ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED INLAND CONTAINER DEPOT NAIROBI ACCESS ROAD LINE A ALONG THE INNER BOUNDARY OF THE NAIROBI NATIONAL PARK

A KENYA VISION 2030 TOWARDS A GLOBALLY COMPETITIVE AND PROSPEROUS NATION PROJECT

PROPONENT:

KENYA

RAILWAYS

CONTRACTOR:

CHINA ROAD AND BRIDGE CORPORATION
(CRBC)

ENVIRONMENTAL EXPERTS:

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This Environmental and Social Impact Assessment report is submitted to the National Environment Management Authority (NEMA) in pursuant to the requirements of the Environment Management and Coordination Act, 1999 and the Environmental (Impact Assessment and Audit) Regulations, 2003

PROJECT PROPONENT

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EIA CONSULTANT

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DECLARATION

KENYA RAILWAYS

That the Environmental and Social Impact Assessment (ESIA) study report submitted is based on the proposed construction of Standard Gauge Railway (SGR) Inland Container Deport Nairobi (ICDN) Access Road A project;

That the study has been conducted to the highest standards possible:

That during construction and operational phases, the developer will abide by the findings and the recommendations of the study.

NAME: …….

DESIGNATION: …….

SIGNATURE and Stamp:

DATE……

EIA CONSULTANTS:
That the Environmental and Social Impact Assessment (ESIA) study report submitted is based on the proposed construction of Standard Gauge Railway (SGR) Inland Container Deport Nairobi (ICDN) Access Road A project;

To my knowledge, all information contained in this document is an accurate and truthful representation of all findings as relating to the proposed projects as per projects information provided by the proponent and contractor to the ESIA consultant:

That the study was conducted to the highest standards possible:

NAME: **Vincent O. Oduor (NEMA Registration Number 346)**

SIGNATURE…….

DATE……...

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LIST OF ACRONYMS AND ABREVIATIONS

AIDS	Acquired Immuno-Deficiency Syndrome
BoD	Board of Directors
BOD	Biochemical Oxygen Demand
CBD	Convention on Biological Diversity
CRB	China Roads and Bridge
CBO	Community Based Organization
CPP	Consultative Public Participation
CSR	Corporate Social Responsibility
CSRP	Corporate Social Responsibility Program
dBA	Decibels
DFI	Development Finance Institutions
DOE & C	Directorate of environment and compliance
DRSRS	Department of Resource Surveys and Remote Sensing
EA	Environmental Audit
EMCA	Environmental Management and Coordination Act
EHS	Environmental, Health and Safety Guidelines
EIA	Environmental Impact Assessment
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GoK	Government of Kenya
WHO	World Health Organization
KNBS	Kenya Bureau of Statistics
KWS	Kenya Wildlife Service
m asl	meters above sea level
MoENR	Ministry of Environment and Natural Resources
NEAP	National Environmental Action Plan
NEMA	National Environmental Management Authority
NGO	Non-Governmental Organizations
NNP	Nairobi National Park
OHS	Occupational Health Safety
OHSAS	Occupational Health and Safety Standards
PAP	Project Affected Persons
PPE	Personal Protective Equipment
ROW	Right of Way
SGR	Standard Gauge Railway
TOR	Terms of Reference
TSS	Total suspended solids
UNFCCC	United Nations Convention on Climate Change
WB	World Bank
WRMA	Water Resources Management Authority

0. NON TECHNICAL SUMMARY

0.1. General overview

The proponent, Kenya Railways (KR) proposes to construct an access road linking the Nairobi Inland Container Depot (ICD) and the Southern bypass road in Nairobi, Kenya. The total length of the proposed access road is approximately 4.153km long and 21m wide. Its starting point will connect the west entrance of the ICD running through the inner boundary of the Nairobi National Park (NNP) and the end forming a partial "pear-shaped "interchange with the Southern bypass road. The main material inputs will include sand, ballast, cement, steel, bitumen and stones.

Since the proposed project is designed to utilize land in the Nairobi National Park (NNP), it will impact on it negatively resulting in loss of habitat, vegetation, and compromising with the ability to provide vital ecosystem services. It may also cause change in wildlife behaviour due to disturbance effects that might be felt beyond the confines of the edges of the road. It is therefore recommended that the proponent in collaboration with relevant lead agencies compensates for wildlife habitat lost due to project activities both during construction and operational phase. This can be done by purchasing land on the southern part of the park where key migratory corridors in the Kapiti plains are under threat.

Public consultation was done by a dual method (a) questionnaire (b) public consultative forum that was held on 2nd March 2018 at Kenya wildlife Service Headquarters. A majority of those consulted at the consultative forum believed the proposed project will result in habitat loss in the NNP. They requested that a viable alternative route be used instead of the current proposal while the proposed road A neighbourhood establishment consulted via questionnaires approved of the project and couldn't wait to get alternative route from Mombasa road. The alternatives considered in this report include:

1. Construction of the access road A along the outer boundary of the NNP.
2. Construction of the access road A under the NNP as a tunnel linking it to the Southern Bypass road.
3. No project alternative – Project is not constructed thus trucks from ICD continue using Mombasa road.
4. Construction of the proposed project as currently proposed along the inner boundary of the NNP

0.2. Environmental, socio-economic impacts and mitigation measures

The project has many advantages, including improved transport capacity, safety, punctuality that is helpful for improving lagged transport conditions in Kenya, reduction of emissions and transportation costs among others.

The project will also bring with it some negative impacts on the physical, cultural and the socio-economic environment. In view of this, the proponent has undertaken this Environmental and Social Impact Assessment to address the negative impacts and enhance the positive impacts.

Table 1: Summary of potential environmental impacts and mitigation measures

No.	Impacts and Objective	Mitigation measures
DESIGN AND PLANNING PHASE AND CONSTRUCTION PHASE		
Socio-cultural and economic conflicts		
	To control the impacts on the NNP especially habitat loss	Compensation of land ceded for the project including that affected by disturbance impacts such as noise and air pollution. Such land should be purchased on the Southern side of the NNP (i.e. Kapiti plains) pursuant to the objectives of Kenya's vision 2030 regarding environmental conservation.
	To reduce possible conflicts related to hiring of workers	Equitable provision of employment opportunities with regards to gender, skills, indigenous people and disability
	To promote the use of local service providers	Local procurement of goods and services will be undertaken wherever possible and cost effective and where practicable to the project
	To ensure minimum public inconvenience during construction across key public utilities	Continuous consultation and involvement of the directly affected stakeholders (DAS) will be undertaken with respect to water, sewerage, pipelines, electricity, old rail, roads, etc., at all stages of the project cycle
T**raffic management and safety**		
	To promote smooth traffic flow and safety during the construction period	No overloading of trucks and. good driving practices to be practiced. Suitable junction/access point to be provided. Use of appropriate & legible signage. Employment of formal flagmen / women to ensure the public safety. Erect road signage informing other road users of the nearby construction works. Ensure that truck drivers are educated on road safety
Soil Erosion		
	To reduce and control the impact of soil erosion	Fine grained materials (sand, marl, etc.) will be stockpiled away from drainage channels and low berms will be placed around the piles which themselves will be covered with tarpaulin to prevent them from being eroded and washed away. Loose soils to be used to fill back excavated/disturbed areas. Loose soils to be compacted with a mechanical roller to avoid erosion by wind or water. Planting of grass on the slopes of the subgrade to slow runoff
Noise and excessive vibrations		
	To minimize disturbance of neighbouring establishments, construction workers & communities with excessive noise and vibrations	Provision of mufflers on exhausts and standard restrictions to hours of site works. Water spraying on dusty sites during strong wind. Utility of machinery with high noise e.g. pile drivers should be conducted at day time; Night operations (if necessary) should only include machinery with low noise emissions. Use of ear muffs by construction workers
	Air quality management	
	To minimize the entrainment of dust during	Covering wetting of materials and wastes, during transportation. Regular surface wetting on roads under

construction	construction and cleared areas to minimize entrainment of dust.
Loss of vegetation	
To reduce and control loss of vegetation	Retention of vegetation where possible and replanting of grass, shrubs and trees in other undisturbed areas should be applied. Minimize the destruction or damage of vegetation cover by clearing construction designated areas only
Occupational Health and Safety	
To ensure healthy and secure environment along the construction route for all the construction workers	Employees will be informed on the necessary safety procedures and be competent in the work they are employed to do; All necessary safety regulations must be abided by including building codes and fire practice requirements; Inspection of material and harmonization to the occupational health and safety standards.
To establish a proper accident and emergency response strategy	The construction company shall establish an emergency leading group, accident scene command group, an accident treatment group, a guard and defend group, a medical aid group, an environmental monitoring group, a logistics group, an accident investigation team
Increased use of local resources (sand, timber, gravel etc.)	
To enhance prudent usage of resources	The sources of all required materials should be inspected prior to acquisition to confirm that they are legitimate operations. In the case of sand or ballast, an EIA license should be applied for before commencement of quarrying activities. WRMA permits and EIA licenses must be obtained before any water abstraction
Construction waste management	
To prevent the contamination of soils and water resources due to inappropriate management and disposal of waste	The management of construction solid waste shall adopt the integrated solid waste management system through a hierarchy of options: a) Source reduction, b) Recycling, c) Composting and reuse, d) Combustion, e) Sanitary land filling. The proponent & contractor will liaise with the County government & designate a proper site for disposing excavated soils
Visual Impact	
To reduce and control the impact on local aesthetics during construction	Adoption of alternatives to the alignment and their associated above-ground structures; and refinements to the basic engineering and architectural design including layout, built structures etc. to avoid and/or minimize potential adverse impacts. Care will be taken to avoid having open trenches in an area for a long period of time.
Exhaust and gaseous emissions	
To reduce the health and environmental impacts of gaseous emissions from construction vehicles and	Reduce gaseous emissions by selection of appropriate machinery and regular servicing of vehicles. Provide workers with appropriate protective gear including masks to cut down on gaseous emissions inhaled. All workers

machinery	involved in construction activities to wear face masks.
Invasive species	
To prevent the introduction and spread of invasive species along the access road route	Screen the construction equipment to avoid the spread of invasive species such as *Nicotiana glauca* and *Prosopis* seeds attached to road construction machinery
Public health	
To promote awareness on issues related to STIs and HIV/AIDS	Continuation of awareness (through distribution of flyers, condoms and holding related sensitization classes) program on risks associated with STIs and HIV/AIDS will be undertaken.
OPERATIONAL PHASE	
Potential for accidents	
To reduce the occurrence of road accidents	Erect appropriate road furniture to inform road users about safety e.g. speed limits; Patrolling of the road by National Transport Safety Authority (NTSA) and Traffic police to ensure that road users adhere to set rules and regulations
Increased surface run off	
To reduce the impact of surface runoff	locate appropriately sized culverts in the correct locations to eliminate any flooding problems that the access road may cause; The road is designed with a drainage system that'll reduce or eliminate any negative impacts resulting from the proposed access road, to improve drainage conditions where possible and to enhance public safety
Reduced Surface area for rain water percolation	
To enhance water percolation along the access road	This impact is cumulative but measures such as planting grass on the embankment slopes as opposed to having embankment slopes that are completely made of concrete will enhance rain water percolation.
Noise and vibration	
To reduce the impact of noise occasioned by the new road	Conduct annual noise assessment to determine if traffic from the new road is causing negative impacts to the environment; Where necessary, noise mitigates structures such as noise barriers should be put in place

0.3. Conclusion and recommendations

Conclusion

1. The proposed project is an important infrastructure that will link the Nairobi inland container depot and the southern Bypass road enabling smooth, faster and cheaper transportation of freight into the hinterland of the Northern corridor. This will enhance the ICDs objective of decongesting the port of Mombasa as well as decongest Mombasa road and other nearby feeder roads
2. However, the project construction as with any other anthropogenic activity will result in negative and positive impacts. The negative impacts to the NNP are long term thus

adequate measures should be undertaken to compensate both for lost habitat and the disturbed area beyond the edges of the road.

Recommendations

1. Since the proposed project is designed to utilize approximately 21m width x 4153m length of land in the inner boundary of the eastern side of the NNP, the proponent is advised to compensate for this land by purchasing at least 10 times or more of similar land on the southern side of the park that is currently in danger of being fully developed thus preventing migration of wildlife. The purchased land must be subsequently gazetted as protected land belonging to the NNP. This will not only compensate for land but also aid in the conservation efforts for the NNP.
2. Compensate for loss of existing support facilities to the NNP. These facilities include, the boundary fence, offices and wardens camp. Similar facilities must be constructed (under the guidance of KWS) as first order of business before commencement of the proposed road construction.
3. The proponent is therefore advised to facilitate replanting of trees, shrubs and grass inside the park as directed by KWS.
4. Effective Monitoring and Evaluation (M&E) to ensure all the mitigation measures proposed are adhered to fully during project construction.
5. Given the dearth of data on post transport infrastructure project impacts in Kenya, it is further recommended that life cycle assessments, cumulative impact assessments (CIAs) and other related studies for similar projects undertaken by the proponent and others should be commissioned.

1. INTRODUCTION

1.1. Background

The current proposal is to construct a 4.15km Road linking the Embakasi Inland Container Depot (ICD) through the Nairobi National Park inner boundary and onto the Southern Bypass Road. The proposed project is currently the missing link to the ICD. The ICD is linked to Eastern Bypass Road (construction complete) by the access road B and onto Mombasa Road by the ICD Road. The proposed access road A is the missing link to the Southern Bypass Road.

1.2. The Embakasi Inland Container Depot

The ICD in Embakasi (Nairobi County) is owned and operated by the Kenya Ports Authority and is linked by the standard gauge railway (SGR) to the Port of Mombasa. It provides shippers with dry port facilities in the commercial heart of the country and it was established in 1984. The spacious yard of 29 hectares located in Industrial area off Mombasa Road on ICD Road can accommodate a throughput of over 180,000 TEUS per annum making it ideal for shippers of both Exports and Imports and Empty containers[1].

The key function of the ICD and other dry ports under development is to relieve the congestion at the Mombasa port and its adjacent areas and to some extent aid the continuous movement of container traffic into the hinterland. Dry ports were introduced (first in Europe) as a means of accessing the hinterland and reduce the pressure on the bottle necked, congested and inefficient sea ports (Werikhe & Zhihong, 2015).

In Kenya the dry port concept has provided more efficient logistics at the Mombasa seaport terminal, reduced waiting times for truckers at the terminal and eased congestion and thereby better transit time. However, Kenya and other East African Countries still lag when it comes to faster movement of cargo due to lack of adequate infrastructure such as railway and roads. As a result, the government of Kenya and others in the Northern Corridor[2] (World Bank, 2005) are making efforts to improve the road and railway networks to facilitate speedy and affordable movement of cargo to and from the region.

1.3. The need for ICD Access Road Line A

As mentioned earlier, the ICD is linked to the Mombasa port by railway. Transportation from the ICD to other parts of the country is currently by road. The ICD is linked to the Eastern Bypass via ICD access road line B; it is also linked to the busy Mombasa Road via the ICD Road. There is however a missing link to the Southern Bypass dubbed ICD Road Line A i.e. the current proposal under study. The ICD and associated infrastructure such as access roads is part of the SGR project making Kenya Railways the proponent.

[1] https://www.kpa.co.ke/EquipmentsAndFacilites/Pages/ICD-nairobi.aspx - accessed 3rd March 208 at 11:19 am

[2] The Northern Corridor is the main artery of transport facilities and infrastructure linking landlocked countries in the Great Lakes region of East and Central Africa. The corridor links Mombasa port with Burundi, D.R. Congo, Rwanda and Uganda.

The increased freight from the port of Mombasa due to the upgraded ICD is bound to increase congestion on Mombasa Road in a business as usual scenario. Therefore, the proposed ICD Access Road Line A is needed to among others:

1. To facilitate faster movement of cargo from the ICD thereby reducing transportation cost and transported goods.
2. To enhance the transportation between ICD yards and existing road networks with minimal inconvenience or with reduced pressure on existing roads especially Mombasa Road
3. Greatly improve and alleviate traffic congestion in the surroundings thereby reducing potential for accidents
4. Reduce overall emissions from road transportation thus reducing the carbon footprint of transported goods
5. Reduce transportation costs and overall freight transportation times thereby building business and investor confidence in Kenya's economy

1.4. Need for the EIA

Every anthropogenic activity has some impact on the environment. More often it is detrimental to the environment than benign. However, mankind as it is developed today cannot live without taking up these activities for his food, security among other needs. Subsequently, there is a need to harmonize developmental activities with the environmental concerns (Ogola, 2007). Environmental impact assessment (EIA) is one of the tools available to achieve the above-mentioned goal. It is a tool that was formalized by the United Nations Conference on the Environment in Stockholm in 1972[3].

1.5. Project objectives

The main objective of the project is: **To construct a 4.153km access road linking the Nairobi inland container depot to the Southern Bypass road along the inner boundary of the Nairobi National Park (NNP)**.

1.6. Study objectives and scope

The main objectives of this EIA are to identify the impacts and risks from the proposed construction of the access road and ensure compliance with Kenya's environmental laws and regulations and recommend appropriate measures that will mitigate as well as enhance the current condition of the environment in the project area. This report was prepared in compliance to the EIA and EA regulations of 2003.

The scope of the EIA was to:

[3] https://sustainabledevelopment.un.org/milestones/humanenvironment - accessed 3rd March 2018 at 11:11am

1. Undertake a comprehensive baseline environmental assessment along the proposed Access Road route and Nairobi County at large
2. Ascertain the expected social and environmental impacts of the proposed project and the magnitude of impacts,
3. Ascertain and analyze alternatives to the proposed project,
4. Recommend mitigation measures that will be implemented during preparation, construction, operation and decommissioning phases of the project,
5. Develop an all-inclusive Environmental Management Plan (EMP) with mechanisms for monitoring and evaluating compliance and environmental performance; which shall include the cost of mitigation and the period of executing the measures.

1.7. Terms of reference (TOR)

The terms of reference that were approved by the National Environment Management Authority for this project are appended to this report.

2. METHODOLOGY

2.1. Review of literature

Various relevant documents were reviewed for a clear understanding of the terms of reference, environmental status of the project area, data on demographic trends, land use practices in the affected areas, development strategies and plans (local and national) as well as the policy, legal and institutional documents. A list of references for all documents reviewed is provided at the end of this report (see List of References).

2.2. Screening and Scoping

Environmental screening and scoping is meant to determine whether an EIA was required and what level of assessment was necessary. This was done persuant to requirements of the EMCA, 1999, and specifically the second schedule. Issues considered included the physical location, sensitive issues and nature of anticipated impacts.

2.3. Data collection and analysis

The data collection was carried out through questionnaires/standard interview schedules, key stakeholder's meetings, use of checklists, observations and photography, maps, satellite imagery, site visits and desktop environmental studies, where necessary in the manner specified in Part III and IV (refer to Section 16-18) of the Environmental (Impact Assessment and Audit) Regulations, 2003.

2.4. Field assessment

Environmental conditions of the project area were investigated during the fields trips made into the project area. During the field trips, the team made relevant observations and carried out detailed survey of appropriate attributes of the project area including physical and biological parameters. Photographs of interesting characteristics of the project area were taken where appropriate. The environmental attributes of the project area captured during the field study are presented in a series of photographic plates in Annex 1-Photographic Plates Showing the Salient Features of the Project Area. Specific objectives of the field survey included.

a) Evaluating the environmental setting around the proposed project site. General observations were focused on the topography, land use trends, surface water sources, public amenities, land cover, climate, settlements, forests, soils, etc.
b) Undertake comprehensive consultative public participation exercises through questionnaires

2.5. Public consultation and data analysis

Public consultation is comprehensively covered in See section 7 of this report. The consultants used their past experience and knowledge with the aid of statistical tools to analyze field data so as to determine potential impacts, the severity of arising effects from the impacts and how these impacts could be best mitigated and positive impacts enhanced. This analysis provided a

framework on corrective actions and remedial measures and provides basis for the formulation of the EMP.

2.6. Interviews with proponents and contractors technical team

The EIA team consulted the proponents engineer and the contractor's technical team. This enhanced the EIA team's understanding of the proposed project, alternatives considered, projects design and operations among others. The information gathered was used to analyze the environment and socio-economic impacts of the projects.

2.7. Reporting

The EIA report (draft) was prepared within pre-agreed time frames such as to cover the requirements of the NEMA guidelines. The Final EIA report is submitted to NEMA for review and licensing. The proponent was continuously briefed throughout the EIA process.

3. BASELINE ENVIRONMENTAL AND SOCIO-ECONOMIC INFORMATION

3.1. Overview of Kenya's socio-economic profile

Kenya is the economic and transport hub of East Africa. Kenya's real GDP growth has averaged over 5% for the last eight years. Since 2014 Kenya has been ranked as a lower middle-income country because its per capita GDP crossed a World Bank threshold. Agriculture remains the backbone of the Kenyan economy, contributing one-third of GDP. However, GDP has been critiqued as an inefficient measure for standard of living with HDI being the preferred metric. Kenya's HDI in 2015 was 0.555 placing Kenya in the medium development category (UNDP, 2015). Inadequate infrastructure continues to hamper Kenya's efforts to improve its economic growth to the 8-10% range so that it can meaningfully address poverty and unemployment. The Table 2 below summarises some of the key socio-economic indicators for Kenya.

Table 2: Key socio-economic indicators for Kenya

No.	Indicator		National Value	Nairobi County	Remarks and References
1.	Land area (km^2)		580,370	695	GOK, 2009; (CCCC, 2017a)
2.	Population ($x10^6$ unless specified)		46.1	3.13	GOK, 2009; https://www.knbs.or.ke/
3.	Population density (2009) people per sq. km of land area		78.83	4,516	KNBS https://www.knbs.or.ke/
4.	GDP (%)	2016	5.9	-	Data obtained from www.worldbank.org
5.	GDP per capita US$ (2015)		1,376.71	-	www.energypedia.info
6.	HDI (2015)		0.555	0.671	UNDP, 2015
7.	Electrification rate 2013 (%)	Rural	7	72.4	Overall electrification rate for Kenya according to IEA, 2016 was 35%
		Urban	60		
8.	Poverty headcount ratio at national poverty lines (% of population) – 2009 unless specified		45.9	-	National poverty headcount ratio is the percentage of the population living below the national poverty lines[4]. In 2005-2006 poverty line was estimated at Ksh1,562/month and Ksh2,913/month per adult equivalent in rural and urban areas respectively
9.	Transportation (km- unless specified)	Paved roadways as % of total roads (2012)	13.7%[5]	44.1	According to (GOK, 2014) 11,197.9km of paved roads in 2013
		Unpaved roadways (2013)	149,687.7		
		Railway (meter gauge)	3,334	-	Mombasa-Nairobi SGR began operations in June 2017

[4] Source: World Bank, Global Poverty Working Group www.worldbank.org
[5] https://data.humdata.org/dataset/paved-roads-as-a-percentage-of-total-roads-in-kenya accessed 10th June 2017

		Pipelines (2013)	932	-	

3.2. Nairobi County

3.2.1. Location and size

Nairobi County is one of the 47 counties in the Republic of Kenya. It borders Kiambu County to the North and West, Kajiado to the South and Machakos to the East. Among the three neighbouring counties, Kiambu County shares the longest boundary with Nairobi County (Figure 1). The county has a total area of 696.1 Km^2 and is located between longitudes 36° 45' East and latitudes 1° 18' South. It lies at an altitude of 1,798 metres above sea level. The County is divided into seventeen sub-counties and a total of eighty-five wards. Administratively the proposed project i.e. Line A is in Langata Sub County, Nairobi County. The sub county measures approximately 52.1 km^2. Line A's starts on the geographical coordinates -1.335384 S, 36.875487 E and ends at -1.327800 S, 36.842628 E.

