials | Inspection/observation  
  ◆ Complaints of traders  
  ◆ Insecurity along the road | regularly  
  ◆ Random inspection of new informal settlements | No Direct costs |
| **General Health & Safety**  
  - Traffic, Road Safety & Public health and safety  
  **CONSTRUCTION PHASE**  
  ◆ Provide medical and insurance cover for all workers  
  ◆ Provide and enforce use of PPEs to all workers | | Supervising Engineer and Contractor  
  Municipal Health & Environmental Officer, local authorities | inspection  
  ◆ Regular meetings with local authorities on health and road safety issues  
  ◆ Complaints from local residents | Monthly  
  ◆ Information flow, dissemination and awareness on health and safety  
  ◆ Minimal complaints from residents  
  ◆ Compliance with road regulations and rules | Bill No 1,5,9,20 |
<table>
<thead>
<tr>
<th>Project Activity Environmental and Social Impact</th>
<th>Proposed Mitigation Action Plan</th>
<th>Responsibility for intervention and monitoring during design, construction and defects liability period</th>
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<th>Timing - Recommended frequency of monitoring and Targets</th>
<th>Cost of Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Road Safety</strong></td>
<td><strong>OPERATION PHASE</strong></td>
<td>♦ Construction of all road furniture ♦ Construct speed bumps on approach to the town centres ♦ Enforcement of speed limits on the road ♦ Regular sensitization and awareness campaign on HIV/AIDS and STDs to roads users of the roads and the local community</td>
<td>Supervising Engineer and Contractor Traffic Police</td>
<td>inspection ♦ Regular meetings with local authorities on road safety issues ♦ Complaints from local residents</td>
<td>Monthly ♦ Prevalence of prostitution, HIV/AIDS and STDs, especially along the main centres located on the main road ♦ Number of accidents recorded by category ♦ Minimal complaints from residents ♦ Compliance with road regulations and rules</td>
</tr>
<tr>
<td><strong>Drainage Structures</strong></td>
<td><strong>CONSTRUCTION PHASE</strong></td>
<td>♦ Proper installation of drainage structures</td>
<td>Design Engineer, Supervising Engineer and Contractor</td>
<td>inspection ♦ Efficiency of drainage structures ♦ condition survey along the road</td>
<td>During construction and on completion of each structure ♦ construction methods</td>
</tr>
<tr>
<td><strong>HIV/AIDS, STDs, and any other environmental health disease prevalence</strong></td>
<td><strong>OPERATION PHASE</strong></td>
<td>♦ Regular maintenance program of drainage structures ♦ Sensitization program to motorists and residents along the road on waste disposal that might clog the drains</td>
<td>Environmental Unit and Local Road Authority Engineer Municipal Council</td>
<td>inspection ♦ Efficiency of drainage structures ♦ maintenance and market condition survey</td>
<td>Routine maintenance ♦ Unclogged drainage ♦ Free flow of surface water</td>
</tr>
<tr>
<td></td>
<td><strong>CONSTRUCTION PHASE</strong></td>
<td>♦ Sensitization campaign on HIV/AIDS and STDs in the communities and workers ♦ HIV/AIDS awareness campaigns, distribution of materials ♦ Training of the dangers of HIV/AIDS and Prevention</td>
<td>Contractor, Supervising Engineer Municipal Health &amp; Environmental Officer, local authorities</td>
<td>observation / reports</td>
<td>Continuous ♦ Response to HIV/AIDS issues ♦ Information flow, dissemination and awareness on health and safety</td>
</tr>
<tr>
<td>Project Activity Environmental and Social Impact</td>
<td>Proposed Mitigation Action Plan</td>
<td>Responsibility for intervention and monitoring during design, construction and defects liability period</td>
<td>Parameters for Monitoring/Indicators</td>
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<td>Cost of Mitigation</td>
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<tr>
<td>measures (provision of condoms)</td>
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<tr>
<td><strong>OPERATION PHASE</strong></td>
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<tr>
<td>♦ Regular sensitization and campaign of traders and customers on HIV/AIDS</td>
<td>Environmental Unit in Municipal Council</td>
<td>observation / reports</td>
<td>Continuous</td>
<td>♦ Response to HIV/AIDS issues ♦ Information flow, dissemination and awareness on health and safety</td>
<td></td>
</tr>
<tr>
<td>♦ Provision of free HIV/AIDS written materials and prevention materials such as condoms</td>
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<td><strong>Social Issues</strong></td>
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<td>♦ Employment</td>
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<td>♦ Social Economic effects</td>
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<td><strong>CONSTRUCTION PHASE</strong></td>
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<tr>
<td>♦ Utilization of local skilled and unskilled workers</td>
<td>Contractor, Supervising Engineer</td>
<td>observation / reports</td>
<td>weekly</td>
<td>♦ Number of people looking for employment ♦ Complaints from local residents</td>
<td>No direct costs</td>
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<td>♦ Utilization of Labour Based Methods when necessary</td>
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<td><strong>OPERATION PHASE</strong></td>
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<tr>
<td>♦ Utilization of local skilled and unskilled workers during maintenance</td>
<td>Road Authority local office</td>
<td>observation / reports</td>
<td>Continuous</td>
<td>♦ Improvement in key economic indicators compared to previous years for local residents</td>
<td>No direct costs</td>
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<td><strong>Disaster Management</strong></td>
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<td><strong>CONSTRUCTION &amp; OPERATION PHASE</strong></td>
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<td>♦ Plan to be drawn up, considering likely emergencies and steps required to prevent/limit consequences.</td>
<td>Contractor, Supervising Engineer, All Local Municipal authorities (police, fire, and hospitals)</td>
<td>observation / reports</td>
<td>monthly</td>
<td>♦ Number/percentage of incidences that warrants disaster preparedness</td>
<td>No direct costs</td>
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<td>♦ Sensitize all construction workers on various disasters that might arise during construction</td>
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<td>♦ Ensure that there is a communication system/method involving local authorities, fire,</td>
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<tr>
<td>Project Activity Environmental and Social Impact</td>
<td>Proposed Mitigation Action Plan</td>
<td>Responsibility for intervention and monitoring during design, construction and defects liability period</td>
<td>Parameters for Monitoring/Indicators</td>
<td>Timing - Recommended frequency of monitoring and Targets</td>
<td>Cost of Mitigation</td>
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<td>police etc in place to handle any disaster</td>
<td>♦ Ensure that there is a standby committee with a documented Disaster Management Plan to be followed in case of an emergency ♦ Availability of DMP for local authorities for use ins case of an emergency during operational stage of the project such as an accident</td>
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9.3 Decommissioning phase
The decommissioning plan is important in ensuring that after the construction of the project is over, any activity that could have resulted to a negative impact is restored to a better or its original environmental status. Example of such activity could be the rehabilitation of a material site, handing over boreholes used for water sources to the local community, etc.
It is important to note that whatever decision is taken by the stakeholders in the project, it will be important for the leading authority to consult with the relevant authorities on the local and national on the environmental and social implications that might arise out of their decision.