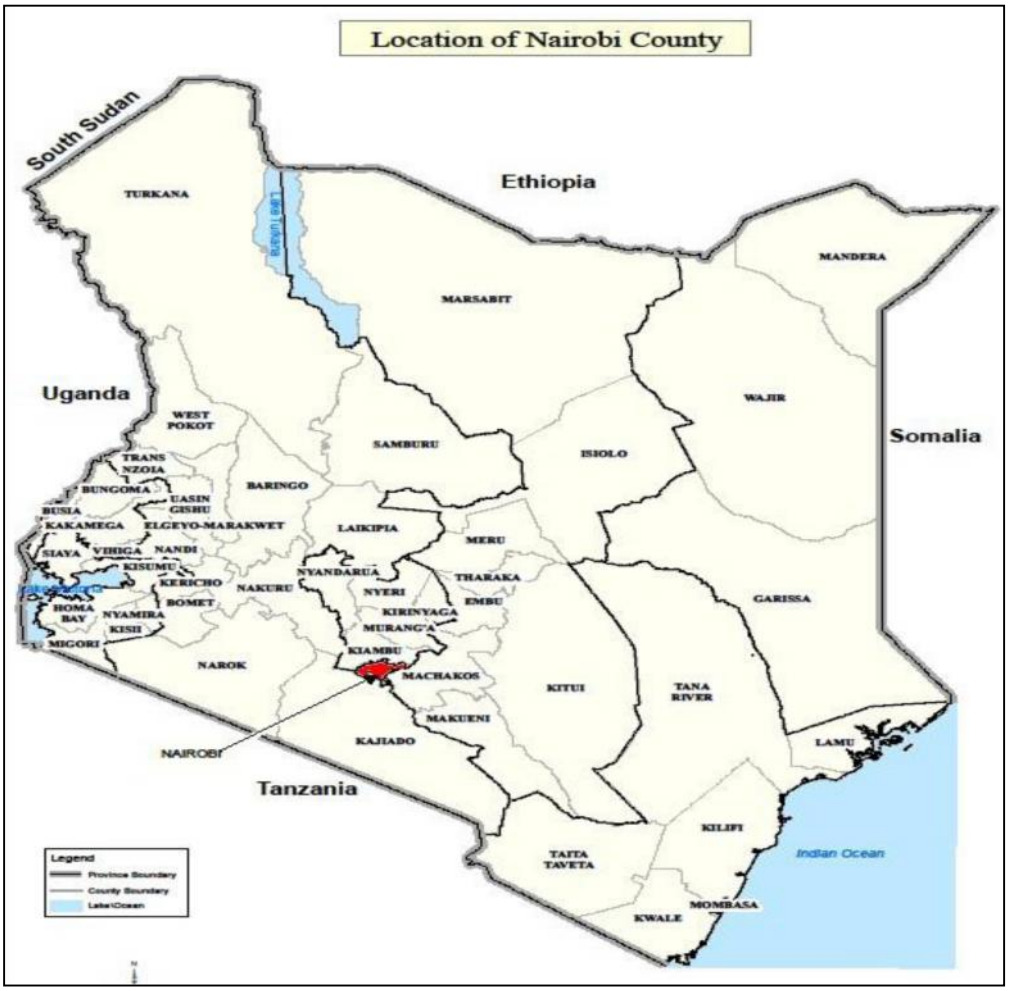


Figure 1: Location of Nairobi County

3.2.2. Climate conditions

The mean annual temperature in the area is 17° C and the mean daily maximum and minimum temperature are 23° C and 12° C respectively, On the other hand, the mean annual rainfall is 1080 mm falling in two distinct seasons: the long rains from March to May and the short rains from mid-October to December. The Northern and Western areas have a high rainfall; the East and South a low rainfall. The average annual temperatures of the area range from 18 to 20°C, with average minima and maxima of 12–14 and 24 – 26°C, respectively. The warmest period occurs from January to March. Average potential evaporation is between 1,550 and 2,200 mm per year [6].

3.2.3. Average Daily Temperatures

The average daily temperature throughout the year varies slightly from month to month with average temperatures of around 17°C during the months of July and August to about 20°C in March. But, the daily range is much higher, with the differences between maximum and minimum temperatures each day around 10°C in May and up to 15°C in February. Between the months of June to September, southeast winds prevail in the coastal parts of Kenya and last up to several days without a break. The clouds cause day temperatures to remain low and most times the maximum temperature stay below 18°C. The minimum temperatures also remain low during cloudy nights, usually hovering around 8°C and sometimes even reaching 6°C. Clear skies in January and February also bring colder nights. The highest temperature ever reached was 32.8°C and the lowest was 3.9°C.

3.2.4. Average Humidity Values

Because of its location just south of the equator in combination with humid air pumped in from the Indian Ocean, the humidity values for each day are generally on the higher end. This is not to say that values are always high, since the easterly winds coming off the Indian Ocean tend to keep the temperatures standard throughout the country. In the summer to autumn months of January to April, relative humidity values have been known to plummet to anywhere from 10% to 20%. The typical day, humidity-wise, starts off with nearly saturated in the morning hours, and steadily decreases throughout the remainder of the day.

3.2.5. Average Rainfall

With these routinely high relative humidity figures, it is not surprising that the Nairobi climate is one that produces much rain annually. In fact, from the past 50 years, the expected amount of rain could be anywhere in the range of 500 to 1500 mm, with the average ringing in at 900 mm. Most of these rainfall figures crash down in Nairobi in one major and one minor monsoon seasons respectively. That is what the meteorologists know about the monsoon seasons. What they do not know is exactly when these seasons will start. There is usually not an indication of when these rainy seasons will start, since it is difficult to determine when one starts and when the

6 https://www.google.com/search?q=nairobi+climate&oq=nairobi+climate&aqs=chrome..69i57j69i59.4722j0j8&sourceid=chrome&ie=UTF-8

other finishes. Consequently, one may think there is only one rainy season when looking at the annual rainfall amounts

3.2.6. Average Winds

Winds along the surface are predominantly easterly throughout the entire year. They are shifted to northeast between October and April, and they are shifted southeast between May and September. Right before the "Long Rains" season, the strongest winds occur, reaching speeds of 20 to 25 miles per hour. During the rest of the year, winds are usually at speeds of 10 to 15 miles per hour. During the night, the winds are calm [7].

3.2.7. Average Sunshine

Early mornings are often cloudy, but the sun peeks through by mid-morning. Throughout the year, there is an average of seven hours of sunshine per day. Thirty per cent more sunlight reaches the ground during the afternoon than in the morning. Of course, there is more sun shine during the summer months, when the sun is more overhead in the southern hemisphere. Infrequently during the rainy season, the sun never shows through the clouds. Even in August, the cloudiest month, there is an average of four hours of sunshine.

3.2.8. Transportation

3.2.8.1. Integrated Urban Development Master Plan for the City of Nairobi (NIUPLAN, 2014)

The Nairobi Master Plan (2015) has just been prepared by Nairobi City County government. The master plan gives very limited focus on the railway and air transport systems. The transport sector is mainly focused on road transport. The transport survey did not cover rail traffic (Section 7-1.3) (Nairobi City County Government/JICA, 2015). The NIUPLAN provides an integrated framework based on a comprehensive and holistic view of urban development. It was formulated through a thoroughly participatory and inclusive process marked by stakeholder participation from inception to validation.

The development vision for the plan is "Nairobi 2030: An Iconic and Globally-attractive City Aimed at Regional Integration and Sustainability" which is anchored on four pillars: i) Economy, ii) Environment, iii) Governance, and iv) Social Culture capturing the views and aspirations of the city residents and is as a result of numerous grassroots meetings and consultations held in each of the nine sub-counties of the City. In Section 7-2, the master plan is focused on the railway system but gives limited analysis on demand and supply.

The development policy is focused on the existing railway infrastructure and the construction of new MRT/LRT routes in the CBD and along 5 corridors- Thika, Juja, Jogoo, Ngong, Waiyaki

[7] https://www.google.com/search?q=nairobi+climate&oq=nairobi+climate&aqs=chrome..69i57j69i59.4722j0j8&sourceid=chrome&ie=UTF-8

and Outer Ring roads. An outer ring rail loop line is proposed to connect these radial corridor lines (Sector 7-2.3). The new Nairobi Master Plan (2015) does not provide for a new and modern national rail system (e.g. SGR) serving the city or linking Nairobi to the rest of the county and beyond. NIUPLAN 2014 recognizes that the main line of the Kenyan Railways Corporation (KRC) is the line from Mombasa to Uganda through Nairobi. Many railway commuters are using this line from the Athi River (south-east direction) to Nairobi, and from Kikuyu, (north-west direction) to Nairobi.

Many passengers are also commuting from Ruiru, (north-east direction) to Nairobi, on a branch line towards Thika Town. A short branch line towards Embakasi is also used by commuters. The NIUPLAN also recognizes the need for mass transit systems due to the increasing severe traffic congestion in the city. There are two approaches for the development of a rail-based mass transit system in Nairobi: 1) utilization of the existing KRC facilities and 2) construction of a new light rail transit (LRT) line or mass rapid transit (MRT) line. The NIUPLAN indicates that when the SGR is constructed, all the freight trains will be shifted to the new track, and the existing meter gauge track will be dedicated for passenger services.

3.2.8.2. Traffic management

The deterioration of public transport and traffic conditions has afflicted Nairobi County since the 1980s. These can be explained by the problem of inadequate means of mass public transport, the rapid increase in the number of cars mostly private, the lack of mass public transportation, poor enforcement of traffic regulations and lack of discipline on the part of both motorists and pedestrians. Much time is lost on the roads with vehicles consuming extra fuel due to the delays. This means heavy losses for the economy every day.

Road projects such as construction of the Thika super highway, Eastern and Southern by pass ring roads is aimed at easing congestion in the City. There are also plans to open up various by-pass roads, remove the round-a-bouts, find alternative parking for motorists outside the City center and review the Nairobi metropolitan public transport master plan.

3.2.8.3. Spatial Planning Concept for Nairobi Metropolitan Region

The spatial plan concept looks at multi-modal transport system in Nairobi Metropolitan Region. The spatial plan concept notes that the present transport network in Nairobi Metropolitan Region is inadequate and requires being re-structured, up-graded and technology modernized (Government of Kenya, Ministry of Nairobi Metropolitan Development, 2012).

3.2.9. Link between the proposed project and the county development plans

The key objective of the county development plans (such as those sited above) with regards to transportation is to reduce congestion and enhance movement of goods and people within the

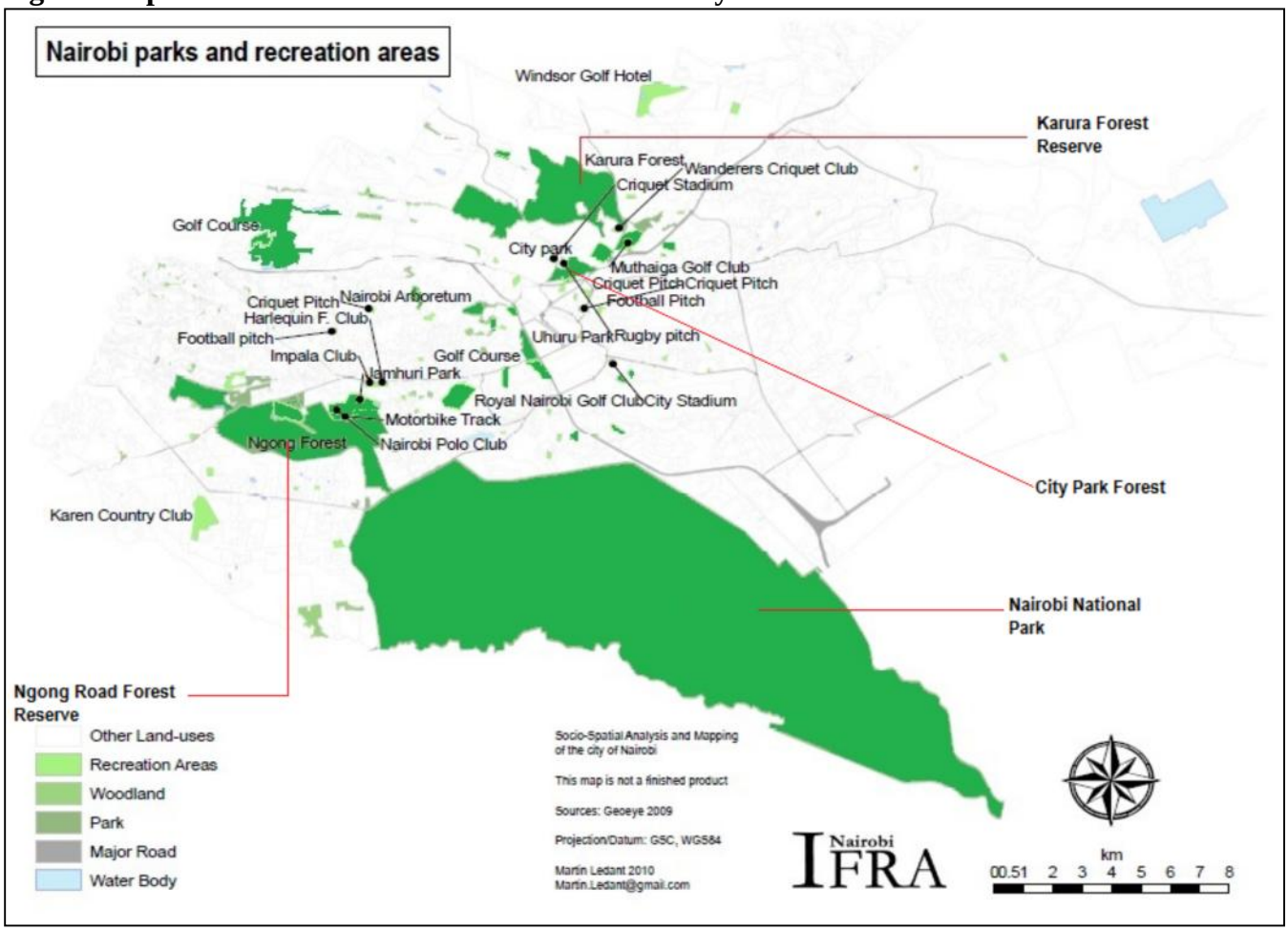
city[8]. The proposed access road construction is in line with these goals as it will ensure reduced congestion and enhance transportation of freight from the inland container depot.

3.3. The Nairobi National Park

3.3.1. Location and acreage

Nairobi National Park is in Nairobi, the Capital City of Kenya. The park is situated only 7 km south of Nairobi's Central Business District (CBD), in the southernmost part of the city. It lies between 2°18'- 2°20' South and 36°23'-36°28' East, at an altitude of 1780m above sea level (Kenya Wildlife Service 2005). The park measures 117km^2, (28,911.33) acres[9], covering almost 17% of the city (Government of Kenya, 2012).

Figure 2: Spatial context of NNP within Nairobi County



Source: French Research Institute, Nairobi

[8] Whereas the Nairobi County Integrated County Development acknowledges that there are "missing road links", it does not specifically mention what these links. This ambivalence makes it difficult for prediction of future cumulative impacts (both positive and negative) for such projects.

[9] http://www.kws.go.ke/parks/nairobi-national-park - accessed 3rd March 2018 at 1:26pm

The park is left open in the southern part, opening up to the rural Kitengela Community Region within the Athi-Kapiti Ecosystem in Kajiado County (also referred to as the Kitengela Conservation area) by Kenya Wildlife Service (Government of Kenya, 2012). Regionally, Nairobi National Park is part of the larger Athi-Kapiti-Ecosystem which covers an area of about 2200 km^2 as shown in the map below (Gichohi, Functional Relationships Between Parks and Agricultural Areas in East Africa, 2003).

3.3.2. Uniqueness of the NNP

It is believed that NNP is the only game reserve in the world that is inside a big city. Because of this, the park is not just an important ecological feature, but also a significant national symbol, with substantial economic, social and cultural benefits (Mbatia, 2015). Being in a big city, during major urban, industrial and transport processes, the park is environmentally significant, acting as a major carbon sink.

Economically, the park generates significant revenues from wildlife tourism, as well as creates employment for many working directly and indirectly in the sector. Socially, the park acts as an important recreational space for the urban residents, who use it as a recreational green space. Furthermore, the park is an important cultural feature that contributes to preserving the countries natural heritage. Despite its small size, NNP has a rich combination of flora, fauna and geomorphological features. The parks major habitats include grasslands, scattered trees, bush land, rocky habitats, rivers and streams, dams, wetlands and forest. The animals include a range of herbivores, carnivores, primates, reptiles and amphibians and birds.

3.3.3. Key Challenges faced by the NNP

The main challenges to the conservation of the NNP can be linked to urbanization and sprawl, habitat fragmentation, habitat loss and degradation, pollution, land cover and climate change among others. These aspects have mainly been driven by resource consumption and human activities that support it. On the extreme conservation point of view, the NNP could have been better without the city of Nairobi and its high population growth rate.

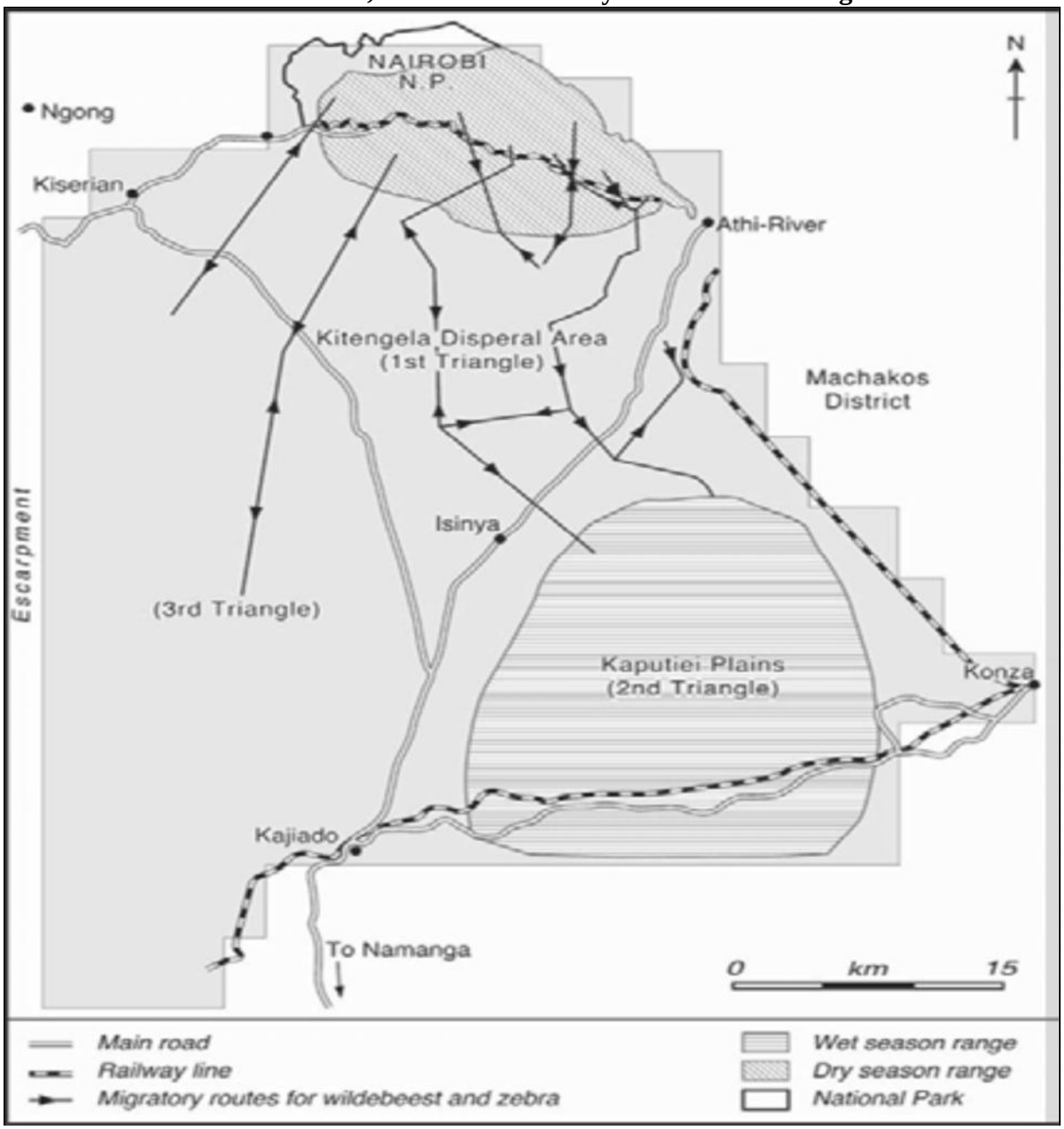
On the urban and peri-urban sides of the park, the threats to the park include: (1) pollution emanating from nearby residential areas and industries on the urban and peri-urban sides; (2) Contamination of the parks Water bodies from peri-urban homes, industries and flower farms; (3) Proposed and ongoing new road and railway infrastructure development and (3) Illegal housing developments (encroachments) from upper middle-class homes and slums/informal settlements, in the parks buffer zone (Mbatia, 2015)

During the wet season, wildlife must be able to migrate to the south into the Kitengela dispersal area. This area is privately owned and in a fast process of land use change that affects the structure and function of the dispersal corridors, jeopardizing the ecological sustainability of the Park (Rodriguez, et al., 2009). At present because of increasing population pressures and the proximity to Nairobi, the Kitengela plains are in a fast process of subdivision, fencing,

development of permanent settlements, conversion of grasslands to croplands, and creation of industries for export.

These changes in land-use affect the integrity of the dispersal area; declining primary productivity, diminishing animal biodiversity, and reducing wildlife migratory corridors (Nkedianye, 2004). Thus, one of the key threats facing the viability of NNP is that community lands acting as dispersal areas for the wildlife have increasingly been sub-divided, sold and fenced, in the process blocking the wildlife migratory corridors (Reid, et al., 2008), which are pathways or routes (Figure 3 below) in which game animals use when migrating from the northern parts of at Athi-Kapiti ecosystem to the southern parts in the Serengeti (Mbatia, 2015).

Figure 3: Map of the Athi-Kaputie Ecosystem showing the three triangles, the migratory route for wildebeests and zebra, and the wet and dry season wildlife ranges



Source: (Radeny, Nkedianye, & Kristjanson, 2007)

The parks openness in the south into the rural community land results into a number of human wildlife conflicts cases which are increasing, due to increasing settlements in the area (Reid, et al., 2008) (Gichohi, Functional Relationships Between Parks and Agricultural Areas in East Africa, 2003). Two main types Human wildlife conflicts have been identified. These are: (1) predator conflicts and (2) resource conflicts. Predator conflicts occur when carnivore's lions,

leopards and hyenas from the park attack livestock and occasionally people, and then the community reacts to protect itself by hunting and killing the predators (Mbatia, 2015).