The following section describes the potential positive and negative impacts during the decommissioning stage.

9.3.1 Construction Camp Sites
The contractor, together with the employer (in this case the road authority) and the local authorities can establish what the site can used for in future, such as a maintenance or site office for the authority’s road maintenance department in the area. However, if no use for the camp site is established before the end of the project, the camp site should be decommissioned by demolishing all the structures and sub structures to discourage informal settlement at the site.

9.3.2 Construction site Solid Waste
The construction waste will mainly consists of earth materials, such as concrete and any other waste left after the temporary site is demolished. It is anticipated that most of the waste will be recyclable and can be re-used in the future projects by the contractor or per the contract with the responsible road authority, while the unused will be disposed properly at an approved dumpsite, or any other approved method.

9.3.3 Air Quality
During the decommissioning stage of the road project, dust during the demolitions of structures is likely to cause some impact on the area population and the residing population within immediate vicinity of the temporary storage and camp sites. These impacts will be short term and with the proper and efficient method of dust control, the impacts can be minimized.

9.3.4 Noise Pollution
Demolitions might cause a little noise pollution during the breaking of concrete structures that might be built at the temporary site. This there will be short-term noise impacts in the immediate vicinity of the temporary site, lasting only a few days because there will be very few concrete structures at the temporary market.
Since the temporary site is bounded by open land, the impact will diluted. Whatever minimal impact due to noise pollution is anticipated, it will be further minimized by ensuring that no noise generating activity is carried out during night hours.

9.3.5 Solid and Chemical Waste
The construction waste will mainly consists of earth and other materials such as fuels, oils, bitumen, concrete and any other waste left after the road is complete and temporary camp and storage sites are demolished. It is anticipated that most of the waste will be recyclable and can be re-used in the future projects by the contractor, while the unused will be disposed properly at the Municipal Council dumpsite, or any other approved method or site. In addition, none of the materials that will be used for camp and storage sites for construction will be harmful leading to certain hazardous chemicals into
the environment or into the affect the groundwater quality. The contractor should also ensure that the storage sites, especially where bitumen and other fuels/oils are stored should be cleaned up under the supervision of an environmental expert to ensure no residue of any potential harmful chemicals are left on the sites.

9.4 Institutional Responsibilities

Institutional responsibilities for incorporating mitigation measures and for monitoring various environmental/socio-economic aspects have been indicated in Table 9.1 above.

During the defects liability period the contractor must make sure that the road is completely serviceable, which entails ensuring optimal performance of all structures.

During construction, the Supervising Engineer and Contractor will be responsible for implementing all the proposed mitigation measures. However, the overall task of ensuring that mitigation is in fact implemented lies with the MoR&PW Maintenance Unit.

After the defects liability period, responsibility for the maintenance of the project road will lie with the Maintenance Branch of the Roads Department in the MoR&PW Maintenance Branch. Therefore the District Roads Engineers, during routine or periodic maintenance can monitor certain parameters such as efficiency of drainage structures, or when carrying out annual maintenance needs assessments.