This is especially the case during and after the rainy season, when majority of the herbivores leave the park to utilize short, fresh and delicious grass on the community land in Athi-Kapiti plains, where they also breed and calve (Owaga, 1975); (Gichohi, Functional Relationships Between Parks and Agricultural Areas in East Africa: the Case of Nairobi National Park, 2000). Accordingly, the carnivores follow the herbivores outside the park, resulting in predation of the community's livestock, which are more docile than the animals from the park.

3.3.4. Interventions to the NNP challenges

Some of the strategies by the non-governmental and governmental organization have included among others campaigns to push the government to legally protect the dispersal areas as conservation areas; the world Bank funded wildlife conservation lease programme (Mitiko, 2014) , which involves paying money to Maasai land owners under lease payment benefits to keep their land open for free movement of wildlife; the lion lights programme[10] which involves installation of solar powered bulbs around the Maasai pastoralists cattle bomas to prevent predation of livestock by lions, which mostly takes place at night; the livestock consolation programme which involves compensation for livestock loss to families whose livestock have been attacked by lions; the land lease programme, which has had the opportunity to mature having been the first major conservation intervention to be implemented in the case of Nairobi national park and its ecosystem.

3.3.5. Biodiversity in key protected areas of Nairobi

Table 3: Characteristics and biodiversity of key protected areas in Nairobi (JICA, 2005)

Name	Managing Authority	Area (Ha)	Common Species	
			Plants	Animals
NNP established 1946	KWS	11,700.0	Olea africana, Croton dichogamus calodendrum, Themeda, Cyprus, Digitaria Cynodon, Acacia xanthophloea, Euphobia candelabrum, Apodytes dimidiate Canthium schimperanum, Elaeodendron buchananii, newtonia sp, Ficus eriocarpa, Aspilia mossambicensis, Thus natalensis, Euphobia brevitorta, Drimia calcarata, Murdannia clarkeana and Crassula sp.	Giraffes, lions, gazelles, buff aloes, hartebeest, wild pigs, wildebeest, warthogs, crocodiles' hippos, and about 400 species of birds
Karura Forest; (Gazetted 1932)	Kenya Forest Service	1063.0	Olea europeae var. africana, Croton megalocarpus, Warburgia ugandansis,	Monkeys, bush baby, bush bucks, bush pigs, porcupines, duikers,

[10] http://lionguardians.org/lighting-it-up/ - accessed 3rd March 2018 at 3:56pm

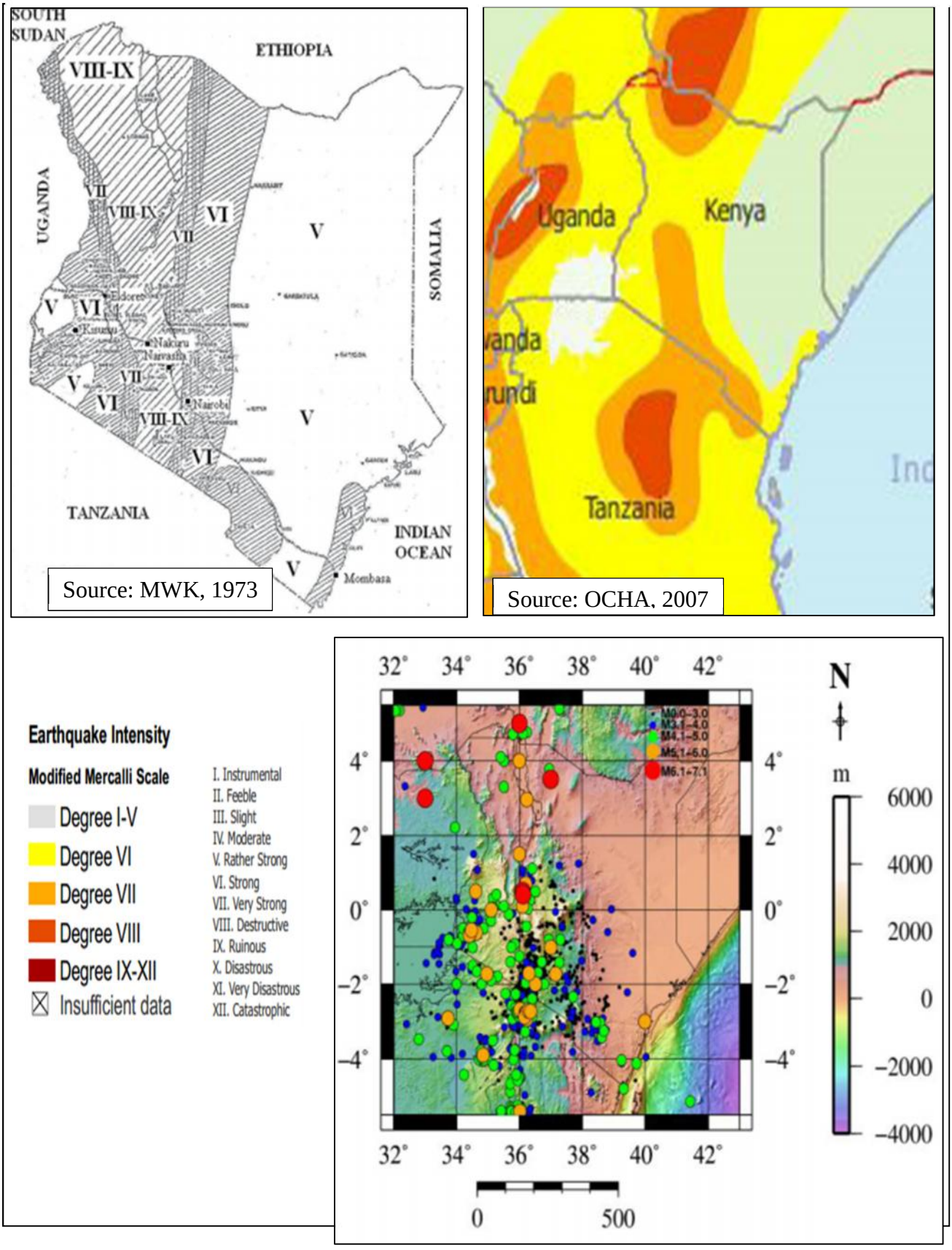
			Brachyleana huillensis and Uvaridendron anisatum	genets, dikdik, epauletted bat, Africa civet
Ngong Forest	Kenya Forest Service	638.4	Eucalyptus, Pine, Cyprus, Croton and Cordia species	Over 120 species of birds, over 35 mammals such as leopards, monkeys, reptiles, insects and amphibians
Ololua Forest	The County Government of Kajiado and the National museums of Kenya	667.0	Olea africana, Eleodendron buchananii, Akokanthera schimperi, Brancylaena species, Croton megalocarpus, Carisa edual and Rhus natalensis. Others include aloe, Acacia species	Olive baboons, monkeys, yellow baboons, porcupines, bush baby bush bucks, bush pig, dikdik epauletted bat, duikers, African civet, and genets, grey wagtail, Eurasian cuckoo, willow warbler
The Nairobi Arboretum (established 1907)	Kenya Forest service	25.0	Several collections of plant species	Chameleon, skunks, butterflies, dragonflies, ants, bees and beetles, Ayres's hawk eagle
Nairobi City Park	Nairobi County Government	60.0	Olea europeae var. africana, Croton	Hundreds of bird species, butterflies and baboons

3.4. Seismicity

Seismic risk, as a concept, is understood to be the product of seismic hazard (the probability of harmful seismic phenomena) and seismic vulnerability (the degree of loss from seismic phenomena) (Giardini, 1999; Smith, 2013). , Kenya faces a relatively low earthquake hazard in comparison to neighboring countries with hazard levels highest in the north-west and south-west regions (Rao, 2013). The proposed project is in seismic zone VII as shown in below

Figure 4: Seismic map of Kenya

Figure 5: Seismic map of Kenya



Seismicity in Kenya for the period 1906-2010

4. POLICY, LEGAL, REGULATORY AND ADMINISTRATIVE FRAMEWORK

4.1. Introduction

Today Kenya is faced with innumerable environmental problems and challenges that include land degradation, loss of biodiversity, environmental pollution, water management and desertification among other challenges. There is a growing concern that many forms of development activities cause damage to the environment and the natural resources upon which the bulk of national economy is based.

A major national challenge today is how to maintain sustainable development without damaging the environment. It is now accepted both nationally and globally that development projects must be economically viable, socially acceptable and environmentally sound. To protect the environment from negative impacts of development, it is a condition of the Kenya Government for the developers and proponents of projects to conduct ESIA on the proposed development projects and environmental audits for the on-going projects.

Until late 90's, Kenya did not have a consolidated legislation for the protection and management of environment. The legal provisions on environmental protection were scattered in 77 statutes, which touched on various aspects of environment. This set up did not offer adequate protection of the environment mainly due to weak legal and institutional frameworks. Significant progress has, however, been accomplished towards arresting this situation. The turn of events commenced with the finalization of the National Environmental Action Plan (NEAP) in 1993(GOK, 1993).

4.2. The National Environment Action Plan

In 1993, National Environment Environmental Action Plan (NEAP) was finalized under the Ministry of Environment and Natural Resources (MoENR). NEAP addressed environment and conservation challenges, through appropriate legislative and institutional mechanisms. It provided not only a strategy for achieving sustainable development in Kenya but also served as a basis for domesticating Agenda 21 – the Global Program of Action on Environment and Development.

NEAP's main objectives were to coordinate stakeholders in the preparation of a national environmental legislation and establish a single institution with legal authority to coordinate the management of environmental resources that were at that time managed by different sectoral statutes. The adoption of the NEAP in 1994 marked an important step towards integrating environmental matters in the development planning process. Following the adoption of NEAP, the Environmental Management and Coordination Act (EMCA) of 1999 was enacted.

4.3. The Environmental Management and Coordination Act

The main objective of the Environmental Management and Coordination Act (EMCA) is to provide for the establishment of an appropriate legal and institutional framework for the management of the environment in Kenya. EMCA further aims to improve the legal and administrative co-ordination of the diverse sectoral initiatives in the field of environment to

enhance the national capacity for effective environmental management. In addition, the Act is set to harmonize the 77 sector specific legislations touching on the environment in a manner designed to ensure greater protection of the environment in line with national objectives. The ultimate objective is to provide a framework for integrating environmental considerations into the country's overall economic and social development. The major institution established to implement and operationalize the objectives of EMCA is the National Environmental Management Authority (NEMA).

4.4. The National Environment Management Authority

In July 2002, the Government established the National Environmental Management Authority (NEMA), a body corporate under the Ministry of Environment and Natural Resources for the administration of EMCA. The NEMA is headed by a Director General appointed by the President. Its functions include coordination of various environmental management activities, initiation of legislative proposals and submission of such proposals to the Attorney General. NEMA is involved in conducting research, investigations and surveys in the field of environment. In addition, NEMA has instituted EIAs and Environmental Audits EAs as normal practices in Kenya.

4.5. Environmental Impact Assessment

The EMCA makes it mandatory for any person being a proponent of a project to submit a project report to NEMA in a prescribed format. Of immediate relevance regarding conducting EIA are Part VIII, Section 58 (1&2) and the Second Schedule of the EMCA. Section 58 (1) states that: "Notwithstanding any approval, permit of license granted under this Act or any other law in force in Kenya, any person, being a proponent of the project, shall before financing, commencing, proceeding with, carrying out, executing or conducting or causing to be financed, commenced, proceeding with, carried out, executed or conducted by another person any undertaking specified in the Second Schedule to this Act, submit a project report to the Authority in the prescribed form, giving the prescribed information and which shall be accompanied by the prescribed fees".

Section 58(2) states that the proponent of a project shall undertake or cause to be undertaken at his own expense an environmental impact assessment study and prepare a report thereof. In accordance to the Section 147 of the above Act, Environmental and (Impact Assessment and Audit) Regulations, 2003 have now been formulated and gazetted in Kenya. Gazette Supplement No. 56. Part IV, Section 18 (1) states that a proponent shall submit to the Authority, an environmental impact assessment study report incorporating but not limited to the following information:

1. The proposed location of the project;
2. A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project;
3. The objectives of the project;
4. The technology, procedures and processes to be used, in the implementation of the project;
5. The materials to be used in the construction and implementation of the project;
6. The products, by-products and waste generated by the project;

7. A description of the potentially affected environment;
8. The environment effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated;
9. Alternative technologies and processes available and reasons for preferring the chosen technology and processes;
10. Analysis of alternatives including project site, design and technologies and reasons for preferring the proposed site, design and technologies.
11. An environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment; including the cost, time frame and responsibility to implement the measures;
12. Provision of an action plan for the prevention and management of foreseeable accidents and hazardous activities in the cause of carrying out activities or major industrial and other development activities;
13. The measures to prevent health hazards and to ensure security in the working environment for the employees and for the management of emergencies;
14. An identification of gaps in knowledge and uncertainties which were encountered in compiling the information;
15. An economic and social analysis of the project;
16. An indication of whether the environment of any other state is likely to be affected and the available alternatives and mitigating measures; and
17. Such other matters as the Authority may require.

4.6. Summary of legal, policy, guidelines, regulations and MEAs frameworks in relation to the proposed project

A summary of the relevant laws, policies, regulations, guidelines, multilateral environmental agreements in relation to the proposed project is described in Table 4 below.

Table 4: Summary of legal, policy, regulatory frameworks and MEAs with respect to the proposed access road

No.	Legislation, Policy and regulations	Environmental requirements	Relationship with the proposed projects
Legislative frameworks			
1.	The constitution of Kenya	Article 42 – Supporting public involvement in ensuring the rights to a clean and healthy environment; Article 43 – Supporting public involvement in ensuring the need for every person to have access to clean and safe water in adequate quantities; Article 69 - Environment and natural resources (1) (d) Encouraging public participation in the management, protection and conservation of the environment (f) Supporting environmental impact assessment, environmental audit and monitoring of the environment (g) Eliminating processes and activities that are likely to endanger the environment; and; Article 66 – Regulating use of any land or any interest or right over any land, in the interest of public health or public planning Article 185: 22 - Protection of the environment and natural resources with a view to establishing a durable and sustainable system of development	The proposed project will help reduce traffic congestion thereby reducing emissions from the transport sector hence contributing to a clean and healthy environment. On the other hand, the project will lead to reduction of green cover at the section along the NNP.
2.	Environmental Management and Coordination Act (EMCA) chapter 387	Prohibiting and controlling the introduction of alien species into natural habitats; Controlling and prevention of environmental pollution; Carrying out EIA for all proposed projects with a potential for adverse impacts; Carrying out environmental audit and monitoring of all activities that may have detrimental impacts to the environment	Proponent has undertaken the EIA study with wide public consultation as required under this law
3.	Kenya Railways Corporation Act (Chapter 397), 1979	The general obligation of KR is to provide a synchronized and incorporated system within	KR being the proponent for the proposed access road will ensure that the project meets all legal

		Kenya for rail and inland waterways transport services and inland port facilities.	obligations related to it.
4.	Wildlife (Conservation and Management) Act Cap 376 of 1976, 1989 & Bill, 2013 (GoK, 2013)	33 (c): Supporting the establishment of wildlife Development Fund for development of conservation areas 68:(4): Preventing development in a National Park without approved management plans Section 30 of part VI: Prevention of adverse effects on the environment, including the seepage of toxic waste into streams, rivers, lakes and wetlands.	Since the proposed project is designed to utilize approximately 2m width x 4000m length of land in the inner boundary of the eastern side of the NNP, the proponent is advised (20m x 40,000m) to compensate for this land by purchasing at least 10 times of similar land on the southern side of the park that is currently in danger of being fully developed thus preventing migration of wildlife. The purchased land must be subsequently gazetted as protected land belonging to the NNP.
5.	The Water Act 2002; revised 2012	Section 25 of the Act requires a permit to be obtained for among others any use of water from a water resources, discharge of a pollutant into any water resource. According to section 29 of the same Act, application for such a permit shall be subject to public consultation as well as an environmental impact assessment as per the Environmental Management and Coordination Act, 1999	The proposed project will require large amounts of water during construction. If water will be abstracted form a river and or a new borehole, the proponent will apply for necessary permits for boreholes and water abstraction from rivers during construction phase.
6.	Public Health Act, Cap 242, 1986; revised 2012	Article 129: Supporting the protection of public water supplies; Article 117: Supporting the prevention or remedy danger to health from unsuitable activities including dust and noise	The proponent should ensure that all construction operation activities do not in any way interfere with public water supply systems and remedy project effects that may impact on public health.
7.	The Occupational Health and Safety Act, 2007	The purpose of this Act is to secure the safety, health and welfare of persons at work, and protect persons other than persons at work against risks to safety and health arising out of, or in connection with, the activities of persons at work. It applies to all workplaces where any person is at work, whether temporarily or permanently.	Failure to comply with the OSHA, 2007 attracts penalties of up to KES 300,000 or 3 months jail term or both or penalties of KES 1,000,000 or 12 months jail term or both for cases where death occurs and is in consequence of the employer

8.	The Way Leaves Act (Cap. 292)	Section 3: Allows the Government to carry out any works through, over or under any land whatsoever provided it shall not interfere with any existing building or structures of an on-going activity	Prior to commencement of construction activities, the proponent through/ in conjunction with the NLC will prepare a resettlement action plan (RAP) -**If need be**- with extensive public consultation pursuant to the requirements of these laws to facilitate compensation and relocation of the affected businesses/ establishments. However, resettlement and
9.	The Land Act, 2010	Part viii: Provides procedures for compulsory acquisition of interests in land. Section 111 (1): States that if land is acquired compulsorily under this Act, just compensation shall be paid promptly in full to all persons whose interests in the land have been determined.	
10.	National Land Commission Act, 2012 (No. 5 of 2012)	Section 5: Mandates the Commission to: - a) Initiate investigations, on its own initiative. or on a complaint, into present or historical land injustices, and recommend appropriate redress; b) Encourage the application of traditional dispute resolution mechanisms in land conflicts; c) Assess tax on land and premiums on immovable property in any area designated by law	
11..	Land Adjudication Act, 2010	The Act applies to any area of Trust land where the County government in whom the land is vested so requests; and the Minister considers it expedient that the rights and interests of persons in the land should be ascertained and registered	
12.	The Trust Lands Act, 2012 (Chapter288)	Section 38: Way leave license may be granted to any person empowering him and his servants and agents to enter upon Trust land vested in the Council and to lay pipes, make canals, aqueducts, weirs and dams and execute any other works required for the supply and use of water, to set up electric power or telephone lines, cables or aerial ropeways and erect poles and pylons	

		therefore, and to make such excavations as may be necessary	
13.	The Physical Planning Act, Chapter 286, of 1998	Section 29: Ensuring that developers to ensure proper execution and implementation of approved physical development plans. Other legal obligations are among others, (a) Ensuring that subsidiary area plans are recognized and integrated in the County Physical Development Plans (b) The local authority concerned shall require the developer to restore the land on which such development has taken place to its original condition within a period of not more than ninety days	Proponent will ensure that the proposed access road is in line with the existing goals in the Nairobi County and government. The proponent will further ensure that all disturbed areas are immediately restored after decommissioning of construction activities
14.	The Antiquities and Monuments Act, 1983, Chapter 215	The Act aims to preserve Kenya ‘s national heritage. Kenya is rich in its antiquities, monuments and cultural and natural sites which are spread all over the country. The National Museums of Kenya is the custodian of the country ‘s cultural heritage	The proposed project encroaches into the NNP thus, the proponent must seek authorization from relevant government agencies such as the ministry of environment and the Kenya wildlife service before commencement of works
15.	The penal Code Chapter 63	Section 191 - States that if any person or institution that voluntarily corrupts or foils water from public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence; Section 192 – States that a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons /institution, dwelling or business premises in the neighbourhood or those passing along public way, commit an offence.	The proponent will implement the proposed environment management and monitoring plan as well as the licensing conditions and any other improvement notices issued by NEMA during the course of implementing the proposed project. They will further ensure that the proposed project complies with all the requirements of this law
16.	The Explosives Act Chapter 115	Section 7(1) - Stipulates that No person shall keep, store or be in possession of any unauthorized explosive in or on any premises except in an explosives factory or explosives	In case the contractor plans a storage facility for explosives to be used in the blasting processes (though none is anticipated on site) during construction phase they are obligated to adhere

		magazine or unless the explosive is kept for private use, and not for sale or other disposal, and in accordance with rules or unless the explosive is kept for use in the construction of railway, road or other public work, in quantities not exceeding two thousand five hundred kilograms in weight and is stored in a temporary magazine approved by an inspector and under conditions specified in writing by an inspector	to the provisions of this Act.
17.	The Forest Act, 2005	Highlights the integration of the community on the management, utilization and conservation of forests and its resources. It prohibits wanton destruction of the forests.	The design for the proposed project runs along the inner boundary of the NNP. Hence, the proponent is obligated to seek permission from the Kenya Forest and related agencies before beginning of construction works.
Policy frameworks			
1.	The water quality regulations, 2006	These regulations are aimed at protecting water resources from pollution. It requires that proponents of projects in areas with no municipal sewers to deploy adequate measures that will ensures safe disposal of waste water from their activities.	The proponent shall acquire or lease portable toilets that will be used by construction workers.
2.	The Noise and excessive vibrations pollution control regulations	Section 13(1) states that no person shall operate construction equipment (including but not limited to any pile driver, steam shovel, pneumatic hammer, derrick or steam or electric hoist) or perform any outside construction or repair work so as to emit noise in excess of the permissible levels as set out in the Second Schedule to these Regulations	The proponent shall ensure that equipment used during construction and operation is muffled to control noise and vibrations. Where necessary, noise permits shall be obtained prior to undertaking blasting activities
3.	The Waste management regulations of 2006	The regulations require a waste generator to collect, segregate and dispose each category of waste in such manners and facilities as provided by relevant authorities.	Proponent shall apply an integrated solid waste management protocol and ensure that generated waste is disposed in a manner prescribed under these regulations.

4.	Sessional Paper No. 6 of 1999 on Environment and Development	Regulating urban development to only those areas which are suitable, avoiding ecologically fragile areas; Encouraging sustainable use of resources and ecosystems; Undertaking EIA for all private and public projects increase public awareness on environment	Public consultation was undertaken during the EIA process; All views gathered during the process have been incorporated into this report
5.	The National Policy for Disaster Management, 2009	Promoting the mainstreaming of disaster management and climate change into development planning and management for sustainability Providing for well-structured participation of society in disaster management by integrating traditional coping strategies into the disaster management systems and Supporting climate change disaster risk reduction initiatives among others	The proponent has integrated climate change impacts such as extreme flooding into the design of the project. Adequate drainage will be constructed along the proposed access road
6.	The National gender and development policy of 2000	Considering the needs and aspirations of all Kenyan men, women, boys and girls across economic, social and cultural lines and ensuring the empowerment of women	Implementation of the proposed project will create employment and business opportunities. Where such opportunities are directly linked to the proponent and the contractor (especially during construction and operation) the proponent is advised to ensure that there is equal opportunity across gender. They are further advised (applying the principles of sustainable development) not to discriminate against people with disabilities.
7.	The National HIV Policy (GoK, 1997)	Ensuring that new development projects encourage preventive and responsible behaviour both for the workers involved in such projects and also the local people within which projects are taking place as a goal towards curtailing the spread of the disease	The proponent is advised to put in place adequate measures so as to ensure that implementation of the proposed projects does not heighten the spreads of HIV and AIDS
8.	Draft Wildlife Policy (2011)	Wildlife Security	It is recommended that land (at least 10-fold the

	(GoK, 2011)	1. Strengthening wildlife security in wildlife conservation areas Other policy goals -Decentralization of wildlife planning to constituency level -Educating the public and raising awareness on the critical role of wetlands, rivers and lake ecosystems -Ensuring good governance in the management of wildlife conservation areas and sanctuaries -Incorporating or domesticating the provisions of the relevant wildlife related Multi-Lateral Environment Agreements (MEAs) to which Kenya is Party to -Putting in place mechanisms to identify, control and eradicate invasive alien species in wildlife conservation areas in collaboration with relevant lead agencies. -Supporting the conservation and management of wetlands	size of the proposed project developmental footprint) be purchased in the Athi Kapiti plains so as to compensate for the land used for this project. The proponent and contractor are advised to ensure that wildlife security is not jeopardized during implementation of the proposed project. Stakeholder consultation through a public forum was undertaken during the EIA process with the involvement of KWS
9.	The National Environmental Sanitation and Hygiene Policy (2007)	4.3: Sanitation and the environment: Protection of the environment from pollution and its negative effect on human health; Ensuring use of technologies that uphold the right of present and future generations to a healthy and pollution-free environment; Ensuring the use of sanitation systems that are environmentally sound; Preventing environmental pollution from liquid and solid waste; Setting of clear standards and guidelines for environmental sanitation; Increasing environmental sanitation awareness across the country	The proponent is advised to ensure that high standards of hygiene and sanitation are maintained throughout the proposed project' cycle.
10.	11. Draft National Tourism Policy	Promoting the Kenya Tourism industry to be a	Since the proposed project is planned to use up

	(2007) (GoK, 2007b)	leader in responsible and sustainable environmental practices	land belonging to a major tourist attraction site in the heart of the city, all alternatives and mitigation measures must be explored so as to remediate its impacts; if possible land should be purchased on the southern side of the park (where there is the migratory corridor from the NNP) to compensate for the land used up by the proposed project.
Key Multilateral Environmental Agreements			
1.	The EAC Climate Change Policy (EACCCP) (EAC,2011)	Among other obligations, the EACCP requires that climate change be integrated in all planning, design and implementation of infrastructure projects across the region. This will not only enhance adaptation to effects of climate change but also mitigation.	The proposed project has been designed to withstand the imminent and existing impacts of climate change. The project once implemented will see a reduced emission of GHGs thereby enhancing climate change mitigation
2.	The United Nations Convention on biological diversity (CBD) (United Nations, 1992)	Article 8 - In-situ conservation (d) Promoting protection of ecosystems, natural habitats and maintenance of viable populations of species in natural surroundings (j) Respecting, preserving and maintaining knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application; Article 13 - Public education and awareness; Promoting and encouraging understanding on the importance of and the measures required for, the conservation of biological diversity, as well as its propagation and Cooperating, as appropriate, with other States and international organizations in developing educational and public awareness	Implementation of the proposed project will impact on the NNP' ecosystem, natural habitat and biodiversity. Therefore, appropriate measures must be taken so as to adequately compensate for these impacts.

		programmes, with respect to conservation and sustainable use of biological diversity	
3.	The United Nations Framework Convention on Climate Change (UNFCCC), 1992	This convention set out the framework for combating climate change and is also a key guide in formulation of policies and agreements aimed at climate change mitigation and adaptation. Parties to the UNFCCC are required under Article 6, to foster education and awareness on climate change	The proposed project is in line with the objectives of the UNFCCC. In that it will result in reduced overall GHG emissions from Kenya's transport sector. It is further recommended that the proponent continues to engage other lead agencies and indigenous communities and contribute to the common effort of combating and adapting to climate change.
4.	United Nations Sustainable Development goals, 2015[11]	**Goal 8:** Promote inclusive and sustainable economic growth, employment and decent work for all. Sustainable economic growth will require societies to create the conditions that allow people to have quality jobs that stimulate the economy while not harming the environment. Job opportunities and decent working conditions are also required for the whole working age population. **Goal 9:** Build resilient infrastructure, promote sustainable industrialization and foster innovation. Investments in infrastructure – transport, irrigation, energy and information and communication technology – are crucial to achieving sustainable development and empowering communities in many countries. Develop quality, reliable, sustainable and resilient infrastructure, to support economic development and human well-being, with a	The proposed project will largely contribute to achievement of these goals. However, the crux of the matter is in the process of implementing the project in a sustainable manner. The EIA study is just one of the long steps towards answering/achieving the sustainability requirements. Implementation of the proposed EMP and mitigation measures will largely help achieve this objective.

[11] http://www.un.org/sustainabledevelopment/sustainable-development-goals/ - Accessed 3rd March 2018 at 11:11pm

		focus on affordable and equitable access for all. **Goal 11:** <u>Make cities inclusive, safe, resilient and sustainable.</u> Many challenges exist to maintaining cities in a way that continues to create jobs and prosperity while not straining land and resources. Common urban challenges include congestion, lack of funds to provide basic services, a shortage of adequate housing and declining infrastructure. By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.	
Key National strategic plans			
1.	Kenya Vision 2030 (Government of Kenya, 2006)	**Infrastructure:** The vision aspires the country to be firmly interconnected through a network of roads, railway, ports, airport, water and sanitation facilities and telecommunications **Tourism** Tourism has mainly been anchored on national parks among other key tourist attractions facilities in Kenya to be the leading sector in achieving the vision. **Environment**	The current project is a vision 2030 flagship project that seeks to improve infrastructure thereby reducing pollution and foster economic development. However, since it is designed to utilize land along the NNP, it contradicts the objectives set out under Tourism and environment in the Vision 2030. Hence, there is a "thirst" to strike a balance between economic development and conservation of the protected zones that tourism has been anchored upon, specifically the NNP[12]. The access road will

[12] This brings to the forefront the discussion on sustainable development and its application. How do we achieve economic development while balancing it with our ever diminishing carrying capacity? Can we find a balance between population growth (and increased consumerism), economic development and environmental protection? (Wackernagel, 1994) argues that "sustainable development" is semantically ambiguous: it could refer to the necessity to live sustainably (a state), to the process of getting there (a process), to the current unsustainable lifestyle (problem), or to strategies to solve the crisis (solution). The main glaring question for Kenya in sustainably achieving Vision 2030 mainly lies in the state and process. In most if not all developmental projects this part is

		Promoting environmental conservation to provide better support to the economic pillar flagship projects; Securing wildlife corridors and migratory routes	reduce wildlife habitat by encroaching onto it. But it will also lead to economic growth, reduce congestion and pollution on the roads[13]. Since the key objective of the vision is to secure wildlife corridors, it is recommended that land taken by the road be compensated for by purchasing land on the southern side of the NNP where key migratory corridors are under perpetual threat. In other words, a percentage (this can be worked out by among other relevant agencies (e.g. KWS, NLC) in consultation with parliament, non-governmental organizations especially those involved in conservation) of the revenue generated from the entire SGR and related projects must be designated for conservation efforts.
2.	National Biodiversity Strategy and Action Plan (2000) (GoK, 2000b)	Protection of sites of high biological diversity outside the protected area system because they may be habitats for unique endemics. Other activities; Adopting best practices in conservation and management of natural resources	Implementation of the proposed project will impact on the NNP'[14] ecosystem, natural habitat and biodiversity. Therefore, appropriate measures must be taken so as to adequately compensate for these impacts.
3.	Climate Change Response Strategy (2009)	This strategy is interlinked with the UNFCC whose key objective is to reduce greenhouse gas	One of the main contributors to climate change is the transport sector through vehicular GHG

usually neglected especially when it comes to the utilization of the commons e.g. the NNP. Hence, the proponent must strike a balance between the proposed project implementation (i.e. infrastructure development) and sustainable utilization of finite renewable resources (i.e. land along the inner boundary of the NNP).

[13] There is a large gap of missing data with regards to the monetary environmental costs and benefits for infrastructure projects like roads. The classical methods have often centered on the economic benefits of these projects. In most cases projects are valued based on the cost of construction (measured in quantities of cement, steel etc.). But what about the environmental cost? After completion of infrastructure projects there needs to be a monetary quantification of the environmental benefit vs damage e.g. the diminished natural capital.

[14] An internet search on the ecosystem service value in monetary terms for the NNP did not yield much. Such data could be valuable for working out compensation when proposed projects as the current one is implemented.

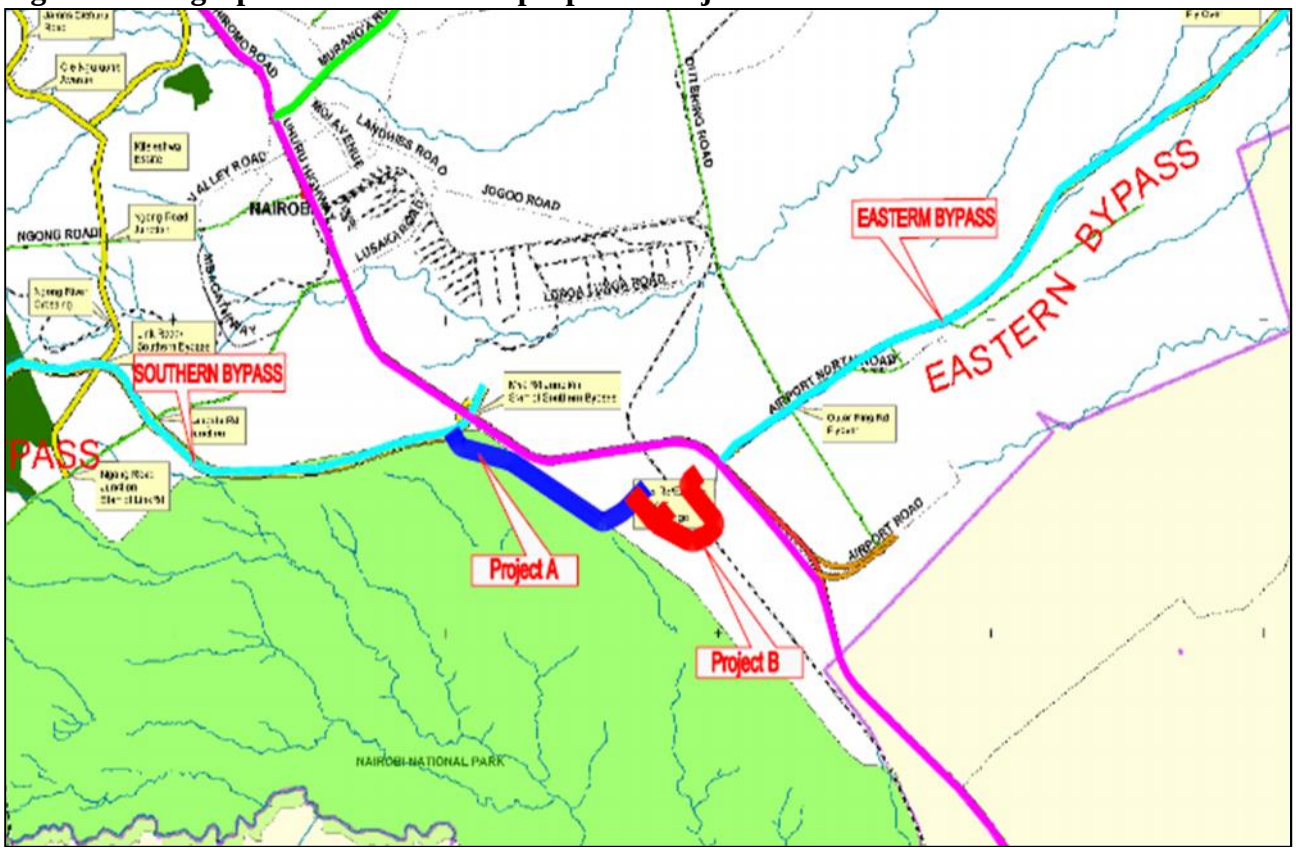
		emissions hence remediate against climate change and global warming	emissions. The proposed project is in line with the objectives of the UNFCCC. In that it will result in reduced overall GHG emissions from Kenya's transport sector. It is further recommended that the proponent continues to engage other lead agencies and indigenous communities and contribute to the common effort of combating and adapting to climate change.
4.	Economic Recovery Strategy for Wealth and Employment Creation (2003)	The Strategy includes Macro-economic objectives for economic growth, objectives relating to governance, public sector reform, infrastructure, productive sectors and equity.	Implementation of the proposed project will improve infrastructure hence contribute to economic development.
5.	Poverty Reduction Strategy Paper Second Medium Term Plan (2013-2017)	The poverty reduction initiatives are necessary for the implementation of Vision 2030's equity and poverty reduction objectives (within the Social Pillar). The objectives include high growth, job creation, poverty reduction, improved income distribution and gender equity.	Implementation of the proposed project will have a positive social impact through job creation albeit mostly in the short term and foster economic growth in the long term, However, as far as equity is concerned, other measures (e.g. equal opportunity for employment across gender, age and ability) must be implemented during project implementation.

5. PROJECTS DESCRIPTION

5.1. Introduction

The proposed project is the access road located between the ICD yard and the southern bypass road in Nairobi, Kenya. The total length of the proposed access road is approximately 4.153km. Its starting point will connect the west entrance of the ICD running through the inner boundary of the NNP and the end forming a partial "pear-shaped" (Figure 6 and Figure 9) interchange with the Southern bypass road. The project will enhance the transportation within the ICD yard of the Mombasa-Nairobi railway (now operating) and greatly improve traffic flow while significantly reducing congestion in the surroundings. This will result in the adaptation to the growing traffic demands, and provide convenient, comfortable and safe transportation for achieving healthy and rapid economic development in Nairobi as well as promoting regional socio-economic sustainable development.

Figure 6: Geographic Location of the proposed Project

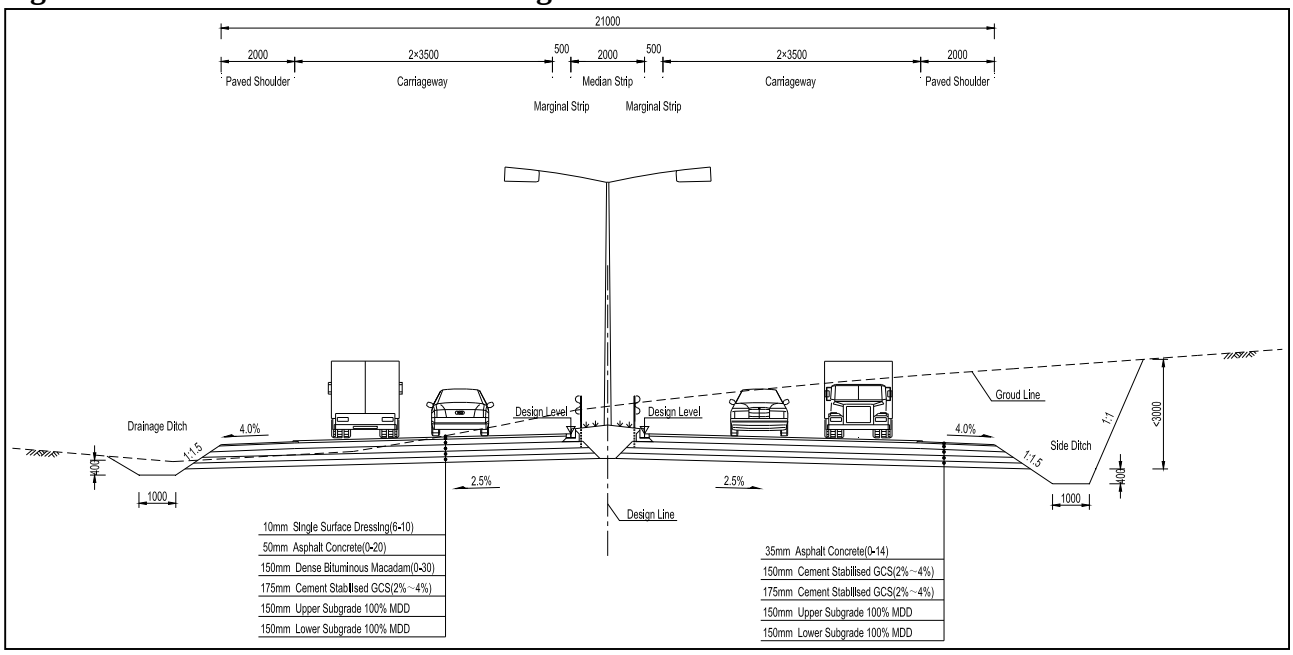


Source: CRBC, 2018

5.2. Main technical standards

According to the guiding opinions from the communication meeting, the layout of Nairobi – ICD Access Roads shall minimize land acquisition and resettlement to lower construction costs. Adequacy of clearance should be considered when crossing the Southern Bypass. In accordance with traffic volume forecast results and Kenya Highway Design Manual, Grade B national highway standards and 4-lane section with central median are applied in the Project, with a design speed of 60km/h and a subgrade width of 21m. See Table 1 for main design technical parameters.

Figure 7: Standard cross-section of subgrade



Source: CRBC, 2018

Table 5: Main technical parameters

Indicator	Unit	Indicator	Adopted Value Indicator
Geology type	-	Plain	Plain
Highway grade	-	Grade B national highway	Grade B national highway
Design speed	km/h	60	60
Design flood frequency	Years/once	100/1	100/1
Subgrade width	m	21	21
Lane width	m	2-2×3.5	2-2×3.5
Stopping Sight Distance	m	80	80
Minimum Horizontal Curve Radius	m	160	160
Maximum Longitudinal Grade	%	8	3.9
Minimum Radius of Convex Curve	m	1750	16000
Minimum Radius of Concave Curve	m	1750	2857
Design vehicle load for	-	BS5400HA load, HB load	BS5400HA load, HB load

culverts		for 45 units	for 45 units
Bridge width	m	22	22
Clearance (Overpass Road)	m	5.8	5.8

5.3. Overall design scheme

Route A length is 4.153km. One new 2×26m span cast in place concrete box-girder bridge, eleven new pipe culverts and box culverts which overpass KPLC cable and KPC oil pipe are set six intersections will be constructed in Route A.

5.3.1. Alignment

The Project A route starting point connects with the northwest entrance of ICD and the end point connects the Southern Bypass in a partial "pear-shaped" interchange. The route alignment is along the existing unsurfaced road in the southwest direction, enters the verge of Nairobi National Park at AK1+000, continues in the park along the northwest direction and then connects with Southern Bypass at AK4+153.021. The total length of the Project A route is 4.153km. The main key points are KPLC cable, KPC oil pipe, Nairobi National Park, Southern bypass.

5.3.2. Subgrade and pavement

Subgrade

A. General subgrade

(1) General principles of subgrade design

General principles of subgrade design mean to adopt economical and effective disease control measures according to the national and geological conditions along the road such as terrain, landform, hydrological conditions and meteorological conditions.

(2) Subgrade cross-section

It is bidirectional and has four lanes. The medial strip width is 2m, the marginal strip width is 2x0.5m, the lane width is 2×3.5＋2×3.5m and the road shoulder width is 2.0m, totalling 21 m.

(3) Crossfall

See Kenya Highway Design Manual for the pavement type of the Project, local natural conditions and practices of other highways in the same region. The Crossfall of traffic lanes is 2.5% and the cross fall of hard shoulder 4%.

(4) Subgrade slope

According to Kenya Highway Design Manual, the arrangement of generally-filled subgrade slope is shown as following

As in this project, the height of the cut is small, which is less than 3m, the proposed grade of cut slope is 1:1.

The proposed grade of fill slope is 1:1.5, while the slope is higher than 8m, a berm of 2m width is required at very 8m.

(5) Removing of the soil on the surface and compaction before filling
In the Project, the removing planting soil of the original ground is calculated as 20 cm, and the compaction before filling is calculated as 15 cm.

(6) The range of the land occupied by road
All lines are mainly within the range of land occupied.

(7) Subgrade soil borrowing
Subgrade soil borrowing is mainly cantered on the borrow area along the lines out of consideration for environment.

B. Special subgrades

There is black cotton soil distributed along the project alignment which has low immersion strength and cannot satisfy the requirements for subgrade filling, and the position of distribution can be found in geological report. As the total thickness of the black cotton soil is shallow, and weathered basalt is found beneath the black cotton soil, we suggest removing all the black cotton soil, and replace it with backfill materials.

C. Subgrade protection

Carry out necessary protection on the slopes of embankments and cuttings to ensure the stability of the subgrade slops, prevent water and soil loss, and guarantee good road appearance. When the filling height of soil section slope is more than 8m, adopt the herringbone skeleton vegetation protection mode; when the excavation height of the section slope of stable soil is 8m or under, adopt vegetation protection with local grasses.

Plate 1: Grasses fit for local subgrade protection

D. Subgrade drainage

The drainage design shall take comprehensive consideration of the road class, the topography, geology, hydrology, climate, and other conditions along the lines, as well as the bridge and culvert set up, and the subgrade drainage system shall include drains, side ditches, chutes and intercepting ditches. Generally, drains are used in fill embankment sections, and side ditches are used in excavation sections; chutes are set at the bottom of the concave curve of fill sections and on the conical slope of bridge-head; In the super elevation segment with median, lateral drainage

is arranged by segments in the median, through longitudinal U-shaped drainage ditch, water collected by wells in the median strip is conveyed outside right-of- way through lateral pipe. The drainage design of the roads across towns and cities shall coordinate with the existing or planned drainage system and facilities.

5.3.3. Pavement

5.3.3.1. Design principles

Pavement structure

In case of the asphalt concrete pavement, adopt the multilayer elastic continuous system theory under the effect of dual circular vertical uniformly distributed load; calculate the thickness of pavement structure with deflection value as the design indicator of the integral rigidity of the pavement; and check the base tensile stress of the surface, flexible materials of the base and sub-base.

The pavement structure of the lane is:

1cm	Single-layer asphalt surface treatment (10/14)
5cm	Fine-grained asphalt concrete (0-20)
15cm	Dense bituminous macadam (0-30)
17.5cm	Cement treated graded crushed stone (cement dosage 2%~4%)
30cm	MDD 100% roadbed

Total 68.5cm

The pavement structure of the shoulder is:

3.5cm	Fine-grained asphalt concrete (0-14)
15cm	Cement treated graded crushed stone (cement dosage 2%~4%)
17.5cm	Cement treated graded crushed stone (cement dosage 2%~4%)
30cm	MDD 100% roadbed

Total 66 cm

Pavement structure of the ramp is:

1cm	Single-layer asphalt surface treatment (10/14)
5cm	Fine-grained asphalt concrete (0-20)
15cm	Dense bituminous macadam (0-30)
17.5cm	Cement treated graded crushed stone (cement dosage 2%~4%)
30cm	MDD 100% roadbed

Total 68.5cm

After checking the deflection value and the allowable tension stress, the lane pavement structure meets the requirements of the specifications. Therefore, the road structure above is the recommended scheme for the Project. Moreover, local red clay gravels can be made good use of, which are economical and easy for construction.