9.5 Conclusion and Recommendations

9.5.1 Conclusion

The primary objective of the study on the Bachuma Gate – Maji ya Chumvi (A109) road is to rehabilitate and upgrade the road project to international standards to meet the same specifications as the other section of Nairobi – Mombasa highway. Since the road already exists, the environment along the road has been considerably altered and any major impacts will have already occurred.

The project is not affecting arable lands, historic landmarks, cultural sites, and not causing any major negative environmental and social-economic impacts, thereby causing minimal disruption. Nevertheless, as evaluated by the ESIA, the Project will create some adverse environmental and social impacts, which can be mitigated or minimized to acceptable levels.

Key negative impacts will result from a number of issues including soil erosion during earth and excavation works and the construction of structures, e.g. culverts, cross-drains and bridges. Soil erosion, particularly as a result of excavation works at the gravel pits, can be mitigated through proper supervision and efficient operation activities. Pollution due to air, dust, noise, and sediments will occur during construction. During operation, vehicular air pollution and noise will increase due to the improved road. This will also impact on public health. Sewage systems or waste collection do not serve homes and towns along the road project. Therefore, sanitation and hygiene in the workmen’s camps will be a concern, but this can be mitigated by maintaining proper hygiene conditions at the camps.

Additional disturbances due to construction works will therefore be minor and not significant. No adverse environmental impacts of significant magnitude are foreseen that would hinder the proposed upgrading of the project road.

Water resources might be heavily impacted on during construction works putting an added strain on the local communities and wildlife. Loss of vegetation is inevitable during construction works for extension of the road reserves and the proposed deviations.
Workmen’s camps should preferably be located at market centres along the route to avoid new settlements along the project road. Workmen’s camps must not stress the local resources (fuel wood and water supplies) at the expense of the local population, and livestock.

The project road is to be designed for improved access and is likely to result in higher speeds, which pose a danger to non-motorised traffic. The provision of bumps and installation of directional and warning signs will help to mitigate this impact.

It is anticipated that in the long term there will be considerable economic benefits accruing to the entire country and, the local communities that are directly or indirectly use/served by the road thorough improved traffic flow and increased business activities along the road.

With the total mitigation costs accounting for less than 5% of the total project costs, the Project is considered feasible environmentally as well as economically. It can be concluded that in the long term there will be considerable economic benefit accruing through increased business activities to the areas of influence of the market. Therefore, the proposed Bachuma Gate – Maji ya Chuma road rehabilitation and upgrade has positive impacts that outweighs the key negative impacts that results from the construction works.

9.5.2 Recommendations

Recommendations for the prevention and mitigation of adverse impacts are as follows:

- The local people must be informed of the details and progress of the project, particularly those who have structures on the road reserve
- Establish office of public relations, complaints desk and suggestion boxes for communications along the road project
- The contractor should employ some of his unskilled and skilled labour from the local residents which the road traverses. It is recommended that this should be taken seriously as it could cause friction among communities living along the route and the construction workers from outside the area. Where possible local residents should be used during construction works
- New gravel pits must be cordoned off or fenced during use, and rehabilitated after use or converted to water pans for use by local people and wildlife
- It is also recommended that during implementation of the project, extension and rehabilitation of the area water projects should be considered which in turn would provide water for the construction. The project should then be reverted to the community and act as a social responsibility to the community.
- Unnecessary clearing of vegetation should be avoided to preclude additional erosion.
- Shrubs and grass should be planted along road embankments to prevent erosion
- Road safety signs and other precautionary features should be constructed to guard against the likelihood of increased incidence of accidents especially at near schools and market centres.

A copy of the environmental management and monitoring plan must be given to the Contractor prior to construction. The contractor needs to draw up an environmental management plan of his own to show how he will address all the mitigation measures. The Supervising Engineer is responsible for assessing the Contractor’s environmental management plan.

Compensation to landowners through direct negotiations and agreement between the Ministry of Lands and the land owners/group ranches or clans who must relinquish their land for the project road must be fair and payments have to be made promptly. Compensation should cover crops, all structures (permanent and mud-and-wattle structures, pens, sheds, fences, etc.) and land.
Diligence on the part of the contractor and proper supervision by the Supervising Engineer during construction and the initial operation phase is crucial for mitigating impacts. However all mitigation measures need to be specified in tender and contract documents, and must be included in the Engineering Drawings, Specifications and Bills of Quantities.

Periodic environmental monitoring would ensure that measures that have been implemented in order to prevent or avert any negative impacts have been carried through.
10 REFERENCES

(i) Final Engineering Report, 2003 by MECE / CAPE consult / BKS Consulting Engineers


ANNEXES
ANEX I

MAP SHOWING THE ROAD SECTION
ANNEX II

SAMPLE QUESTIONNARE AND RESPONSE BY STAKEHOLDERS
ANEX III

SITE PHOTOGRAPHS
Annex IV

Copy of Terms of Reference