5.4. Bridge and Culvert Design

5.4.1. Bridge

K0+377.960 Prestressed Concrete Box Girder with 2×26m Span

1) Design specifications
(1) Road Design Manual of Republic of Kenya (1987);
(2) Standards and Technical Codes for Construction of Road and Bridges issued by Ministry of Transport and Communications, Republic of Kenya (1986);
(3) Code of Practice for the Design & Construction of Buildings & other Structures in relation to Earthquakes (1973);
(4) British Standard BS 8110: Structural Use of Concrete (1997);
(5) British Standard BS 5400: Steel, Concrete and Composite Bridges (Part I – X), current version;
(6) British Standard BS 8004: British stand code of Practice for Foundations (1986);
(7) British Standard: Overseas Road Design Manual (1987);
(8) AASHTO Standard Specifications for Highway Bridge, 2007;
(9) Code for Design of Reinforced Concrete and Prestressed Concrete Highway Bridges and Culverts (JTG D62-2004) issued by Ministry of Communications, P. R. China;
(10) General Code for Design of Highway Bridges and Culverts (JTG D60-2004) issued by Ministry of Communications, P. R. China;
(11) Technical Code for Construction of Highway Bridges and Culverts (JTG 041—2000) issued by Ministry of Communications, P. R. China.
2) Design parameters
(1) Road Class: Class B;
(2) Design Speed: 40km/h;
(3) Vehicle Load: BS 5400 HA load, 45 units of HB load;
(4) Bridge Width: 22.0m overall width in typical cross section;
(5) Seismic Zone: The work is located in Seismic Zone-VII as per Seismic Zoning Map of Kenya which is part of "A Catalogue of Felt Earthquakes in Kenya (1892-1969)" published by University of Nairobi.
3) Major Building Materials
(1) Ordinary Reinforcement and Steel
Ordinary steel bars shall be of cold worked plain square twisted steel bars (Grade 460, Tensile Strength=460MPa) conforming to BS 4461 and plain round hot rolled mild bars (Grade 250, Tensile Strength=250MPa) conforming to BS 4449, of which Grade 460 steel bars are in a diameter ≥ 10mm, and Grade 250 bars in diameter < 10mm.

The embedded and levelling steel plates in the design shall adopt ordinary carbon steel (Grade S460), and the welding rolled steel should meet the requirements of weldability.

2) Prestressed Steel Strand

The prestressed steel strands shall adopt high strength and low relaxation steel strands in accordance with Chinese Standard: Steel Strand for Prestressed Concrete (GB/T 5224-2003),

Nominal diameter of steel strand φs=15.2mm, Standard value of tensile strength fpk=1860MPa, elasticity modulus Ep=1.95×105 MPa, Relaxation rate ρ=0.035, Relaxation coefficient ξ=0.3。

(3) Concrete

a) The technical indexes and qualities of sand, stone and water shall be in compliance with Standards and Technical Codes for Construction of Road and Bridges issued by Ministry of Transport and Communications, Republic of Kenya;
b) Box girders shall adopt C50 Concrete, Bridge deck pavement shall adopt asphalt concrete and asphalt surfacing;
c) Abutment structure and abutment spread foundation shall adopt C30 Concrete;
d) Approach slab behind abutments shall adopt C30 Concrete;
e) Crash barrier shall adopt C25 Concrete;
f) Bearing plinth shall adopt C40 micro-aggregate Concrete.

(4) Expansion Device

Expansion joint for the Bridge is carried out to 30mm expansion range by applying the TST elastic-plastic material and aggregate filled-type packing expansion device.

(5) Bearing

All bearings shall be spherical steel bearings, and the service life shall be not less than 50 years in accordance with Technical Requirements for Spherical Bearings (GB/T17955-2000) and relevant design requirements. Based on design requirements, supplier shall provide related information about products such as the installation manual and test evaluation data, and the products can only be used after designer approval.

(6) Other Materials

The bridge deck waterproofing materials shall adopt asphalt waterproofing layer. PVC sluice pipes will be adopted.

4）Key issues of design

(1) BK1+829.867 overpass bridge is a 38-meter single span, cast-in-situ box girder, prestressed concrete bridge. The intersecting angle between route up chainage direction and right line of under passing railway is 113 degrees. Except for No.1 abutment is partly located on the easement curve, others are on the straight line.
(2) Bridge superstructure shall adopt prestressed concrete box girder section and set in parallel.
(3) Bridge abutment shall adopt box section and spread foundation.

5.4.2. Culverts

The project is inclusive of 11 pipe culverts, and box culverts which overpass the KPLC oil pipe or KPC cable.

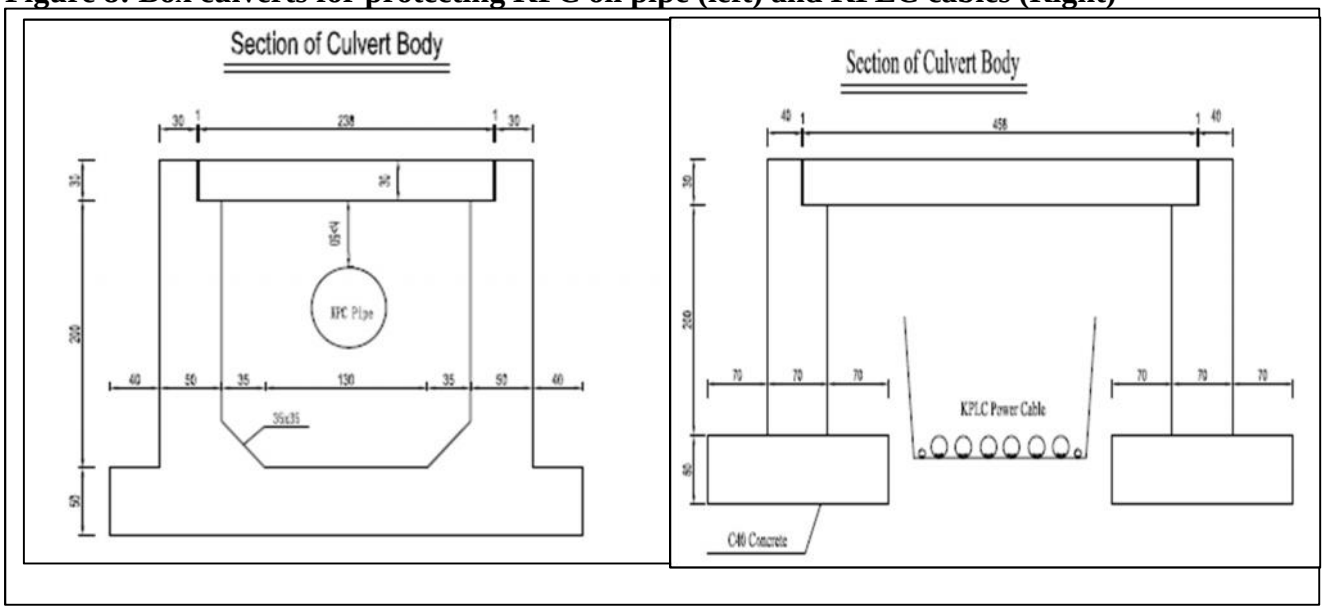
1) 11 pipe culverts are detailed as follows:

Table 6: Culvert Details

No.	Chainage	Type of Culvert	Angle of Intersection (°)	Type of Portal	Remark
1	AK0+380	2-φ0.6 pipe culvert	90	Splayed wing wall	Culvert at the main line
2	AK0+870	1-φ0.9 pipe culvert	90	Splayed wing wall	Culvert at the main line
3	AK1+460	1-φ0.9 pipe culvert	90	Splayed wing wall	Culvert at the main line
4	AK1+740	1-φ0.9 pipe culvert	90	Splayed wing wall	Culvert at the main line
5	AK2+020	1-φ0.9 pipe culvert	90	Splayed wing wall	Culvert at the main line
6	AK2+560	1-φ0.9 pipe culvert	90	Splayed wing wall	Culvert at the main line
7	AK3+020	1-φ0.9 pipe culvert	90	Splayed wing wall	Culvert at the main line
8	AK3+480	1-φ0.9 pipe culvert	90	Splayed wing wall	Culvert at the main line
9	AK3+975	1-φ0.9 pipe culvert	90	Splayed wing wall	Culvert at the main line
10	YK0+220	2-φ0.9 pipe culvert	90	Splayed wing wall	Culvert at the slip road
11	ZK0+120	2-φ0.9 pipe culvert	90	Splayed wing wall	Culvert at the slip road

2) Box culverts for protecting KPC oil pipe and KPLC power cables are detailed as follows:

Figure 8: Box culverts for protecting KPC oil pipe (left) and KPLC cables (Right)



5.5. Road intersection

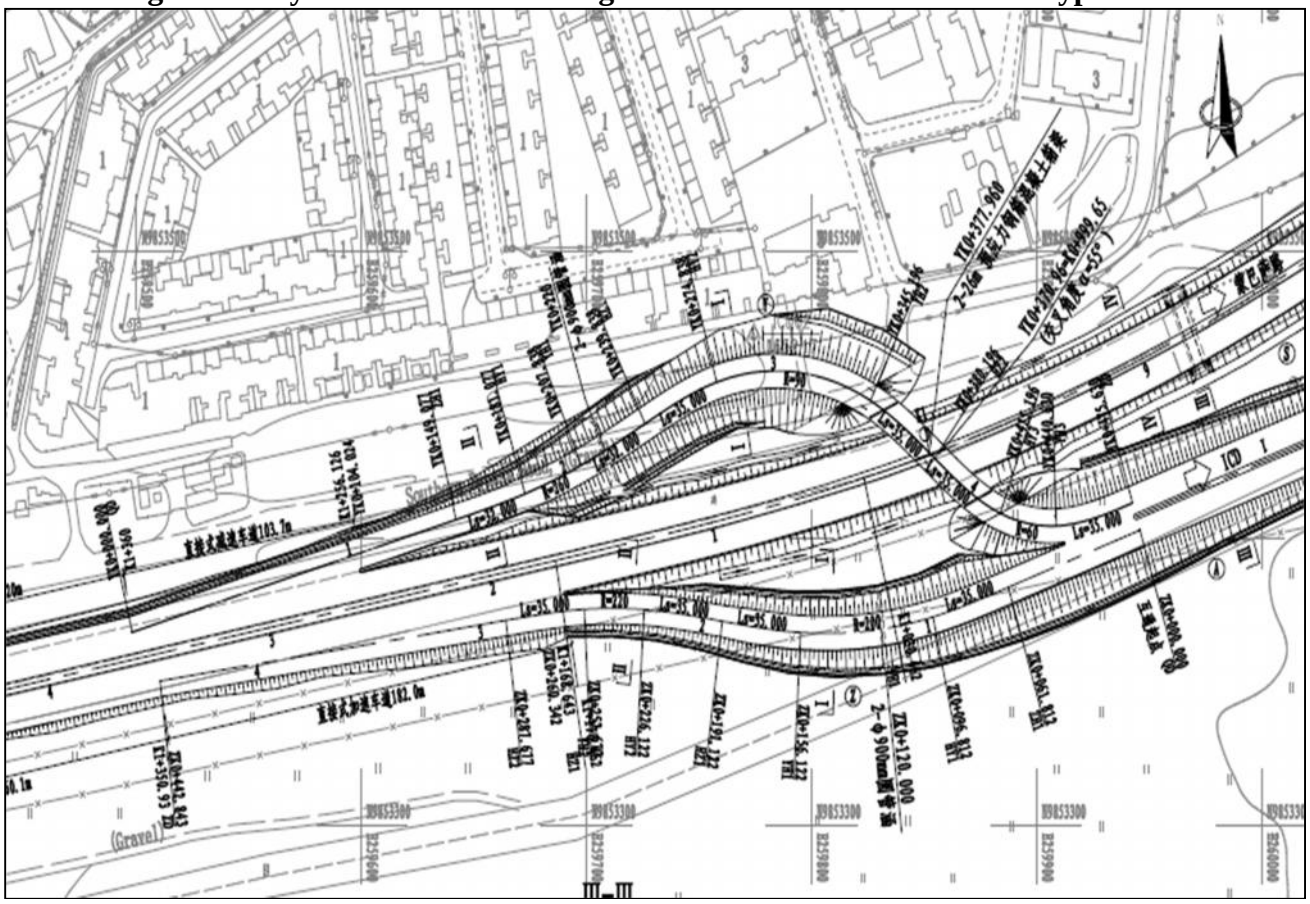
As for the Project A, total one interchange and six intersections are set. The main intersections are situated at AK0+000 and AK0+351. The remaining four intersections are crossed with the local roads and they are not detailed described in this report.

5.5.1. Interchange with Southern Bypass at the End Point of Project A Route

ICD Highway connects the Project A route near the starting point of Southern Bypass in the form of partial “pear-shaped” interchange. Toward the northeast, the route passes A104 to Mombasa. Towards the southwest, the route passes the Southern Bypass to the Uganda. Considering the turning traffic, road condition as well as the Kenya road design standard, the interchange is situated at the intersection of two arterial roads in the form of partial “pear-shaped” interchange. In the interchange area, horizontal and vertical road alignment indexes are well and able to meet the traffic demand. The specific designs are as follows:

As for the Project A, total one interchange and six intersections are set. The main intersections are situated at AK0+000 and AK0+351. The remaining four intersections are crossed with the local roads and they are not detailed described in this report.

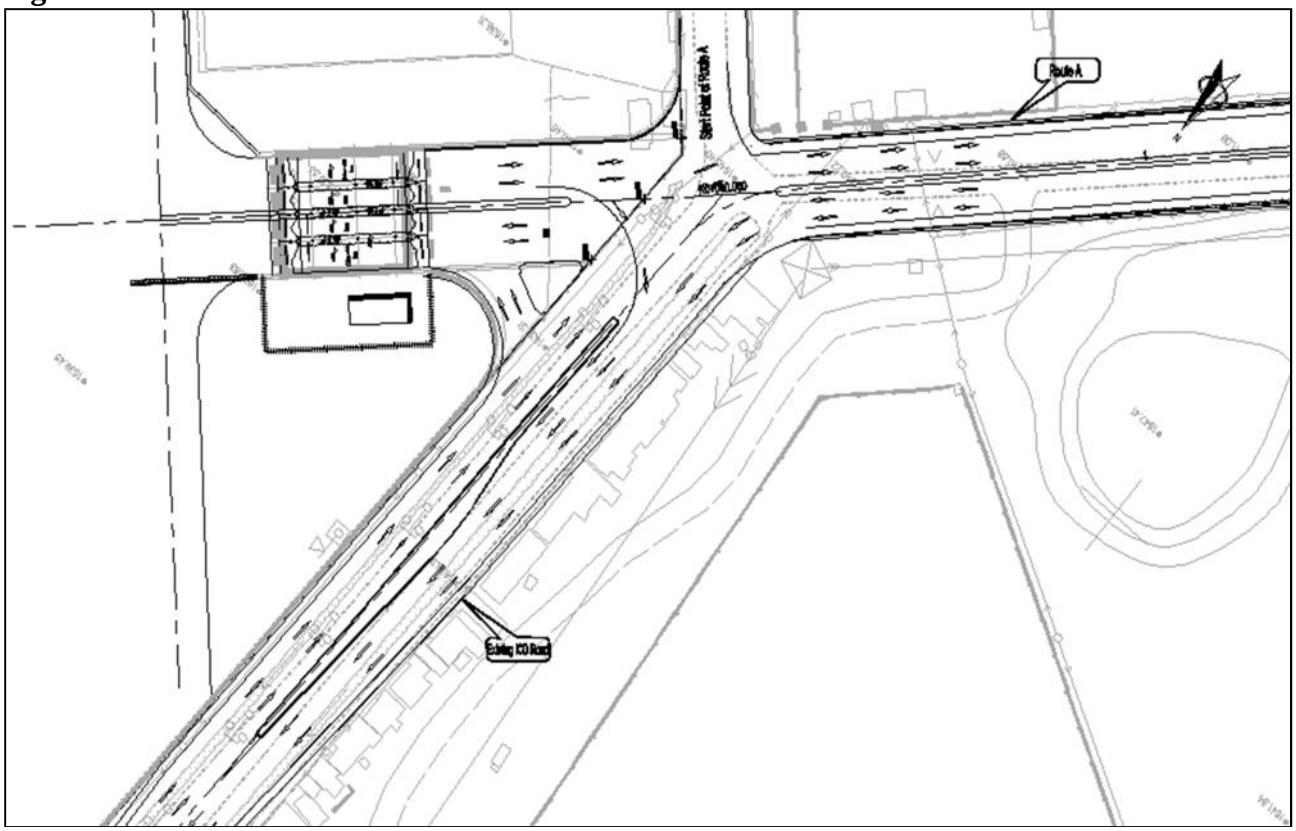
Figure 9: Layout Plan of Interchange at the End Point of Southern Bypass



5.5.2. Intersection AK0+000

The starting point of Route A forms a cross-shaped intersection with the existing road at the chainage AK0+000.

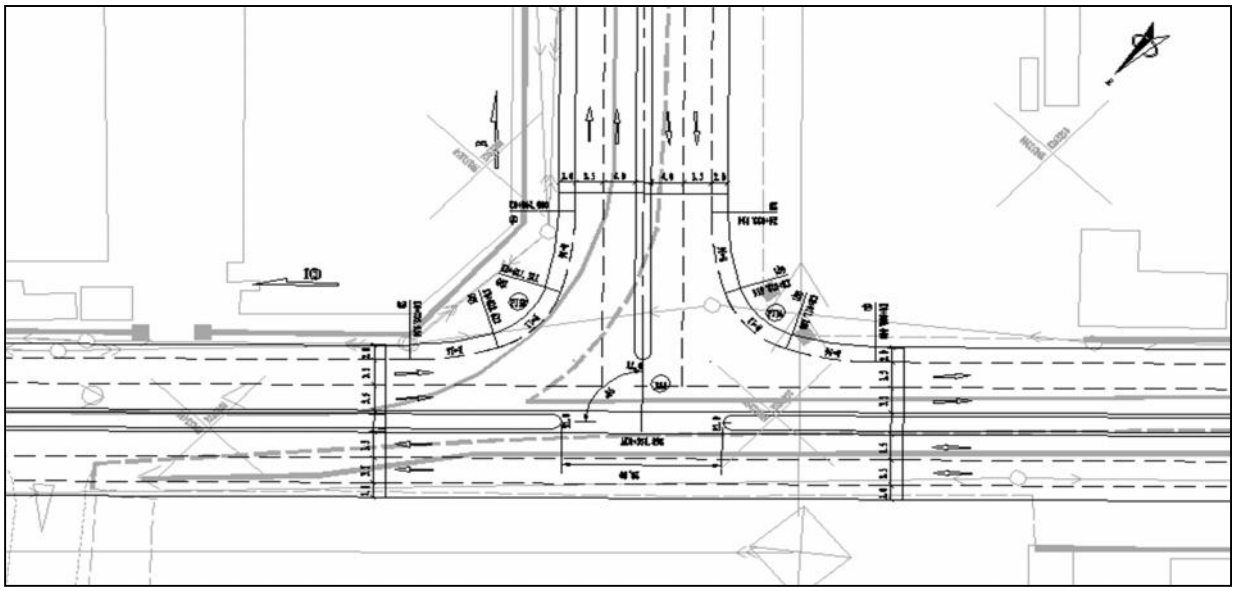
Figure 10: AK0+000 intersection



5.5.3 AK0+351 Intersection

Route A forms a T-intersection with Route B at the chainage AK0+351 of Route A.

Figure 11: AK0+351 intersection



5.6. Traffic Safety Facilities

Traffic safety facilities include traffic signs, road markings, speed bumps, guard post/guard rails, sight-line induction signs, boundary stone, kilometer post, lighting/illumination facilities, as well as variable speed-limit signs etc.

5.6.1. Signs

Speed-limit signs, place name and distance signs, prohibitory signs, and auxiliary signs are erected along the regular road segments whereas exit signs are furnished on interchanges.

5.6.2. Road Markings

Road Markings are divided into pavement centerline marking, lane-dividing marking, carriageway edge marking, entrance/exit marking, direction arrow, etc. To satisfy the vision and safety for driving at night, all markings shall use hot-melt reflecting markings. The thickness of marking of edging line of carriageway and central line of road is 1.8±0.2mm.

5.6.3. Guard Posts and Guard Rails

Guard posts are provided along bridge approaches, steep gradient segments (grade > 4%), and sections with culverts, at 2.5m intervals. Guard rails constitute an essential measure to ensure fast and safe driving, and are, on the segments where embankment fill height is more than 3m of the Project Road, installed with corrugated steel-beam railings.

3.5.4. Sight-line Induction Signs

Traffic diversion and merging signs shall be erected at and in advance of entrance and exit ramps on interchanges to alert drivers to leave or merging into the traffic flow for safety purpose.

5.5.5. Lighting/Illumination Facilities

1) Street Lighting

The street lighting in this project shall adopt single pole double cantilever lamp poles to be located in the median of the road at a center to center spacing of about 40m. The lighting column height is 12m with a cantilever arm length 1.5m and the lamp installation is at elevated angle 10 degrees. The road lightings for Ramps Y and Z adopt the single pole single-arm cantilever on one side of the road with pole spacing of about 35m, pole height 12m, cantilever length 1.5m and installation angle of 10 degrees for luminaires. Considering the local practice, the high-pressure sodium lamp is adopted with power 400W to satisfy the illuminance and uniformity requirements.

2) Illuminance Control

Street lighting adopts two control modes, the manual and automatic (time-controlled or controlled) modes.

3) Cable Laying

The street lighting power supply main cable comes from the road lighting power distribution box, which is used for power distribution to the lighting.
The street lighting trunk cable adopts armored loaded YJV22-1KV cables for direct installation and laying. The branch cable (lamp post built in branch cable) shall be connected by T-wiring through the hand hole at the side of lamp post. The street lighting power cable shall be laid along the median and two Φ114x3.5mm zinc galvanized steel pipes are used as protection, and manholes are set at the two ends of the steel pipes. The road crossing cables shall be put inside the 4 nos. embedded zinc galvanized protection pipes ofΦ114x3.5mm (lighting distribution box positions).

4) Power Supply Design

The power source of street lighting in this project comes from the street lighting distribution box. For the part above the distribution boxes, it shall be responsible and implemented by other discipline. Design interface is at the street lighting power distribution box. The power supplies of connection distribution box to other higher-grade transformers and their quantities shall be responsible by other discipline.
Three street lighting power distribution boxes are set for this project, where boxes #1, #2 and #3 are located at AK0+750, AK2+225 and AK3+750 respectively.

Plate 2: A cross section of the proposed route for the access road

5.6. Project Cost

The proposed access road is estimated to approximately United States Dollar (USD) 213,985,293.68, which includes a provision for the expansion and modernization of the ICDN yard, the access roads Line A, B and L and the railway lines. In Kenya shilling, this is 21,534,065,513 (1 USD = 100.63339 KES).

6. ANALYSIS OF ALTERNATIVES

6.1. Introduction

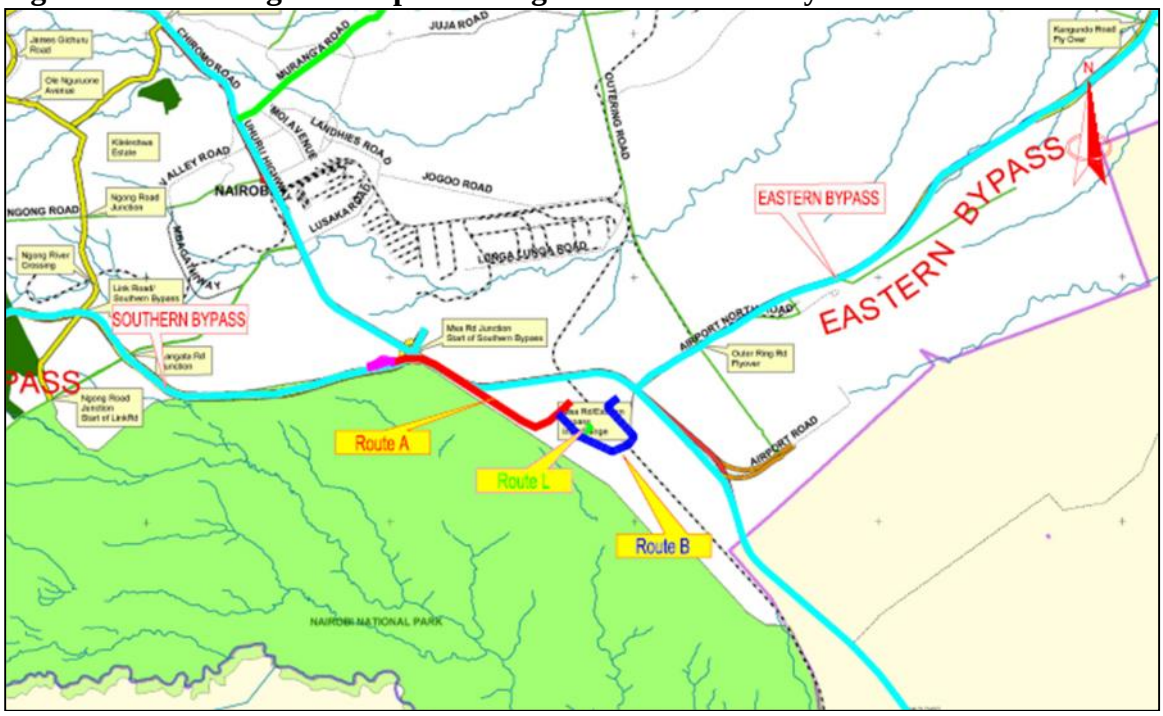
The following alternatives have been considered and are discussed further below.

1. Construction of the access road A along the outer boundary of the NNP
2. Construction of the access road A under the NNP as a tunnel
3. No project alternative
4. Construction of the proposed project as currently proposed along he inner boundary of the NNP

6.2. Construction of the access road A along the outer boundary of the NNP

Under this proposal, the alignment (route A) starts at the west gate of the ICD and goes southwards along the existing road. It turns right at mileage K1 (refer to attached drawings and Figure 12 below) and then runs along/parallel to the outer boundary of the NNP. It joins the southern bypass through an interchange and ends there. The total length of the access road under this option will be approximately 3.8km.

Figure 12: Road alignment option along the outer boundary of the NNP



This proposal will require relocation and demolition of establishments along the route. The costing for relocation, compensation and demolitions for the establishments is beyond the scope of the EIA study. However, the proponent is advised to liaise with the national land commission for the preparation of a resettlement action plan if this alternative is chosen.

6.3. Construction of the access road A under the NNP as a tunnel under the NNP

If this option were to be implemented, then the access road A road will start at the west gate of the ICD running southwards along the existing road. It then runs under the NNP as a tunnel and emerges on the surface as it approaches the southern bypass road. It joins the southern bypass road via an interchange. This option will also result in relocation, compensation and demolitions of some establishments at the start and end points of the road. However, it has minimal negative effects to the NNP ecosystem mitigating against habitat and vegetation loss, noise, dust and visual impact as compared to it being constructed on the surface as currently proposed.

Underground works are usually more expensive, but the cost and benefit balance are positive nevertheless if one considers the social-economical value of the area used, in particular, in urban areas or areas with beautiful or protected landscapes and ecosystems (Gatinnoni, Pizzaroti, & Escesi, 2014). The cost implication for this option had not been worked out at the time of the EIA study. However, the key issues that differentiate tunnels from other infrastructure arise from the risk involved with excavation through unknown ground conditions and the numerous individual cost drivers (e.g. geology, excavation type, face area, depth etc.) that contribute to the overall cost (Efron & Read, 2012).

6.4. The no action alternative

Under this alternative, the proposed project will not be constructed. This means that freight from the Nairobi inland container depot will continue to be transported via the existing roads. The result will be congestion at the ICD which was constructed to ease the same problem at the Mombasa Port. There will also be continued congestion on Mombasa road and the nearby feeder roads.

In addition, there will be increased emissions, road tear, accidents and general frustration from business people, road users and investors at large, increased congestion at the Mombasa port and the Nairobi ICD. The accrued costs (which could be avoided with improved road infrastructure) from transportation will most likely be transferred to consumers in so doing increasing the cost of living and lowering the quality of life.

6.5. The Nairobi Inland Container Deport Access Road to the southern bypass as proposed

Under this alternative, the access road (Route A) project will be constructed as proposed. Its starting point will connect the west entrance of the ICD running through the inner boundary of the NNP and the end point forming a partial “pear-shaped” interchange with the Southern bypass road. The advantages of this are:

1. The construction of this alternative will reduce freight transportation times from the ICD onto the southern bypass and towards the western parts of Kenya
2. Reduced maintenance and fuel costs associated with better quality roads;
3. Job opportunities will be created during the construction phase as well as the post-construction phase. It will give local residents the prospect of earning an income to better sustain their families;

4. Improved travelling conditions during commute especially on Mombasa road which could have been congested by trucks ferrying containers from the Nairobi ICD

The main disadvantage of this option is that it encroaches onto the NNP reducing wildlife habitat, reduces vegetation cover, interfering with the general aesthetics of the area among others discussed in 7 and 8.

6.6. Comparison of alternatives

Table 7: Comparison of pros and cons of the proposed project alternatives

No.	Proposed alternative	Pros	Cons
1.	No action alternative	Interference with the NNP (e.g. through encroachment & loss of habitat) relocation, demolitions, vegetation clearance, dusts and noise emissions among others will be avoided.	-The main purpose of the ICD that is to decongest the port of Mombasa will not be realized. -Continued delays in delivery of freight will be experienced; -High maintenance and fuel costs for motorists using the existing roads; -Loss of potential vital employment & business opportunities; -Increased congestion and emissions from Mombasa Road and other feeder roads; -Increased frustration among investors and business people along the Northern Corridor trade route; Increased cost of goods due to high transportation cost
2.	The ICD Access Road A along the inner boundary of the NNP to the southern bypass as proposed	-Reduced freight transportation times from the ICD into the hinterland; -No demolitions -Reduced maintenance and fuel costs associated with better quality roads; -Increased job & business opportunities; -Improved travelling conditions during commute especially on Mombasa road which could have been congested by trucks ferrying	-Interference with the NNP ecosystem e.g. by encroaching onto it; -Loss of habitat and vegetation cover; -Contribution to the impact of cumulative urban heat island; -Compensation for lost NNP land

		containers from the ICD	
3.	Construction of the ICD access Road A along the outer boundary of the NNP	-Minimal/no interference with the NNP ecosystem; -No habitat loss as the route is mainly built up area -Realization of the key goal for the ICD that is to decongest the port of Mombasa; -Reduced congestion on Mombasa Roads and other feeder roads	-Relocation and demolitions for some establishments along the route -Compensation for lost land and business for establishments along the route
4.	Construction of the ICD access road A as a tunnel under the NNP and onto the southern bypass	-No interference with the NNP; -Minimal impacts (e.g. noise, visual impact & dust) to the surroundings -Realization of the ICDs full potential by decongesting the port of Mombasa, Mombasa Road and other feeder roads; -Less costly to the environment especially the NNP ecosystem	-Economically costly as compared to surface roads; -Deep excavation and tunnelling might be dangerous; -Demolitions and relocation of some establishments at the start and end points;

6.7. Mitigation of the proposed Action

The key mitigation measure recommended is compensation for lost NNP land by purchasing similar land (or tenfold that acquired for the road) in the southern side of the park (Kapiti plains). This area is key for migration of wildlife from and into the NNP. It is however private land that is fast being developed. Purchasing such land as compensation for that used for road construction will enhance viability of the NNP.

Other mitigation measures proper handling of the waste material as generated, controlling noise and excessive vibrations as well as dust emissions among others. The application or adaptation of standard construction management practices is fundamental. Conflicts arising from the foreseen negative impacts will be solved through consultation with the neighbours/public; by describing the mitigation measures prescribed for the impacts. In addition, the mitigation measures would be appropriately designed and implemented to protect the environment and especially water, soil, drainage, flora and fauna of the area/site.

7. PUBLIC CONSULTATION

7.1. Introduction

Public consultation was viewed as an important activity of this project since it aided the EIA team to get the affected persons views on the perceived environmental and social effects of the project and their ideas on how the negative impacts can be mitigated. It is expected that consultations for this project will continue throughout the project implementation phase. The basic objective of the consultations was to raise awareness, get feedback from the affected persons and improve decision-making.

7.2. Objectives of public consultation

The objectives of the consultation and public participation were to:

1. Disseminate and inform the stakeholders about the project with special reference to its key components and location.
2. Gather comments, suggestions and concerns of the interested and affected parties.
3. Incorporate the information collected in the EIA project report.

In addition, the process enabled:

1. The establishment of a communication channel between the affected persons and the team of consultants and the project proponents
2. The concerns of the affected persons to be known to the decision-making bodies at an early phase of project development.

7.3. Methodology used during public participation

A renaissance survey was undertaken, and the affected persons mapped. These persons were later presented with an open-ended questionnaire. They filled in the questionnaire by answering the questions and further giving their extra comments unsolicited by the questionnaire. Copies of the questionnaires are attached to this report.

A public consultation forum was held on 2nd March 2018at the KWS headquarter, Safari Walk hall. The forum was attended by 40 persons. These were individuals and representatives of different government and non-governmental organisations. A list of attendants is appended to this report. A recording of the entire discussion that took place at the public forum is attached to this report. Questionnaires as well as notebooks (for written comments on issues not covered in the questionnaire) were handed to attendees. Copies of the filled questionnaires are attached to this report as well.

The EIA consultant, contractor and KWS representatives held a meeting on 13th March 2018 at KWS headquarters. During this meeting, the project design and impacts to the NNP from the proposed project were discussed. The emerging issues from this meeting are discussed in section 7.4.3 below. Moreover, representatives of KWS attended had earlier participated in the aforementioned public forum.

Plate 3: A section of participants at the consultative public forum

7.4. Emerging issues

In general, a majority of those who attended the public forum were of the opinion the proposed project will have detrimental effects to the NNP ecosystem. They appealed for those concerned to explore other viable options for the routing of the access road. This and other emerging issues are briefly discussed in .1 and have been reviewed and discussed in section 4, 8, 9 and 10 of this report.

7.4.1. Summary of emerging issues from the public consultative forum

Table 8: Summary of emerging issues from the public consultative forum

No.	Issue raised	Category	Remarks
1.	Why use space in the park yet there is a lot of space outside?	Project alternatives	See section 6.2
2.	Why is Kenya Railways and not Kenya Urban Roads Authority doing this Road?	Agency	The ICD and associated infrastructure such as access roads is part of the SGR project making Kenya Railways the proponent.
3.	You've said that the project is part of the Kenya Vision 2030 flagship projects, but Vision 2030 also says that the park will be protected	Policy	See discussion in section 4.6 (National strategic plans) and section 9.3.1
4.	NNP is a sanctuary to the endangered Black Rhino (*Diceros bicornis*), constructing the proposed road in the NNP; it is illegal to encroach on black rhino sanctuary	Habitat loss	See section 9.3.1

5.	There are currently many development projects in the country on protected areas. Why should protected areas pay the price?	Habitat loss	See section 9.3.1
6.	Will the EIA findings be made public?	EIA Procedures	EIA study report will be submitted to NEMA for review and publication. See section
7.	How sure should we be that our comments will reach the relevant authorities?	EIA Procedures	See section 7.3 above
8.	It is improper to call for public and other stakeholders comments, yet the design has already been done. Public participation should start at design level.	Public consultation	For future projects, the proponent is advised to consult public and relevant stakeholders (e.g. the National Construction Authority, conservation groups etc.) from the design phase of the project
9.	The Serengeti project was overturned by a court order; we should learn from such rulings.		The 385km Serengeti Road commercial road was to cut through the Northern part of the national park. 55km would pass through the park. The proposed project measures 4.153km and would run along the eastern boundary of the NNP. While Serengeti Road would have led to fragmentation of habitat with far reaching impacts[15] on the Mara and Serengeti ecosystems, the current project leads to loss of habitat which can be compensated for as recommended (section 9.3)
10.	Who makes decisions concerning land and development projects in the NNP	Land/habitat loss	Answered by KWS official: The cabinet secretary and parliament make the decision through consultations.

[15] One of the key impacts of the proposed Serengeti Road was that it could have created a barrier across a known migration route for wild beast and other wildlife from Serengeti to the Mara.

11.	We are not against development; however, the proponent should consider other viable alternatives to the current proposal.	Project alternatives	See section 6
12.	We would like to see the project cost for each alternative considered	Project alternatives	See section 6
13.	There is already construction going in the park despite our objections and court orders. Can you assure us that KR will respect due process?	Other projects under construction	The consultant has no control as to what happens after the EIA study report is submitted to NEMA
14.	Government should fund studies on existing projects especially those on protected zones to ascertain their post project impacts	Research funding for post project impacts	This is a good idea as there is a large gap in data and information on post project construction impacts (both positive and negative). Life cycle assessment should be considered for such projects as well.
15.	Kenya lacks long term planning for infrastructure and development. The economy and population are growing but long-term planning is having either stalled or is not adequate.	Planning	There is indeed a dearth of proper long-term plans for our cities, towns and market centres. Plans that not only foster economic development but also put in proper systems and funds including land for environmental conservation.
16.	The NNP land should not be factored in as zero in the project planning. This is a bad perception.	Value of natural capital	See section 8.3.4 and section 4.6 (National strategic plans) and section 9.3.1
17.	Has the proponent considered an alternative far away from the park such as Machakos?	Project alternatives	See section 1.2, 6 and 5

7.4.2. Summary of issues from questionnaires

Table 9: Summary of emerging issues from filled questionnaires

No.	Issue raised	Category	Remarks
1.	The damage to the NNP is much greater than any benefits that the project will bring	Impacts on the NNP vs benefits	See section 1.3; 8.2 and 8.3
2.	Intrusion into the park will lead to loss of tourism income, loss of international standing for Kenya and loss of genetic	Negative impacts on the NNP and	See section 8.3 and 9.3

	resources	Kenya	
3.	Build the road outside the park. The park already has enough intrusions. Let the proponent find an alternative	Project alternatives	See section 6
4.	Encroachment on the delicate NNP ecosystem will disrupt ecological balance causing habitat loss, declining wildlife populations hence loss of tourism revenue	Habitat loss	See section 8.3 and 9.3
5.	Further consultation is needed to agree on an alternative outside the boundaries of the NNP (reference made to the Arusha-Musoma (or Serengeti Road) Road through Serengeti	Project alternatives; Habitat loss; lessons from other projects	The 385km Serengeti Road commercial road was to cut through the Northern part of the national park. 55km would pass through the park. The proposed project measures 4.153km and would run along the eastern boundary of the NNP. While Serengeti Road would have led to fragmentation of the NNP with far reaching impacts on the Mara and Serengeti ecosystems, the current project leads to loss of habitat which can be compensated for as recommended (section 9.3)
6.	NPP is an iconic piece of heritage to Kenya. It is of immense economic value as a tourist destination. Building the road will result in losses. An alternative route should be found that will serve the proposed project goals while preserving the NNP	Project alternative; loss of habitat and other impacts to the NNP	See section 3.3; 5, 6, 8.3 and 9.3 and 10
7.	Disturbance effects for example, traffic, dust noise and vibrations etc.	Impact on the NNP ecosystem	See section 3.3; 8.3; 9.3 and 10
8.	KETRACO has installed 220Kv cables along the park boundary from Athi river substation to Embakasi station. Measures should be established to ensure that the cable is not disturbed for safety purposes. Liaise with KETRACO to ascertain the location of the cables	Interference with installed public utilities	See section 5.4 and 8.2.2.8

Other issues raised were:

1. Increased open trenches – most of those interviewed feared that the construction works will lead trenches being left in the area for a long time. They noted that this had happened before, and they were already suffering the consequences which include impaired

aesthetics, reduced road width making it difficult to drive and dangers of pedestrians falling into the trenches.

2. Noise and dust emissions during construction- they noted that this will be in the short term but the proposed project if completed with a bitumen surface (as proposed), will reduce noise and dust emissions
3. Congestion caused by blocking of existing roads by trucks delivering materials to the construction site
4. Increased risk to public safety – they noted that construction works may lead to accidents if safeguards are not put in place
5. Soil erosion – because of loosening of top soils by excavation activities

7.4.3. Emerging issues from meeting with KWS

There was concern that the proposed project will lead to loss of constructed support facilities to the NNP. These facilities include, the eastern gate, boundary fence, offices and wardens camp. The contractor acknowledged this problem and reported that compensation for these facilities had been factored into the project budget. Thus, the first order of business will be to construct new similar facilities as those affected by the proposed project. In doing so, the proponent and contractor will be guided by the KWS officers.

It was reported that new trees had recently been planted by conservationists in conjunction with KWS along the eastern boundary. The proposed project will result in loss of the trees and other vegetation at least 21m into the park and along the boundary for up to approximately 3.8km. The proponent is therefore advised to facilitate replanting of these trees, shrubs and grass (approximately 21m x 3.8km/ ≈80,000m^2) inside the park as directed by KWS.

There will be risk of road accidents especially during operation phase of the project. This may affect movement into and out of the NNP via the eastern gate. Safety issues have been incorporated in the design of the project as reported in section 5.6. However, the proponent is advised to make necessary adjustments as need arises during project operational phase.

8. IDENTIFICATION OF POTENTIAL IMPACTS

8.1. Introduction

Impact matrices for the site preparation and construction phases were created utilizing the following criteria[16].

Magnitude of Impact: This is defined by the severity of each potential impact and indicates whether the impact is irreversible or, reversible and estimated potential rate of recovery. The magnitude of an impact cannot be considered high if a major adverse impact can be mitigated.

Extent of Impact: The spatial extent or the zone of influence of the impact should always be determined. An impact can be site-specific or limited to the project area; a locally occurring impact within the locality of the proposed project; a regional impact that may extend beyond the local area and a national impact affecting resources on a national scale and sometimes trans-boundary impacts, which might be international.

Duration of Impact: Environmental impacts have a temporal dimension and needs to be considered in an EIA. Impacts arising at different phases of the project cycle may need to be considered.

Significance of the Impact: This refers to the value or amount of the impact. Once an impact has been predicted, its significance must be evaluated using an appropriate choice of criteria. The most important forms of criterion are:

a) Specific legal requirements e.g. national laws, standards, international agreements and conventions, relevant policies etc.
b) Public views and complaints
c) Threat to sensitive ecosystems and resources e.g. can lead to extinction of species and depletion of resources, which can result, into conflicts.
d) Geographical extent of the impact e.g. has trans- boundary implications.
e) Cost of mitigation
f) Duration (time period over which they will occur)
g) Likelihood or probability of occurrence (very likely, unlikely, etc.)
h) Reversibility of impact (natural recovery or aided by human intervention)
i) Number (and characteristics) of people likely to be affected and their locations
j) Cumulative impacts e.g. adding more impacts to existing ones.
k) Uncertainty in prediction due to lack of accurate data or complex systems. Precautionary principle is advocated in this scenario.

8.2. Site preparation and construction phase

[16] Adopted from - Ogola, P. F. A. 2007. Environmental Impact Assessment General Procedures, presented at Short Course II on Surface Exploration for Geothermal Resources, organized by UNU-GTP and KenGen, at Lake Naivasha, Kenya, 2-17 November 2007

Table 10: Impact matrix for site preparation and construction phases

No.	Activity/ Impact	Direction		Duration		Location		Magnitude			Extent			Significance		
		Positive	Negative	Long	Short	Direct	Indirect	High	Moderate	Low	National	Regional	Local	Large	Medium	Small
A. Site preparation and construction																
1..	Loss of vegetation		x	x		x			x				x		x	
2.	Excavation works		x		x	x				x			x		x	
3.	Soil erosion		x		x	x				x			x			x
4.	Solid waste generation		x		x	x	x									
5.	Air quality															
6.	Increased accidents potential		x		x	x				x			x			x
7.	Interference with installed public utilities		x		x	x		x				x			x	
8.	Loss of wildlife habitat		x	x		x		x					x	x		
9.	Reduction of ability of NNP to provide ecosystem services		x	x		x	x		x			x			x	
10.	Disturbance effects to the NNP		x	x		x			x				x		x	
11.	Change in wildlife behaviour		x	x		x	x		x				x		x	
B. Material transport and storage																
1.	Traffic congestion		x		x	x				x			x		x	
2.	Potential spillage		x		x	x				x			x			x
3.	Dust and suspended solids		x	x	x				x							x
C. Construction crew																
1.	Waste water generation		x		x	x	x			x			x			x
2.	Solid waste Generation		x		x	x	x		x						x	

3.	Workers safety															
D. Socio economics																
1.	Creation of employment	x		x	x	x	x		x			x			x	
2.	Improved road transport network	x		x		x	x		x			x			x	
3.	Increased commercial activity	x		x	x	x	x		x			x			x	
4.	Relocation		x	x		x				x			x		x	

8.2.1. Positive impacts during site preparation, construction and operation phases

8.2.1.1. Creation of employment

Employment opportunities will be created during the project preparation and construction phases. Jobs created can be classified as direct, indirect and induced. Indirect jobs are those held by workers in industries that supply road construction manufacturers with materials and by offsite construction industry workers such as administrative, clerical, and managerial workers. Supplying industry jobs include those supported in stone and clay mining and quarrying, petroleum refining, lumber, steel, concrete, and cement products, as well as in miscellaneous professional services. Induced jobs are jobs supported throughout the economy when road construction industry employees spend their wages. Expenditures by these workers on various goods and services stimulate demand for additional employees in these industries, resulting in jobs being supported throughout the general economy.

8.2.1.2. Increased commercial activity

The proposed project is an extension of the SGR project within Kenya and the East African region at large. The access road is meant to improve and complete the cycle of smooth freight transportation. During construction, there will be increased economic activity especially in Nairobi and along the project route. This will be in form of supply of material, provision of services such as security and catering among others. The spill over effect will be promoting regional living standards especially for those directly employed during construction phase.

8.2.1.3. Improved road transport network

The new access road will largely improve the road transport network at the project area and in Nairobi at large. From experience, increased traffic on main roads in Nairobi (e.g. Mombasa road) largely leads to congestion to other feeder roads in the surrounding. The new container deport has thus brought in more vehicles on Mombasa road leading to congestion and thus the necessity of the new access road.

8.2.1.4. Reduced traffic congestion and associated emissions

Currently, freight from the inland container deport is transported via the ICD road onto Mombasa road and to the southern bypass via the Likoni –Mombasa road interchange. This has increased traffic on Mombasa road especially at the section approaching the Likoni road interchange. Construction of the new access road will mean that all traffic to and from the ICD will barely load onto the existing traffic on Mombasa road. This will reduce traffic congestion, increase transportation times and reduce emissions on both roads.

8.2.2. Negative impacts during site preparation and construction phases

8.2.2.1. Soil erosion and siltation

The potential for land slippage is greatly increased as a result of vegetation removal. A plant's roots act as a mesh within the substrate increasing its cohesiveness and improving drainage. Areas where bare ground is exposed tend to erode faster than areas inhabited by plants as they help percolate rainwater into the substrate below and into underground aquifers. The substrate in the project areas is comprised mainly of black cotton soil, which readily succumbs to weathering over time by rainfall and flowing water. Soil erosion and siltation of nearby drainage channels could have a negative impact on storm water flow thereby causing flooding and ponding. It is imperative, therefore, that proper soil/construction material management practices be implemented during site clearance, site preparation and the construction phase of the project.

8.2.2.2. Disturbance and loss of vegetation

The proposed project borders a largely developed area and an undeveloped area. It lies on the periphery of the Nairobi National Park and the industrial/commercial developments along Mombasa Road. Thus, vegetation communities present within the proposed project area exhibited various levels of anthropogenic influence and as such. Vegetation within the developed commercial zones is thin or nonexistent. Roadside vegetation had the highest level of endemism and as such, care should be taken in carrying out the development in these areas. It is foreseen that the project will not bring in new vegetation clearance as the route is already a built-up area. However, there will be impacts on the existing vegetation in the form of blockage of stomata by generated dust thereby impeding growth. Thus, water must be regularly sprinkled on the excavated areas to reduce this impact.

8.2.2.3. Solid waste generation

During this construction phase of the proposed project, solid waste generation may occur mainly from two points: From the living quarters of workers and their activities along the proposed route and from construction activities such as site clearance and excavation.

8.2.2.4. Air quality

Site preparation has the potential to have a two-folded direct negative impact on air quality. The first impact is air pollution generated from the construction equipment and transportation. The second is from fugitive dust from the proposed construction areas and raw materials stored on site. Fugitive dust has the potential to affect the health of construction workers, the resident population and the vegetation.

8.2.2.4. Noise and excessive vibrations

Site clearance for the proposed development necessitates the use of heavy equipment to carry out the job. This equipment includes bulldozers, backhoes, jackhammers etc., additionally some demolitions will be carried out. The noise directly attributable to site clearance activity should

not result in noise levels in the residential areas to exceed 55dBA during day time (7am – 10 pm) and 50dBA during night time (10 pm – 7 am). Where the baseline levels are above the stated levels then it should not result in an increase of the baseline levels by more than 3dBA. Construction noise on a road development project can result in short-term impacts of varying duration and magnitude. The construction noise levels are a function of the scale of the project, the phase of the construction, the condition of the equipment and its operating cycles, the number of pieces of construction equipment operating concurrently. To gain a general insight into potential construction noise impacts that may result from the project, the typical noise levels associated with various types of construction equipment are identified in Table 11 below. The noisiest periods of highway construction are typically the ground clearing and earthwork phases.

Table 11: Typical noise levels from construction equipment[17]

No.	Type of equipment	Typical sound level at 15meters
1	Dump truck	88
2	Portable air compressor	81
3	Concrete mixer	85
4	Jackhammer	88
5	Scraper	88
6	Bulldozer	87
7.	Paver	89
8.	Generator	76
9.	Pile driver	101
10.	Rock drill	98
11.	Pump	76
12.	Pneumatic tools	85
13.	Backhoe	85

8.2.2.5. Storage of materials and equipment

Raw materials, for example sand and marl, used in the construction of the proposed development will be stored onsite. There will be a potential for them to become air or waterborne. Stored fuels and the repair of construction equipment has the potential to leak hydraulic fuels, oils etc. Plant growth and health can be significantly affected by dust, grime and toxic emissions. Leaching from storage areas can disturb the pH balance in the soil and result in plant loss.

8.2.2.6. Transport of raw materials and equipment

The transportation and use of heavy equipment and trucks is required during construction. Trucks will transport raw materials and heavy equipment. This has the potential to directly impact traffic flow along local roads.

[17] *Adapted from - McFarland-Johnson, Inc. May 30, 2007*

8.2.2.7. Traffic management

The construction of the new access road may necessitate the re-routing of some vehicular and pedestrian traffic and introducing traffic delays thereby increasing in travel time. The re-routing of vehicular traffic has the potential to lead to increase fares. Negative impacts on traffic are expected during the construction stages, and these include: Disruptions in traffic and Reduced level of service due to increased large/construction vehicle on the roads.

8.2.2.8. Interference with installed public utilities

Construction activities may interference with the installed public utilities such as underground cables, power lines, water and sewerage lines among others. Thus, utility relocation plan (ERP) must be prepared and put in place. Authorization from service providers shall be sought and adequate notification given to parties to be affected. KETRACO has installed 220Kv cables along the park boundary from Athi river substation to Embakasi station. Measures should be established to ensure that the cable is not disturbed for safety purposes. Liaise with KETRACO to ascertain the location of the cables.

8.2.3. Negative impacts during operation

8.2.3.1. Siltation, flooding and ponding

The proposed project may result in increased run off especially in times of heavy rainfall and storms. In a no project scenario, that is if the project area was undeveloped, the storm waters are expected to percolate into the ground. However, water percolation will be reduced with the proposed project development. The result might be increased flooding and ponding in the project area. Silt carried from the surrounding area and flowing into the drainage system might block the drainage systems of nearby roads e.g. the southern bypass. Thus flooding (including extreme cases occasioned by climate change) siltation and ponding must be considered in the design of the proposed project.

8.2.3.2. Air quality

The volume of vehicles expected along the access road is expected to increase. It is also important to note that emissions are highest at the time of vehicle start up in the morning (cold start). This is due to the fact that the first few minutes of driving generate higher emissions because the emissions-control equipment has not yet reached its optimal operating temperature. Also, emission rates are higher during stop-and-go, congested traffic conditions than free flow conditions operating at the same average speed. Given the above explanations, the potential for vehicular emissions from this project negatively affecting air quality to an extent where human respiratory health may also be negatively impacted is low.

8.2.3.3. Increased noise

The operation of the proposed access road will result in an increase in the existing noise level (cumulative). The cumulative noise impact takes into account all the existing background noise

sources. A noise survey during operation will help get a clear picture of this impact. Noise from the new noise source (the proposed road) will be added to the existing noise levels to determine what if any impact this new development would have on the surrounding community.

8.2.3.4. Road accidents

As with any other road, there is potential for accidents on the new access road during operation. This is therefore a cumulative impact and all concerned agencies must be involved to reduce, control and prevent occurrence and recurrence of accidents. The design of the project includes construction of road furniture (e.g. speed limit signs) and speed control bumps aimed at preventing and reducing accidents. The design also includes an interchange linking it to the southern bypass thereby preventing possible collisions.

8.2.3.5. Spills and air pollutants

The increased traffic flow in the area from the inland container depot to the southern bypass will bring about increased pollutants such as ground level ozone which were not there before project development. However, these pollutants are currently being emitted from the nearby Mombasa road and to a large extent due to congestion. The new access road will reduce traffic on the Mombasa road and speed up its traffic flow. Therefore, this impact is expected to be of low significance.

8.2.3.6. Increased noise

This will mostly affect people working outdoors along the new road (e.g. during maintenance) will be exposed to the extended and continuous traffic noise. Sustained noise levels of this nature may cause hearing loss, induce fatigue or stress, and reduce worker's productivity. The annoyance and discomfort related to the continuous noise exposure may create an unpleasant working condition.

8.3. Impacts on the NNP

8.3.1. Loss of habitat

Construction of the proposed access road along the inner border of the NNP will lead to direct loss of habitat. The developmental footprint of the proposed road is approximately 88,200m^2 with approximately 80% of this being diminished wildlife habitat in the NNP. This impact is of great concern since cumulatively, climate change, pollution, and the loss, fragmentation, and degradation of habitat has major impacts on species richness and major drivers of species extinction (Vitousek, Mooney, Lubchenco, & Melillo, 1997). On the other hand, vegetation adjacent to roads often provides habitat (Bissonette & Rosa, 20009), and in some landscapes, even the majority of habitat (van der Ree & Bennet , 2003). However, wildlife that use this habitat will experience traffic noise and may be affected by it. Anthropogenic noise has the potential to severely disrupt the communication of species by acoustic interference or masking (van der Ree, Jochen , van der Grift, & Clevenger, 2011).

8.3.2. Loss of vegetation

The proposed site is currently covered by trees, grass and shrubs. These will be cleared to pave way for the road construction works. Grass much needed by grazers in the NNP will be lost. Even if it was replanted during landscaping after completion of construction works, it will not be accessible to wildlife as the road will be fenced. During operational phase, traffic may stir up dust and other contaminants that settle on plants, blocking necessary processes like photosynthesis and transpiration. Traffic will mobilize dust from the road surface that will be deposited along verges and in the nearby vegetation. Moreover, because of removing vegetation, the amount of light and heat is likely to increase. Additional light invites different plant species, often replacing native communities.

8.3.3. Risk of wildlife vehicle collisions

Road mortality is undoubtedly the most recognized effect of traffic on wildlife, as carcasses of dead are a common view along roads. It is reported that: "sometime during the last three decades, roads with vehicles probably overtook hunting as the leading direct human cause of vertebrate mortality on land". (Forman & Alexander, 1998). Currently, there is a perimeter fence along the eastern side of the park. Since the road will run along the inner boundary, it is recommended that a new fence be constructed before commencement of works that is if this proposal is approved.

8.3.4. Reduction of ability by NNP to provide ecosystem services

Ecosystem services are the benefits provided to humans through the transformations of resources (or environmental assets, including land, water, vegetation and atmosphere) into a flow of essential goods and services e.g. clean air, water, and food (Costanza, et al., 1997). The key ecosystem services provided by the NNP are climate control (e.g. sequestration of greenhouse gases), water filtration, soil fertility, as well as recreational and cultural services among others. Being in a city, the NNP relieves the effect of urban heat island, provides a large surface area (approximately 117km^2) for percolation of storm water that could have otherwise caused flooding or overburdened our sewer systems[18].

Perhaps one of one of our shortcomings as humanity is to monetize the ecosystem functions that we enjoy from forests, open lands, parks and wetlands among others[19]. Many ecosystem services have not been easy to observe until they cease to flow, hence they have not been formally counted in economic systems, or the effects of their loss have been counted as 'externalities (Costanza, et al., 1997). 'If an ecosystem service is regarded as 'free', there will be no incentive to value its specific role or use. Hence, the undervaluing of many ecosystems services, and the

[18] Nairobi is one of the cities where sewer and storm water systems are interconnected often creating a health hazard when it rains. Open spaces such as the NNP, Uhuru park, city park and golf courses are vital for the drainage of the City. This reduces the cost of constructing drainage and sewerage treatment systems.

[19] It is often easy to obtain the value of developed land e.g. buildings could be valued, and monetary compensation given if they were to pave way for infrastructure development. However, compensation for ecosystem services in monetary terms is often ignored since most of our natural capital has not been valued/monetized.

valuing of only a narrow range of services, has led to patterns of unsustainable resource use resulting in environmental degradation. (Gardner & Prugh, 2008).
The proposed project will utilize land in the NNP thus reducing the capacity of the park to provide these ecosystem services. It is therefore recommended that, compensation for lost land in the NNP due to the road construction be undertaken. This can be done by purchasing land especially on the southern part of the park. This will essentially ensure that the ability of the park to provide ecosystem services is not diminished.

8.3.5. Disturbance effects

Disturbance effects (e.g. noise, dusts, invasive roadside species etc.) are expected to spread into the surrounding landscape and contribute far more to the overall loss and degradation of natural habitat than the road body itself (Seiler, 2001). Effects on vegetation and fauna due to edge effects have been observed up to several tens of meters away from the road (Ellenberg, Müller, & Stottele, 1981). It has also been observed that changes in plant and animal diversity may occur up to 30 m from a road edge into the adjacent forest (Mader, 1985). Additionally, road construction, maintenance and traffic will aggravate edge effects on the surrounding environment by noise and pollution.

Traffic noise during construction and operation may be disturbing to humans and animals as well. However, whether wildlife is similarly stressed by noise is questionable (Andrews , 1990), nevertheless, shy species might read traffic noise as a token for the human existence and subsequently avoid noisy areas near the road. Birds seem to be especially sensitive to traffic noise, as it directly interferes with their vocal communication and thereby affects their territorial behavior and mating (Reijnen & Foppen, 1994).

The proposed site is on the edge of a highly built up area that border a major highway (Mombasa Road) and also a flight path to the JKIA. The noise impact will therefore not be exclusively due to the new road construction but will contribute to the cumulative impact effects of surrounding activities. Many wildlife species have learned to cope with urban conditions and utilize areas that may appear much less suitable than the areas adjacent to infrastructure (Andrews , 1990). Certainly, in many situations, disturbances by noise, lighting or movements are of marginal importance to wildlife; unless these disturbances do not entail increased mortality or barrier effects that multiply the overall impact (Andrews , 1990).

On a positive note, roadsides have been documented to support a diverse plant and animal life (Way, 1977). However, specific data on Kenya regarding this topic is largely missing. In his famous study, (Way, 1977) reported that roadsides in Great Britain supported 40 of the 200 native bird species, 20 of the 50-mammalian species, all 6-reptilian species, 5 of 6 amphibian species, as well as 25 of the 60-butterfly species occurring in the country. Therefore, infrastructure corridors can provide valuable resources for wildlife that are rare or missing in the surrounding landscape, even though they are unlikely to completely substitute the original habitat or reach a similar ecological value as comparable habitat distant from infrastructure (Andrews , 1990).

8.3.6. Risk of introduction of invasive species

Invasive plant species includes either indigenous or non-indigenous species that heavily colonize a habitat and negatively impact on it economically, environmentally or ecologically (Davis, Grime, & Thompson, 2000). Due to transportation of materials such as sand and murram from far flung areas into the site during construction, there is a risk of introducing species that are not native to the area. There is also the risk of introduction of seeds and plant fragments during maintenance and operational face. Some invasive species that have been documented at the NNP include *Solanam incanum, Datura stramonium, Opuntia vulgaris* among others (Omari, 2009). Thus, the proponent and contractor must take utmost care not to introduce these kind of species and others into the NNP.

8.4. Cumulative impacts

The combined, incremental effects of human activity, referred to as cumulative impacts, pose a serious threat to the environment. Cumulative impacts result when the effects of an action are added to or interact with other effects in a place and within a time. Consequently, the cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities affecting that resource no matter what entity (government, non-government, or private) is taking the actions (EPA, 1999).

As mentioned earlier, the proposed site neighbours a built-up area that consists of activities such as industries, banking, hotels, pipelines, electricity transmission, flight path and roads among others. Cumulative impacts in relation to the NNP therefore include loss of aesthetic value, disturbance effects (e.g. noise and dust), increased storm water runoff, and loss of habitat.

Table 12: Impact matrix for operational phase

No.	Activity/ Impact	Direction		Duration		Location		Magnitude			Extent			Significance		
		Positive	Negative	Long	Short	Direct	Indirect	High	Moderate	Low	National	Regional	Local	Large	Medium	Small
A. Water drainage management																
Siltation and flooding			x	x			x			x			x			x
Ponding			x	x			x			x			x			x
B. Air quality																
Increased pollutants in the project area			x	x			x			x			x			x
C. Landscaping																
Maintenance of landscaped vegetation		x		x		x			x				x		x	
D. Noise and vibration																
Increased noise pollution			x	x			x			x			x			x
E. Spills and waste disposal																
Increased potential for oil spills			x	x			x			x			x		x	
Improper waste disposal			x	x			x			x			x			x
F. Road Accidents																
Increased potential for accidents			x	x			x			x			x			x
G. Occupational health and safety concerns																
Increased exposure to air pollutants			x	x		x				x		x				x
Increased noise exposure			x	x		x				x			x			x
H. Socio-economics																
Employment		x		x		x	x		x		x	x			x	
Improved transportation		x		x		x			x			x			x	
Regional and national economic growth		x		x		x			x		x				x	

9. PROPOSED MITIGATION MEASURES AND PROJECT ALTERNATIVES

9.1. Site clearance and construction phase

9.1.1. Storage and transportation of raw materials

A central area should be designated for the storage of raw materials. This area should be lined in order to prevent the leakage of paints and chemicals into the sediment. In terms of transporting equipment, the existing roads should be used with minimum disturbance to other road users, rather than creating temporary pathways just for equipment access. Furthermore:

a) Raw materials that generate dust should be covered or wet frequently to prevent them from becoming air or waterborne.
b) Fine grained materials (sand, marl, etc.) will be stockpiled away from drainage channels and low berms will be placed around the piles which themselves will be covered with tarpaulin to prevent them from being eroded and washed away.
c) Raw material should be placed on hardstands surrounded by berms.
d) Equipment should be stored on impermeable hard stands surrounded by berms to contain any accidental surface runoff.
e) Bulk storage of fuels and oils should be in clearly marked containers (tanks/drums etc.) indicating the type and quantity being stored. In addition, these containers should be surrounded by berms to contain the volume being stored in case of accidental spillage. The berms must be constructed in order contain at least twice the volume of material to be stored.
f) Adequate and appropriate road signs should be erected to warn road users of the construction activities. For example, reduced speed near the construction site.
g) Raw materials such as marl and sand should be adequately covered within the trucks to prevent any escaping into the air and along the roadway.
h) The trucks should be parked on the proposed site until they are off loaded.
i) Heavy equipment should be transported early morning (12 am – 5 am) with proper pilotage.
j) The use of flagmen should be employed to regulate traffic flow.

9.1.2. Noise pollution

Significance of noise impacts depends on whether the project would increase noise levels above the existing ambient levels by introducing new sources of noise. The proponents shall put in place several measures that will mitigate noise pollution arising during the construction phase. The following noise-suppression techniques will be employed to minimize the impact of temporary construction noise at the project site.

a) Install portable barriers to shield compressors and other small stationary equipment where necessary.
b) Establishment of noise buffer, for example waterfalls to mask the traffic noise.
c) Use quiet equipment (i.e. equipment designed with noise control elements).
d) Install sound barriers for pile driving activity.

e) Limit pickup trucks and other small equipment to a minimum idling time and observe a common-sense approach to vehicle use and encourage workers to shut off vehicle engines whenever possible.
f) Construction works should be done during the day when the outside environment is also noisy.
g) Adhere to the provisions of Noise Prevention and Control Rules 2005, Legal notice no. 24 regarding noise limits at the workplace.
h) Use equipment with low noise emissions as stated by the manufacturers.
i) A guide is workers operating equipment generating noise of 80 dBA (decibels) continuously for 8 hours or more should use ear muffs. Workers experiencing prolonged noise levels 70 - 80 dBA should wear earplugs.

9.1.3. Air quality

Controlling dust during construction is useful in minimizing nuisance conditions. It is recommended that a standard set of feasible dust control measures be implemented for all construction activities. Emissions of other contaminants (greenhouse gases, and diesel related PMB_{10B}) that would occur in the exhaust from heavy equipment are also included.

All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction. This means that construction workers will be trained regarding the minimization of emissions during construction. Specific training will be focused on minimizing dust and exhaust gas emissions from heavy construction vehicles. Construction vehicles drivers will be under strict instructions to minimize unnecessary trips and minimize idling of engines.

Dust emissions will be controlled by the following measures:
1. Watering all active construction areas as and when necessary to lay dust.
2. Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard.
3. Pave, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites.
4. Sweep daily (with physical sweepers) all paved access roads, parking areas and staging areas at construction sites.
5. Areas should be dampened every 4-6 hours or within reason to prevent a dust nuisance and on hotter days, this frequency should be increased.
6. Minimize cleared areas to those that are needed to be used.
7. Cover or wet construction materials such as marl to prevent a dust nuisance.
8. Where unavoidable, construction workers working in dusty areas should be provided and fitted with N95 respirators.

9.1.4. Solid waste generation

1. Skips and bins should be strategically placed within the construction site. The ratio of skips/bins to worker needs to be determined to ensure that the sewage and disposal facility is adequate.

2. The skips and bins should be adequately designed and covered to prevent access by vermin and minimize odor.
3. The skips and bins at the construction site should be emptied regularly to prevent overfilling.
4. Disposal of the contents of the skips and bins should be done at an approved disposal site and by a licensed waste handler
5. Use excavated soils for backfilling and landscaping. The project proponent and contractor should liaise with the county government and designate an appropriate site for disposal of excavated soils that may not be used for backfilling and landscaping
6. Provide portable sanitary conveniences for the construction workers for control of sewage waste. A ratio of approximately 15 workers per chemical toilet should be used

9.1.5. Emergency response

a) A lead person should be identified and appointed to be responsible for emergencies occurring on the site. This person should be clearly identified to the construction workers.
b) The construction management team should have onsite first aid kits and arrange for a local nurse and/or doctor to be on call for the construction site.
c) Make prior arrangements with local health care facilities such as health centres or the hospitals to accommodate any eventualities.
d) Material Safety Data Sheets (MSDS) should be store onsite

9.1.6. Traffic management

During Construction the following should be enforced:

1. Delivery trucks should operate ideally during off peak hours.
2. Loading of trucks as per existing axel load guidelines.
3. Traffic diversion routes must be identified and constructed if/as necessary.
4. Adequate caution signage as per existing guidelines and the use of flagmen where necessary.
5. Trucks must be properly covered and loaded so as to not let loose material fall during transport

9.1.7. Soil erosion and siltation

1. Under no circumstance will sand, marl or silt be allowed to collect within existing and constructed drainage channels to the extent that they storm water flow and provide the opportunity for overtopping and flooding.
2. Fine grained materials (sand, marl, etc.) will be stockpiled away from drainage channels and low berms will be placed around the piles which themselves will be covered with tarpaulin to prevent them from being eroded and washed away.
3. Provision of catch or diversion drains to divert surface flows (where necessary) around disturbed area prior to major works.
4. Installation of silt fences where applicable
5. Reduce vegetation clearance to the minimum and ensure that constructed drainage channels do not empty into the nearby land

9.2. Operational phase

9.2.1. Noise and vibration

1. Conduct annual noise assessment to determine if the traffic from the highway is having negative impact on the environment.
2. Where necessary, noise mitigative structures should be put in place such as noise barriers, etc.

9.2.2. Air quality

There are steps that can be taken if the operation of the road causes the air emissions standards to be exceeded. These include:

a) Public education of the dangers and other steps that can be taken.
b) Planting vegetation (trees) along the verges to reduce the spatial range of air emissions especially particulates.

9.2.3. Occupational health and safety

1. Conduct annual noise exposure surveys of the toll booth operators. Provide road maintenance workers with ear muffs and or plugs which should be worn at all times during maintenance works.
2. Conduct annual indoor air quality assessment, checking for parameters such as temperature, relative humidity, carbon dioxide, carbon monoxide NOx and SOx.
3. Ensure that vehicles within the region and Kenya at large have adequate fuel efficiency in line with both local and international air quality guidelines
4. Have established procedures for maintenance teams when working along the highway. This should include adequate signage, reflective gear, lane closure and diversion and providing them with PPE commensurate to the work being carried out

9.3. Proposed mitigation measures for impacts on the NNP

9.3.1. Controlling the impact of habitat loss

The current project is a vision 2030 flagship project that seeks to improve infrastructure thereby reducing pollution and foster economic development. However, since it is designed to utilize land along the NNP, it contradicts the objectives set out under Tourism and environment in the Vision 2030. Hence, there is a “thirst” to strike a balance between economic development and conservation of the protected zones that tourism has been anchored upon, specifically the NNP. The access road will reduce wildlife habitat by encroaching onto it. But it will also lead to economic growth, reduce congestion and pollution on the roads. Since the key objective of the vision is to secure wildlife corridors, it is recommended that land taken by the road be compensated for by purchasing land on the southern side of the NNP where key migratory corridors are under perpetual threat.

In other words, a percentage (this can be worked out by among other relevant agencies (e.g. KWS) in consultation with parliament, non-governmental organizations especially those involved in conservation) of the revenue generated from the entire SGR and related projects must be designated for conservation efforts. In doing so, the environmental & socio-economic benefits of the access road should also be factored in.

9.3.2. Controlling the impact of vegetation loss

It is recommended that replanting of grass and shrubs be undertaken as part of road landscaping program. However, since this vegetation will no longer be available for grazing by wildlife inside the NNP, then the proponent must go beyond landscaping. In this regard, the proponent is advised to laisse with KWS and other relevant organizations (both government and non-governmental) and create funded programs that will ensure that trees, shrubs and grass are replanted in the degraded lands within the NNP as well as land acquired as recommended in section 9.3.1 above. Given that the impact of vegetation loss might go beyond the confines of the proposed road, the revegetation efforts should be at least 10fold or as agreed upon by the KWS and the proponent.

9.3.3. Controlling risk of wildlife and vehicle collisions

Part of the proposed road is designed to run along the inner boundary of the NNP. There is currently an existing fence along the eastern boundary that prevents wildlife from wondering onto neighbouring property and roads. If this plan were to be implemented, then it is recommended that a new fence be constructed before commencement of works. The design and materials to be used for the perimeter fence should be guided by the KWS.

9.3.4. Enhancing ability of NNP to provide ecosystem services

Compensation (see also section 9.3.1) for land ceded for the proposed project by purchasing similar or more land on the southern side of the park will help enhance the ecosystem services of the NNP. It will also ensure that natural capital is not diminished as a result of infrastructure development.

9.3.5. Controlling disturbance effects

Disturbance effects as discussed in section 8.3.5. include among others noise, soil disturbance, dust and exhaust emissions. Mitigation measures for these impacts have been discussed in section 9.1 and 9.2 above. Furthermore, it is recommended that a belt (25-50mwide) of trees be planted along the inside border of the NNP. Once grown up, they will serve as a protective barrier against disturbance effects such as noise and dust and to some extend improve the aesthetics of the area. Trees are well known as effective control agents against wind, noise, dust and harmful gases (Sandeva, Despot, & Simovski, 2013; Kragh, 1981)

9.3.6. Controlling risk of introduction of invasive species

The project proponent is advised to liaise with KWS and undertake comprehensive education and awareness training for the project workers and construction site managers on the risks

associated with invasive species, conditions and protocol to be used during the construction work along the park to minimize and control this impact. The proponent is further advised to liaise with KWS in inspecting and screening of construction equipment to avoid introduction of invasive species. All material source sites must also be inspected and certified by KWS before materials are transported to the site.

9.3.7. Compensation for lost park support facilities

These facilities include, the boundary fence, offices and wardens camp. The contractor acknowledged this problem and reported that compensation for these facilities had been factored into the project budget. Thus, the first order of business will be to construct new similar facilities as those affected by the proposed project. In doing so, the proponent and contractor will be guided by the KWS officers.

10. ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

10.1. Objective of the Environmental Management Plan

The main objective of the environmental management and monitoring plan (EMMP) is to provide guidance on how to protect the environment during the project implementation and thereafter. The EMMP outlines the procedures for the implementation of the proposed mitigation measures and other procedures that will be undertaken to ensure environmental protection of the project area in compliance with environmental laws and regulations. The EMP will be carried out during all the stages of the project implementation from pre-construction right through to decommissioning. In addition, it will involve all relevant stakeholders in the environmental management of the project.

10.2. Organizational - set up for the Implementation of the Management Plan

The proponent will have executive responsibility for the implementation of the EMMP. The proponent will, however, be assisted by a core of several experts including the Contractor, Resident Engineer and the Environmental and Social Development Manager on day to day aspects of decision making in the implementation of the EMP. In addition to the above in-house team, other relevant stakeholders will have an important role to play in the environmental management.

They include representatives of the KWS, Kenya Urban roads Authority, National Transport and Safety Authority (NTSA), Area traffic police commandant; NEMA as represented by the County Environmental Officers (CEOs) in the respective Counties, the local administration including the sub County commissioners, community representatives and other interested parties will also play their different roles in the implementation of the EMP. Details on the implementation of the environmental management plan are contained in . Note that the costs given in the table may not reflect the actual cost of mitigation but are used here as a guide for the proponent.

10.3. The Need for Environmental Monitoring

Environmental monitoring will also be a responsibility of the proponent since it is an essential tool in relation to environmental management. Environmental monitoring provides the basis for rational management decisions regarding impact control and mitigation. Monitoring is envisioned as an important process in the protection of environment of the project areas. It will reveal changes and trends brought about by the presence and operations of the projects. By using the information collected through monitoring, impact mitigation and benefit enhancement measures can be improved, and projects works or operations will be modified or halted when necessary.

10.3.1. Basic attributes of environmental monitoring

The proponent and or their appointed agents and other relevant parties will undertake to conduct sustained environmental monitoring of the project areas putting into consideration the following attributes:

1. Monitor changes in the environmental conditions of the project area through collection and analysis of appropriate environmental data throughout the life of the project;
2. Check the extent to which the mitigation and benefit enhancement measures have been adopted and their effectiveness in practice;
3. Provide a mechanism whereby unforeseen or unexpected impacts during the EIA can now be identified and provide measures to mitigate the unexpected negative impacts;
4. Prepare periodical reports and liaise with relevant bodies and authorities through an established forum to discuss and resolve issues arising from the monitoring process; and
5. Prepare the regular EA reports that should be submitted to NEMA and implement any subsequent recommendations arising from the EA reports.

10.3.2. Significance of environmental monitoring

The significance of monitoring stems from the fact that the inputs derived from the EIA into the project design and planning, including mitigation measures and environmental management plan are largely based on "predictions". It is therefore essential that the basis for the choices, options and decisions made in formulating or designing the project and other environmental and social safeguard measures are verified for adequacy and appropriateness during the monitoring process. Monitoring verifies the effectiveness of impact management, including the extent to which mitigation measures are successfully implemented. The results of environmental monitoring will determine the success and efficacy of the proposed mitigation measures in protecting the environment.

10.3.3. Monitoring arrangement and the way forward

Environmental monitoring will commence at the commissioning of works and the recruitment of the project Contractor, the Resident Engineer and Environmental Monitoring Firm. Once the project is underway, the proponent (as represented by the Environmental and Social Development Manager and Resident Engineer) and representatives of NEMA, local administration, relevant Government officers, community leaders and other relevant stakeholders will regularly visit the project areas to review and ascertain that the clauses and conditions set by NEMA for the protection of the environmental are adhered to by the Contractor.

As part of regular project activity, monitoring will involve systematic collection of data through a series of repetitive measurements and observations. Monitoring reports prepared by Environmental monitoring team will be reviewed by NEMA to ensure that proposals contained in the EMP are being implemented by the Contractor as required. Details on the responsibility for monitoring and monitoring indicators are presented in Table 39 below. Finally, the environmental monitoring team will analyse the collected data and information collected and subsequently compile and formalize the monitoring report in accordance with the set guidelines and timeframes and submit it to NEMA.

10.3.4. Focus areas for monitoring

The proponent is expected to undertake monitoring on both terrestrial and aquatic environments of the project areas and surroundings with a focus on the following key environmental variables:

a) Changes in vegetation cover
b) Air pollutants,
c) Wildlife behavioural changes
d) Soil erosion;
e) Noise levels;
f) Local community dynamics
g) Changes in air quality;
h) Dust and gaseous emissions;
i) Increase in accidents; and
j) Any other relevant changes in ecological, socio-economic and environmental attributes.

10.3.5. Cost of mitigation

Using best practices in other parts of the world, the costs of the mitigation measures and of the institutional and training requirements to implement them will be estimated with a ceiling budget of approximately **2.5% of the total project cost.** A comprehensive work program, budget estimates, schedules, staffing and training requirements, and other necessary support services to implement the mitigating measure will be prepared based on the above budget guideline.

Table 13: EMP for design, planning, construction and operational phase

DESIGN AND PLANNING PHASE					
No.	**Objective**	**Management Action**	**Responsibility for implementation & monitoring**	**Monitoring indicators**	**Reference Guidelines**
1.	**Socio cultural impact**				
1.1.	To reduce, control and avoid land related conflicts	Commissioning of a RAP study for the proposed project. Undertake the RAP (where applicable) in accordance with the legal framework of the Government of Kenya	KR, CRBC Budget as per BQ	Number of establishments and individuals ceding land for construction of the road. Number of RAP reports prepared	The Way Leaves Act (Cap. 292); The Land Act, 2010; National Land Commission Act, 2012 (No. 5 of 2012); Land Adjudication Act, 2010 The Trust Lands Act, 2012 (Chapter288)
1.2.	To compensate for habitat loss, reduced ecosystem services and natural capital	Compensation of land ceded for the project including that affected by disturbance impacts such as noise and air pollution. Such land should be purchased on the Southern side of the NNP (i.e. Kapiti plains) pursuant to the objectives of Kenya's vision 2030 regarding environmental conservation (Government of Kenya, 2006).	KR, Ministry of Environment, Ministry of transport and infrastructure	Area of land used by the project and area disturbed by project impacts. Area of land acquired	The Kenya Vision 2030; EMCA Cap 387, Wildlife (Conservation and Management) Act Cap 376 of 1976, 1989 & Bill, 2013 (GoK, 2013)
1.3.	To reduce possible conflicts related to hiring of workers	Equitable provision of employment opportunities with regards to gender, skills, indigenous people and disability	KR, CRBC Budget as per BQ	Number of workers hired for construction works in their different classes e.g. women vs. men etc.	Employment Act, 2007
1.4.	To promote the use of local service providers	Local procurement of goods and services will be undertaken wherever possible and cost effective and where practicable to the project	KR, CRBC Budget as per BQ	Types of goods and construction materials procured locally. Number of business providing goods, services and construction materials locally e.g. security companies, cement	Employment Act, 2007

				suppliers etc.	
1.5.	To ensure minimum public inconvenience during construction across key public utilities	Continuous consultation and involvement of the directly affected stakeholders (DAS) will be undertaken with respect to water, sewerage, pipelines, electricity, old rail, roads, etc., at all stages of the project cycle	KR, CRBC Budget as per BQ	Type and number of utilities moved before beginning of construction works; Number of complaints received	Feasibility and EIA report for the road construction
CONSTRUCTION PHASE					
No.	**Objective**	**Management Action**	**Responsibility for implementation & monitoring & Budget**	**Monitoring indicators**	**Reference Guidelines**
	T**raffic management and safety**				
1.	To promote smooth traffic flow and safety during the construction period	No overloading of trucks and. good driving practices to be practiced. Suitable junction/access point to be provided. Use of appropriate & legible signage. Employment of formal flagmen / women in order to ensure the public safety. Erect road signage informing other road users of the nearby construction works. Ensure that truck drivers are educated on road safety	KR, CRBC Budget as per BQ	Increased traffic jam along nearby roads Number of accidents caused by construction vehicles	Public Roads and Roads Access Act, 1972
2.	**Soil Erosion**				
	To reduce and control the impact of soil erosion	Fine grained materials (sand, marl, etc.) will be stockpiled away from drainage channels and low berms will be placed around the piles which themselves will be covered with tarpaulin to prevent them from being eroded and washed away. Loose soils to be used to fill back	KR, CRBC Budget as per BQ	Increased soil erosion along the excavated area	Levels of turbidity recorded in the receiving riverine waters and drainage channels

		excavated/disturbed areas. Loose soils to be compacted with a mechanical roller so as to avoid erosion by wind or water. Planting of grass on the slopes of the subgrade to slow runoff			
	Noise and excessive vibrations				
3.	To minimize disturbance of neighbouring establishments, construction workers & communities with excessive noise and vibrations	Provision of mufflers on exhausts and standard restrictions to hours of site works. Water spraying on dusty sites during strong wind. Utility of machinery with high noise e.g. pile drivers should be conducted at day time; Night operations (if necessary) should only include machinery with low noise emissions. Use of ear muffs by construction workers	KR, CRBC Budget as per BQ	No. of complaints from local residents; Noise Levels recorded; No. and type of protective hearing devices dispensed to workers No of noise permits	EMCA {Noise Prevention and Control Rules 2005, Legal notice no. 24 regarding noise limits at the workplace as well as NEMA Noise and Excessive Vibration Pollution Control Regulations, 2000.}
	Air quality management				
4.	To minimize the entrainment of dust during construction	Covering wetting of materials and wastes, during transportation. Regular surface wetting on roads under construction and cleared areas to minimize entrainment of dust.	KR, CRBC Budget as per BQ	Quantity of particulate matter (PM10) recorded in air quality assessments during construction in comparison to preconstruction quantities	EMCA (Air quality regulations, 2008)
5.	**Pollution control management**				
5.1.	To contain spillages of hazardous chemicals	All hazardous chemicals including hydrocarbons such as fuel, oils and greases will be contained in bunded areas with sufficient capacity to contain the quantity stored in the bunded area. Hazardous chemicals including hydrocarbons are to be handled over	KR, CRBC Budget as per BQ	Number of oil and chemical spillage incidents reported	EMCA (Waste management regulations, 2006)

		impervious surfaces. Proper storage of liquids on site, e.g. oil, diesel and solvents must be ensured as well as containment of accidental oil spill; Undertake regular & repair of construction machinery & vehicles.			
5.2.	To manage sewage and effluent	Portable chemical toilets to be provided at site offices; portable toilets are to be cleaned on a regular basis	KR, CRBC Budget as per BQ	Number of complaints received Number of portable toilets provided along the route of construction	EMCA (Waste management regulations, 2006) and the water quality guidelines of 2006
5.3.	To prevent and control the proliferation of plastics	Under no circumstances should construction workers & management bring, or use banned plastic bags at the construction site.		Number of awareness meetings held with workers on waste management and regulations Number of confiscated plastic bags on site and reprimanded workers	EMCA (Waste Management regulations, 2006) and the Kenya Gazette Notice No. 2334 banning the use and manufacture of plastic carrier bags.
	Loss of vegetation				
6.	To reduce and control loss of vegetation	Retention of vegetation where possible and replanting of grass and shrubs in other undisturbed areas should be applied. Minimize the destruction or damage of vegetation cover by clearing construction designated areas only	KR, CRBC Budget as per BQ	Number of shrubs and grass panted as well as area (in m^2) covered by replanted grass	
7.	**Occupational Health and Safety**				
7.1.	To ensure healthy and secure environment along the construction	Employees will be informed on the necessary safety procedures and be competent in the work they are employed to do;	KR, CRBC Budget as per BQ	No of complaints from workers and local community; No. of traffic	Occupational Health and safety Act, 2007

	route for all the construction workers	All necessary safety regulations must be abided by including building codes and fire practice requirements; Inspection of material and harmonization to the occupational health and safety standards.		accidents; No. and type of protective clothing and gear provided to workers Accident reports, number and types of accidents, causes etc.	
7.2.	To establish a proper accident and emergency response strategy	The construction company shall establish an emergency leading group, accident scene command group, an accident treatment group, a guard and defend group, a medical aid group, an environmental monitoring group, a logistics group, an accident investigation team	KR, CRBC Budget as per BQ		
8.	**Increased use of local resources (sand, timber, gravel etc.)**				
	To enhance prudent usage of resources	The sources of all required materials should be inspected prior to acquisition to confirm that they are legitimate operations. In the case of sand, an EIA license should be applied for before commencement of quarrying activities. WRMA permits and EIA licenses must be obtained before water abstraction	KR, CRBC Budget as per BQ	Derelict land caused by quarrying of sand, stones and gravel. Quantity of material used for construction No. of EIA and WRMA licenses obtained	
9.	**Construction waste management**				
	To prevent the contamination of soils and water resources due to inappropriate management and disposal of waste	The management of construction solid waste shall adopt the integrated solid waste management system through a hierarchy of options: a) Source reduction b) Recycling	KR, CRBC Budget as per BQ	Quantity of wastes recycled, reused and disposed	EMCA (Waste Management regulations, 2006)

		c) Composting and reuse d) Combustion e) Sanitary land filling The proponent & contractor will liaise with the County government & designate a proper site for disposing excavated soils			
	Visual Impact				
10.	To reduce and control the impact on local aesthetics during construction	Adoption of alternatives to the alignment and their associated above-ground structures; and refinements to the basic engineering and architectural design including layout, built structures etc. to avoid and/or minimize potential adverse impacts Care will be taken to avoid having open trenches in an area for a long period of time.	KR, CRBC Budget as per BQ	Number of open trenches left open beyond the contract time frame Number of complaints received	
	Exhaust and gaseous emissions				
11.	To reduce the health and environmental impacts of gaseous emissions from construction vehicles and machinery	Reduce gaseous emissions by selection of appropriate machinery and regular servicing of vehicles. Provide workers with appropriate protective gear including masks to cut down on gaseous emissions inhaled. All workers involved in construction activities to wear face masks.	KR, CRBC Budget as per BQ	Quantity and type of fuel used per equipment and related volume of emissions in PPM Number of face masks issued and number of air quality reports	EMCA (Air quality regulations, 2008) and Occupational Health and safety Act, 2007
	Invasive species				
12.	To prevent the introduction and spread of invasive	Screen the construction equipment to avoid the spread of invasive species such as	KR, CRBC Budget as per BQ	Number of invasive species discovered during screening	EMCA (Cap 387), IUCN-GISP guidelines

	species along the access road route	*Nicotiana glauca* and *Prosopis* seeds attached to road construction machinery			
	Public health				
13.	To promote awareness on issues related to STIs and HIV/AIDS	Continuation of awareness (through distribution of flyers, condoms and holding related sensitization classes) program on risks associated with STIs and HIV/AIDS will be undertaken.	KR, CRBC Budget as per BQ	Number of workers trained on HIV and AIDS; Number of awareness training meetings and associated materials distributed among workers	HIV/AIDs Policy 'Kenya AIDS strategic Framework 2014/2015-2018/2019
OPERATIONAL PHASE					
No.	**Objective**	**Management Action**	**Responsibility for implementation & monitoring & Budget**	**Monitoring indicators**	**Reference Guidelines**
	Public safety				
1.	To reduce the occurrence of road accidents	Erect appropriate road furniture to inform road users about safety e.g. speed limits; Patrolling of the road by National Transport Safety Authority (NTSA) and Traffic police to ensure that road users adhere to set rules and regulations	NTSA; Area traffic police commandant	Number of road informative road furniture erected; Number of speed bumps at strategic locations	Number of road accidents recorded on the new access road per annum; Number of road safety signs and speed bumps erected on the road.
	Increased surface run off				
2.	To reduce the impact of surface runoff	locate appropriately sized culverts in the correct locations to eliminate any flooding problems that the access road may cause The road is designed with a drainage system that'll reduce or eliminate any negative impacts resulting from the proposed access road, to improve drainage conditions where possible and to	KR, CRBC Budget as per BQ	Number of culverts and length of drainage system constructed as proposed in the design	EIA report and licensing conditions

		enhance public safety			
	Reduced Surface area for rain water percolation				
3.	To enhance water percolation along the access road	This impact is cumulative but measures such as planting grass on the embankment slopes as opposed to having embankment slopes that are completely made of concrete will enhance rain water percolation.	KR, CRBC and Kenya Urban Roads Authority Budget as per BQ	Area occupied by grass planted along the slopes of the road	EIA report and licensing conditions
	Noise and vibration				
4.	To reduce the impact of noise occasioned by the new road	Conduct annual noise assessment to determine if traffic from the new road is causing negative impacts to the environment; Where necessary, noise mitigates structures such as noise barriers should be put in place	KR, Kenya Urban Roads Authority	Noise level measurements and mapped receptors along the new access road	EMCA (Noise and excessive vibrations regulations, 2009)

11. CONCLUSION AND RECOMMENDATIONS

11.1. Conclusion

1. The proposed project is an important infrastructure that will link the Nairobi inland container depot and the southern Bypass road enabling smooth and faster transportation of freight into the hinterland of the Northern corridor. This will enhance the ICDs objective of decongesting the port of Mombasa as well as decongest Mombasa and other nearby feeder roads
2. However, the project construction as with any other anthropogenic activity will result in negative and positive impacts. The negative impacts to the NNP are long term thus adequate measures should be undertaken to compensate both for lost habitat and the disturbed area beyond the edges of the road.

11.2. Recommendations

1. Since the proposed project is designed to utilize approximately 21m width x 4153m length of land in the inner boundary of the eastern side of the NNP, the proponent is advised to compensate for this land by purchasing at least 10 times or more of similar land on the southern side of the park that is currently in danger of being fully developed thus preventing migration of wildlife. The purchased land must be subsequently gazetted as protected land belonging to the NNP. This will not only compensate for land but also aid in the conservation efforts for the NNP.
2. Compensate for loss of existing support facilities to the NNP. These facilities include, the boundary fence, offices and wardens camp. Similar facilities must be constructed (under the guidance of KWS) as first order of business before commencement of the proposed road construction.
3. The proponent is therefore advised to facilitate replanting of trees, shrubs and grass inside the park as directed by KWS.
4. Effective Monitoring and Evaluation (M&E) to ensure all the mitigation measures proposed are adhered to fully during project construction.
5. Given the dearth of data on post transport infrastructure project impacts in Kenya, it is further recommended that life cycle assessments, cumulative impact assessments (CIAs) and other related studies for similar projects undertaken by the proponent and others should be commissioned

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APPENDICES